THE

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INDEX TO VOLUME XXIX.

January to June, 1907.

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AUTHORS' INDEX

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During 1906 *the Street Railway Journal printed and circulated* 426,950 *copies, an average of* 8210 *copies per week. Of this issue* 8500 *copies are printed.*

Keeping Equipment Details

The benefit of having in an accessible place the principal dimensions and details of the cars of the system has probably never occurred to many master mechanics of small systems. At any rate, quite a few men who keep their equipment in excellent shape have very vague ideas as to the total length, width, height, or weight of their cars. It is, however, of considerable advantage to have these figures and many others of similar character at hand. Of course it cannot be expected that all of them can be retained in the memory. To attempt to do so would result in failure. Such dimensions as the length and width of the greater numbers of the cars should probably be committed to memory, but the smaller details should be kept in note books or on data sheets. It is also of great advantage to have as many blue prints of the equipments as can be obtained. Floor plans and elevations of the cars and drawings of the trucks and draw bars will frequently be found of much service. Considering the ease with which these are to be obtained, it is surprising that every master mechanic does not have them. The manufacturers of the cars and apparatus are usually most willing to send them on request. If for no other reason, such data should be kept for the effect that the ability to answer questions or give information to visitors or friends will have on the inquirers. A man may rightfully be expected to have definite knowledge concerning those things about which he spends practically all of his time, and he should have more than general information to give when called upon for definite figures.

Keeping Records of and Checking Train Orders

The importance with which the dispatching systems of electric railways are regarded by railway managements sometimes varies according to the number of collisions that have been due, or are thought to have been due, to errors in dispatching. On some roads where no trouble has occurred it is the custom for the trainman who is nearest the telephone to call up the dispatcher in an informal manner and receive oral instructions from him as to what to do. Neither the trainmen nor the dispatcher keeps any records. Other systems, however, have been taught by experience that it pays to surround the dispatching system with every possible precaution tending to minimize or prevent wrecks. If those companies which are lax in the matter of dispatching would profit by the experience of the other roads, no doubt in the course of a few years the work of the claim agent and the car maintenance expenses would be considerably less than what they will be otherwise. On a small road operated probably on ordinary days by two cars which always pass at one point, at first thought it does appear unnecessary to compel the trainmen to go to the trouble of copying all orders in duplicate and have the dispatcher keep a record of such orders. But on Sundays and holidays probably several extra cars are put on these roads, and the meeting orders are more complicated. When orders are not written on ordinary days, usually the practice is not varied with heavier schedules, and under such circumstances it may happen that sooner or later an order will be

misunderstood or will be forgotten and an expensive wreck will result.

Copies of all orders received should be made by the trainmen receiving them and the dispatcher should also keep a record of the orders so that those made by the trainmen may readily be compared with his. The copies of orders should not be regarded merely as a means of locating the blame for accidents after they have occurred—they should rather be considered as a means of detecting every mistake made in issuing orders. To do this the dispatcher's copy and the trainmen's copy should be compared and checked in every instance. It is safe to say that not one mistake in giving orders out of a dozen results in a wreck. If no order record is kept or if the copies are not compared, the chances are great that no one other than the dispatcher and the trainman will ever know anything about the eleven mistakes that do not result seriously. Under such circumstances there is a natural tendency for both trainmen and dispatchers to get careless. But if all copies of orders are compared and some one is obliged to explain every discrepancy between the copies, mistakes will be fewer and claims for damages against the road will consequently be less. The expense attached to keeping copies of orders and comparing them is of course small, and should be regarded in the light of insurance.

Some Advantages and Disadvantages of Large and Small Car Wheels

That there are many arguments in favor of wheels of both large and of small diameters for interurban cars, is well proven by the fact that throughout the country wheels varying in size from 33 ins to 39 ins. in diameter are employed in practically the same class of service. At first thought it might be supposed that the desired height of the car floor would always be the determining factor in selecting the diameter of the wheels to be employed, but an inspection of cars of different companies will show that the car body is not always placed as low as the clearance of the wheels would permit. Some managements evidently prefer a small wheel for other than the reason that it permits the car body to be hung low. In such instances the weight of the wheel is probably considered. With other advantages and disadvantages equal, the small wheel would certainly be preferable because of its less weight. A wheel 33 ins. in diameter should weigh from 50 to 100 lbs. less than a 37-in. wheel of equal strength and similar tire section. The use of a 33-in. wheel should consequently decrease the total weight of the car from 400 to 800 lbs., and this fact is worthy of a great deal of consideration. Although the decrease in weight by the use of the smaller wheel would be less than 1 per cent of the usual weight of interurban car, in the course of a year the cost of the current that would be consumed in hauling the unnecessary weight around would cause many who had not otherwise thought of using small wheels to consider them seriously.

Another advantage obtained with small wheels, although this advantage is probably of more theoretical than practical importance, is that the flange friction has a smaller lever arm than with large wheels. In other words, on account of the shorter radius of curvature, the surface of contact of the flange and the rail in taking a curve is a shorter distance from the line of contact of the tread and the rail. This, of course, lessens the consumption of energy in flange friction.

So far as bearing friction and life is concerned, it is of course advantageous to use a large wheel. The bearing friction will of course vary inversely as the size of the wheel and due to the greater amount of metal in the tire, the life will be lengthened in about the same ratio. This increase of life, of course, lengthens the intervals between turning the tires or changing the wheels, and consequently reduces to an extent the labor item.

It is, to be sure, an easy matter to refer to the advantages and disadvantages of the different sizes of wheels. But it would be of more value to operating men if the relative importance of each advantage or disadvantage could be definitely determined upon. This, of course, would necessitate almost an endless number of tests, but probably within a few years enough of these will be made so that practice will narrow down to a smaller range of sizes than is at present in use.

The Rapid Transit Situation in New York

The message sent by Governor Hughes to the New York Legislature on Jan. 2 calls renewed attention to the congested condition of the traffic facilities in Greater New York, and particularly those intended for long-distance travel. Of the Governor's suggestion to relieve this situation by the appointment of a new commission with enlarged powers to take the place of the present State Railroad and municipal Rapid Transit commissions, we shall say nothing at the present time. We do believe, however, that all will agree in his recommendation for immediate action to relieve a situation long intolerable. That an "extraordinary congestion" exists on the long-distance transportation lines is not news to those who have to depend upon them for their daily transportation, nor to those who have read the articles in this and the last issue of this paper upon the East Side-Bronx transportation problem in New York.

In this series, which concludes with this issue, we have presented merely the bald facts, without any attempt to sit in judgment upon the causes of failure or the prospects of relief. The condition of affairs at the present moment is nothing short of terrible, and it grows almost daily worse. The great underlying cause we have pointed out in the unique geographical features of the metropolis. There is no other great city in the world driven by the deep sea into so narrow quarters. In spite of bridges and tunnels to the east and west, Manhattan Island must depend, in the main, on easy access from the north.

Within a decade or two the business section of the city has expanded uptown, but more than this skyward, piling the equivalent of three modern cities one upon another with no increase of street area. The second city in the world in gross population, New York stands absolutely alone in the density of its commercial population. As everyone knows, the subway, with all its serious disadvantages, has shortened a little the time of transit in certain directions, but is now hopelessly congested owing to in-

creasing demands. The elevated roads are in a similar state, and the surface lines cannot adequately meet even the minor requirements of local traffic. The commercial city is growing with prodigious rapidity, and within comparatively few years the daily flow and ebb of population will be doubled in volume. Even now it sweeps into the subway entrances like water into a penstock. Whatever may be done by extra tunnels and bridges to the east and to the west is only palliative. The main course of the tide can no more be deflected from its flow north and south on Manhattan Island than in the huge channels that hem it in. It is not something that needs to be done, but everything, if the transit facilities are to keep pace with the needs of the metropolis.

The two most striking features of the case brought out by our investigation are the inadequate facilities on the enormously crowded East Side, and the comparative slowness of the service everywhere. A glance at our map giving time contours shows plainly that a narrow strip of the West Side, inhabited largely by people who do not work long hours, is the section most easily reached. On the East Side and in the Bronx the time of transit is greatly lengthened, and the congestion is even more frightful there than elsewhere save on that terrestrial Tartarus, the Brooklyn Bridge. And for so-called "rapid transit" the time taken is prodigious. It is, roughly, 40 minutes from the Battery to the Bronx, a distance of less than 10 miles. It is half an hour to the region just north of Central Park, and yet it is clearly on the East Side in the territory beyond 110th Street and stretching far up into the Bronx that the future population of New York must dwell.

How can an extra million people in that region be adequately transported? Some slight relief may come from a shifting of the business center northward, but this movement is slow and does not in the least imply a cessation of activity far downtown. For every worker who moves uptown, two occupy the space made vacant by his departure. And the growth of business in the region between Fourteenth Street and Forty-Second Street displaces a considerable population which is added to that to be transported farther north. No working population is able to adjust itself so as to remove the necessity for rapid transit, since employment is, on the whole, non-permanent, and rents in New York rise much faster than wages, which, experience has shown, are uniformly "last on the field and first to leave it." There is therefore no reasonable prospect that any shifting of business or population can materially relieve the transportation situation. The population carried and the average distance of transport must be expected to increase steadily for years to come, and so far from making provision for this increase the congestion is steadily going from bad to worse, and remedial measures are subjects of talk rather than of action.

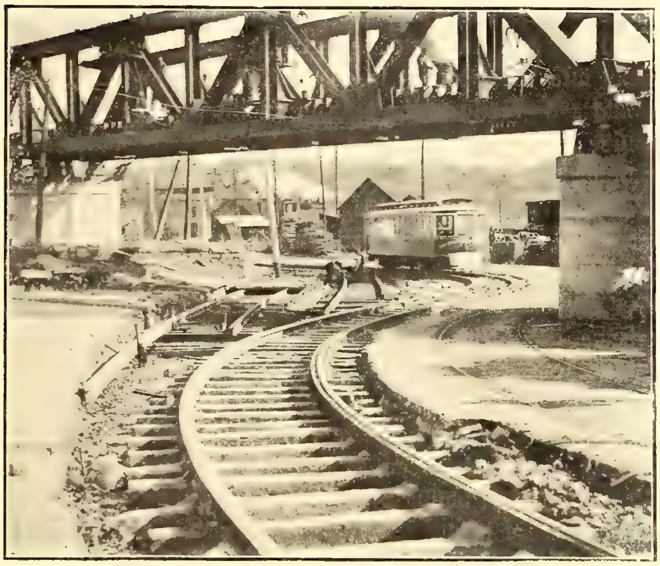
The need of the city to-day is immediate and forceful action, not along one line, but along many. A single subway or viaduct or elevated track is foredoomed to hopeless congestion before ever a wheel can be brought to turn upon it. Experience has already shown this in New York and other cities. There is no use in sitting timidly down and wondering whether remedies will pay. They must be applied at whatever cost, and no one who knows New York can doubt that the returns will be adequate even from the start.

The present proposals for relief are of two kinds. First, it has been many times urged that the East Side elevated roads should be completely equipped with three tracks, thus giving one track for express service extending at least as far as 129th Street. Even the existing stretch of express track on the Third Avenue elevated has proved useful, and there is no doubt that the proposed extensions would be valuable. Second, there are two proposed subway routes via Third and Lexington Avenues, respectively, extending clear into the Bronx. It goes without saying that these would add greatly to the existing facilities, but they are of course open to the very grave objections to subways in general. The present subway with its serious ventilation problems is not an encouraging example in every particular, and it has not been a distinguished success in the matter of speed owing to the great number of local stops. Whatever the situation of the tracks in the next rapid transit scheme, the virtues of real express service should be tried, for without it any material improvement is hopeless. At least four express tracks are needed, stretching from the Battery, or near there, to the vicinity of 200th Street, and making no stops between, say, Fourteenth Street and 125th Street, with a running speed of not less than 40 m. p. h. between these points. This would send a passenger from City Hall to 200th Street in about half an hour at the outside, with due allowance for lessened schedule near the ends of the route, which is time enough and to spare for the 14 miles run. Some minutes could be clipped off this without much difficulty in giving a real express service. It does not make much difference in the general result whether the tracks are on one level or another. We have always been impressed with the advisability of avoiding subways when feasible, and see no reason why a four-track elevated structure, in two stories if necessary, and provided with all the modern improvements to reduce noise and secure stability, could not be used with admirable results. With express tracks on the higher level almost any speed could be maintained, and the trains would be in the open air so that they could be properly ventilated. A street already having an elevated road of the older sort would be very little damaged by the addition, were it suitably constructed. A third track on the present elevated structure would bring relief and should be installed immediately, but viewed in the broader aspects of the question would relieve the situation only temporarily. As to subways proper, the two proposed lines already mentioned and those proposed for the West Side should also be carried through to completion and the increase in speed decided upon for them over the present subway is in the right direction. There is no such thing as an effective compromise between express and local service.

The time has come for decided action. It is a tremendous problem that lies before the metropolis, and it must be handled in a large way and promptly. The prosperity of New York, involving as it does the welfare of nearly four million souls, is a thing too vast to be imperiled by legislative delays or conservatism, or blocked by the petty objections of a few East Side real estate owners. The need of action has grown to overwhelming proportions, and it is time to sink trivial questions in united effort.

TRACK CONSTRUCTION AND OTHER IMPROVEMENTS OF THE TRI-CITY RAILWAYS

The railway, gas and electric light properties of Rock Island and Moline, Ill., and Davenport, Ia., are at the present time being reconstructed by J. G. White & Company, who recently acquired them. The more extensive improvements, however, are being made in connection with the electric railway system. The railway properties at the time they were purchased consisted of three separate systems: the Davenport & Suburban, with 11 miles of track; the Moline, East Moline & Watertown, having 8 miles of track, and the Tri-City Railway, with 65 miles of track. The work of reconstructing the systems will consist in centralizing the power supply for all of the systems, reconstructing and rebuilding a considerable portion of the track, providing new car equipment and additional car-house capacity for it, and extending an interurban line to Silvis, a new town a few miles east of Moline. In fact, about $1,500,000 will be spent in improving all of the properties.



DOUBLE S CURVE UNDER BRIDGE, BEFORE AND AFTER STRAIGHTENING TRACK

PORTABLE CONCRETE MIXER AT WORK

POWER AND DISTRIBUTION SYSTEM

At the time the railway systems were acquired, power to operate them was obtained from three separate generating stations, one in each of the three cities. The station in Moline is now being provided with sufficient additional generator capacity to furnish power for all of the railway and lighting load, and the other stations are being dismantled and will be converted into sub-stations. A 1500-kw Parsons turbine is being installed in the Moline station and another will probably be installed within a few months. In connection with the turbine there are being installed three 500-hp Stirling water-tube boilers. The additional units in the station will provide emergency capacity to be used in the event of failure of the water-power plant of 2000-kw capacity which is run in connection with the steam plant. The water head under which the water-power plant is operated, and which is obtained by damming the chute of the Mississippi River between Rock Island and the Illinois shore, is at the present time limited to about 2000 kw, but is capable of a very much greater development, and when the river freezes over in winter the plant under present conditions is liable to temporary shutdowns of brief duration due to floating needle ice, etc.

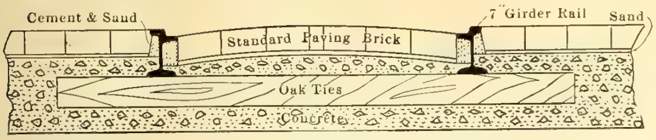
JOINT WITH HALF OF 15-IN. I-BEAM AS SUPPORT

The two sub-stations, one in Davenport and one in Rock Island, will be connected to the main station by 5000-volt high-tension lines. The Davenport sub-station equipment

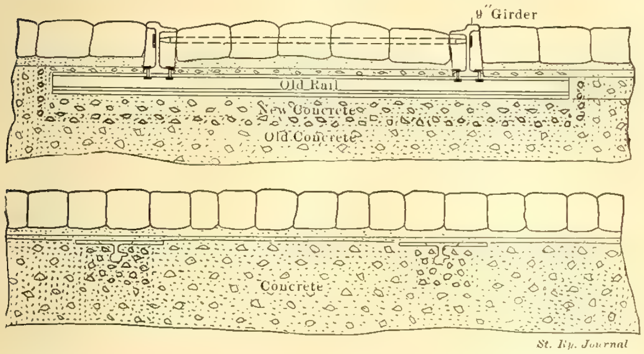
will consist of two 400-kw motor generator sets, two 300-kw and one 200-kw rotary converter.

TRACK CONSTRUCTION

The fact that the new purchasers might have radically dif-



SECTION OF STANDARD TRACK CONSTRUCTION

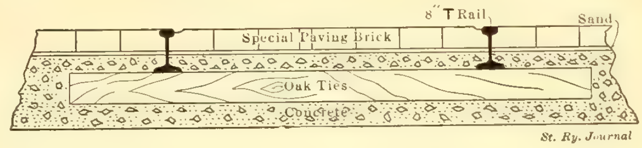


CROSS AND LONGITUDINAL SECTIONS OF TRACK CONSTRUCTION ON FORT ARMSTRONG AVENUE

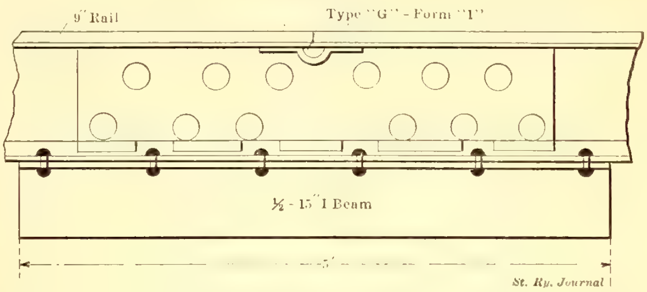
ferent ideas regarding track construction deterred the old management from making much-needed improvements of the track during the period the negotiations for the sale of the properties was being carried on. The rebuilding of about 20 miles of track was consequently the first work begun by the construction department of the purchasing company. As the city ordinances in all three of the cities did not permit of T-rail construction, girder rails were at first employed in the new work. However, permission was obtained from the City Council of Davenport to lay 800 ft. of double track with T-rail in paved street in order that the advantages and disadvantages of this construction might be observed. The location chosen for this strip of track was at a point where it would receive the hardest usage from crossing wagons. It is

pected that permission will be obtained from the city authorities in Rock Island and Moline to use the same rail.

The sample track as built consisted of 8-in., 80-lb. T-rails supported by oak ties embedded in concrete. The concrete



SECTION OF IMPROVED T-RAIL CONSTRUCTION IN PAVED STREETS

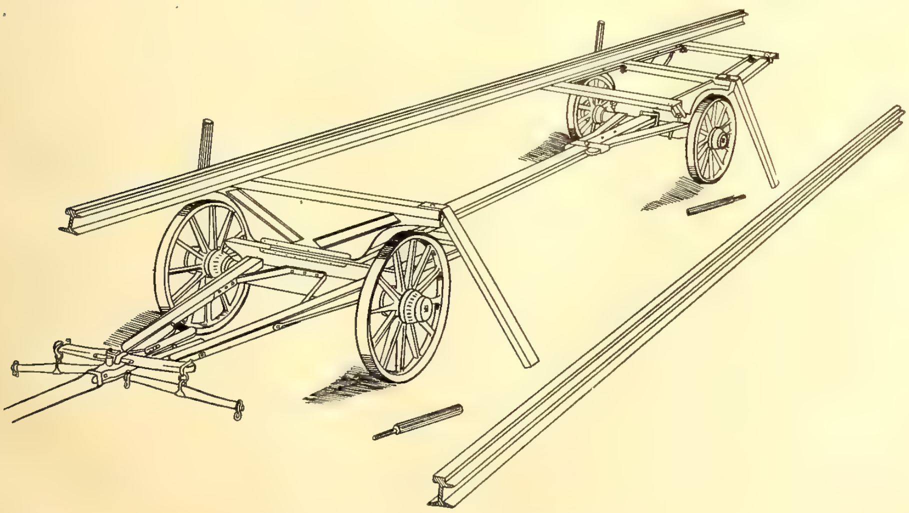


SIDE ELEVATION OF JOINT, WITH HALF OF 15-IN. I-BEAM

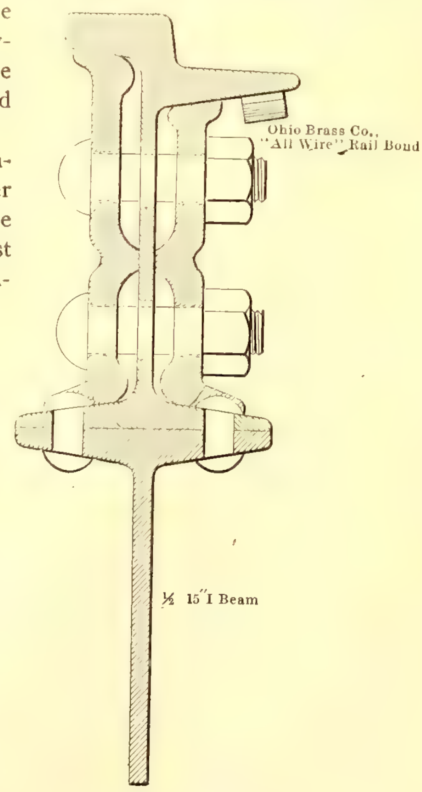
bed extended 4 ins. below and 2 ins. above the ties. Nose brick of the "Twin City" type were laid next to the rail and these, as well as the remainder of the paving brick, were laid on a cushion of sand 1 in. thick.

The track construction with girder rails is very similar to that with T-rails. To avoid chipping the brick and extending them under the head of the rail, however, the rails were filled with cement and sand.

Some special construction with girder rails which is of more than passing interest was employed in recon-



RAIL WAGON USED IN DAVENPORT



RAIL JOINT WITH HALF OF 15-IN. I-BEAM

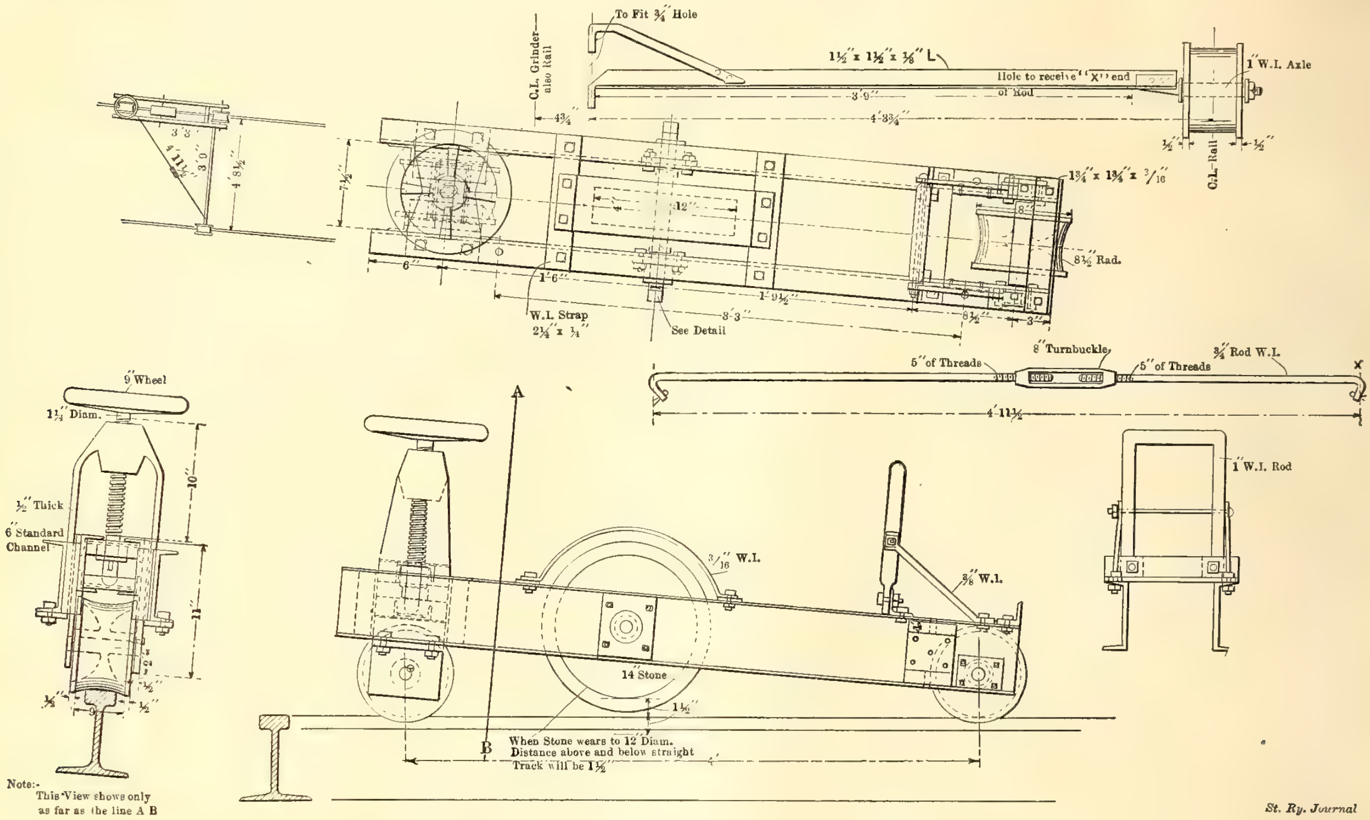
interesting to note in this connection that within three weeks from the time permission was obtained to lay the strip of track the T-rails were ordered, were rolled, and were on the ground. After a trial section of track had been in use for a few months and after frequent inspections had been made by the members of the Council, permission was granted to use T-rail in all of the new track work in Davenport. It is ex-

structing the tracks on Fort Armstrong Avenue, which extends across the lower end of Rock Island Arsenal. When the work of tearing up the old track was begun it was found that this track had been laid with wood ties in a bed of concrete. The concrete was found to be in excellent condition, and as the work of tearing it out would have proved an almost endless task, a method of construction was devised whereby it was

allowed to remain practically undisturbed. At intervals of 5 ft., which was the spacing of the old ties, the new 9-in. girder rails were bolted together by means of anchors consisting of sawed lengths of old girder rails. Each tie was fastened by means of four bolts and interlocking washers, with its flange uppermost, to the running rail. The rail joints were made in a manner which practically assures of their remaining solid throughout the life of the track. In addition to the two 12-in. bolt plates on either side of the web a T-iron 5 ft. long, made by cutting a 15-in. I-beam longitudinally through the middle, was hot-riveted to the under side of the rail. After the rail sections had been bolted and riveted together, a rich mixture of concrete consisting of one part cement to two parts sand was flowed around the ties and around the bases of the running rails.

SPECIAL CONSTRUCTION TOOLS

The construction department in charge has designed and constructed several special devices to facilitate the work. One of these is a rail grinding machine the use of which prevents pitting the rails by excessive grinding at any one point. The emery wheel is carried at the middle point of a frame consisting of two parallel channel bars about 5 ft. long bolted together. This frame rests on two wheels immediately over the rail to be ground, and is held in an upright position over the rail by a bar extending across the track to the opposite rail, and which is provided at the extreme end with a double-flanged wheel riding on this rail.



RAIL-GRINDING MACHINE OF TRI-CITY RAILWAY COMPANY

A hand wheel by means of which one end of the channel-bar frame may be raised or lowered permits the height of the emery wheel to be varied as desired. The wheel is driven by a motor, power being supplied to it through a flexible shaft. Suitable handles are provided on the frame to facilitate the operator in moving the machine back and forth over the point being ground.

STANDARD DOUBLE-TRUCK CLOSED CAR

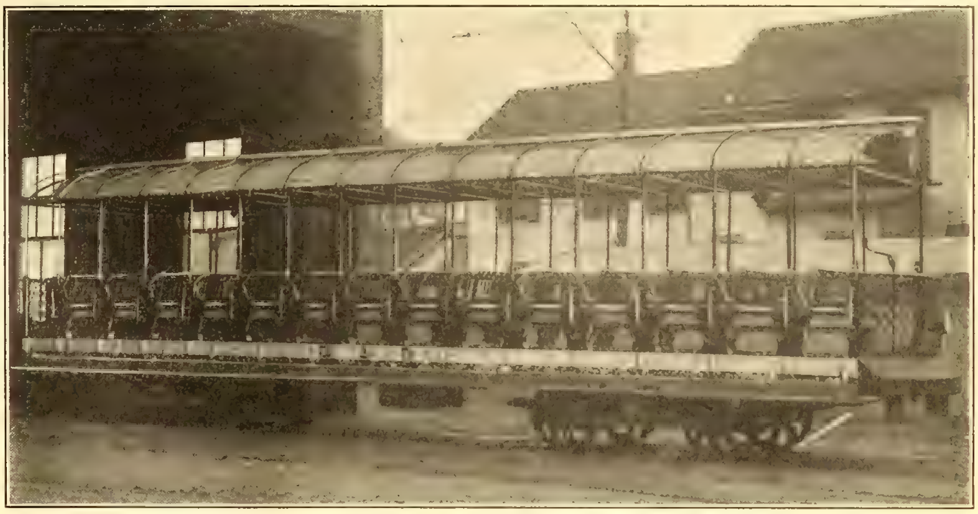
A rail wagon with several very novel features has also been designed. The wagon is intended for hauling 60-ft. rails, and is designed especially to prevent unnecessary lifting of rails in loading and unloading them. The wheels are comparatively small in diameter and the bolsters extend out over and beyond them. When rails are to be unloaded the bolster standards on one side are removed and skids sloping to the ground are fastened to the ends of the bolster. This design permits the rails to be unloaded by simply sliding them off the end of the bolster. In order to lessen the overhang of the rails on the rear end a supporting frame extends back several feet beyond the rear bolster. The front hounds

are of such a length as to permit of several feet of overhang of the rails beyond the front bolster without endangering the horses.

NEW CARS

The new cars for the system will be constructed in the company's shops. They will be of the semi-convertible type with cross seats, and will seat thirty-two people. The length over all will be 31 ft., and they will be mounted on a single truck.

For several years past the company has built all of its cars, and the building of the passenger cars that have been the company's standard for several years was the subject of an interesting paper read by John D. Fish, master mechanic of the system, at the Iowa Street and Interurban Railway Convention held at Dubuque, April, 1905. The cars measure 31 ft. over the body and seat 44 people. Owing to the fact that the head room is limited while passing over the Mississippi River on the government bridge the cars are constructed very low. In fact they measure but 11 ft. 2 ins. from rail to top of trolley board. The cars are of the semi-convertible type, the windows being removable in summer.



FOURTEEN-BENCH OPEN CAR USED FOR SIGHT-SEEING PARTIES

Two cars of rather unusual design were recently completed in the shops. These are large double-truck open cars having canvas tops supported on iron pipe framework. They were constructed especially to be used in handling excursionists from river steamboats and for "sight-seeing" cars during the summer season. The cars are 42 ft. long and seat seventy people. The framework supporting the canvas top is of very rigid construction. Wood posts which are carried up above the seat swivels are capped by heavy brass castings. The series of arches and uprights extending up from the wood posts are each constructed of one piece of double strength wrought-iron pipe. The framework is stiffened by longitudinal stringers at the top of the upright portions by ties extending between these stringers and by heavy trolley boards at the highest point of the arches. The lamp sockets are screwed to the board on the under side of the arches and the circuit breakers are mounted under the ends of the boards which project a short distance beyond the end arches. The canvas awnings are mounted on rollers, and when desired may be rolled back under the trolley boards. The car has latticed iron dashes at either end.

FRONT OF STANDARD CAR

CONSTRUCTION OFFICE

With the exception of the car construction, all of the other new work is being carried on by a construction department under the supervision of H. A. Johnson, construction superintendent for J. G. White & Company. This department has a complete organization of its own entirely independent of the operating department. The two departments of course operate in harmony in order to avoid any interruption to service. The new cars will be built by the operating department of the railway system under the supervision of J. F. Lardner, general manager.

END VIEW OF SIGHT-SEEING CAR

THE EAST SIDE-BRONX TRANSPORTATION QUESTION OF NEW YORK CITY—II., PROPOSED REMEDIES

The long-continued agitation for an increase in the transit means via the East Side to Bronx borough has now taken definite form in two distinct propositions, one for a pair of subways with feeders and the other for the continuous third-tracking of the Second and Third Avenue lines. The first plan is favored by East Side property owners, who are opposed to any further additions of any kind to the elevated railways in their territory for reasons which are obvious; while the second plan is approved by many residents of the Bronx, who are eager for rapid transit, believing that no other method will bring quick relief. These opposing elements of the public have not yet succeeded in coming to an understanding. As matters stand now, it is still uncertain which of these schemes will go through.

In furtherance of the latter scheme the Interborough Rapid Transit Company has proposed the addition of a third track as the only plan that can be carried out quickly, and has directed attention to the fact that even if a subway should be built its construction would take so long that by the time it was built the traffic would probably have increased so greatly that, like the present subway, both lines would soon carry their full capacity without relieving the elevated lines.

It should be understood that at present the majority of the Rapid Transit Commission is opposed to the third-tracking plans, while, on the other hand, the State Railroad Commission, in its report of Nov. 20, 1906, on New York transit problems, recommended the immediate adoption of the Interborough Company's proposal. It is apparent, then, that the doctors, as well as the patients, disagree as to the cure.

The first extra-trackage proposal of the Interborough Rapid Transit Company was made on Feb. 9, 1905, when it applied for authority to four-track its Second Avenue line from the City Hall to 154th Street. The Rapid Transit Commission's Committee on Plans and Contracts reported adversely on this plan, and on May 12, 1905, its report was confirmed. On May 25, 1905, the company's application was revised in the form of permission to third-track its Second and Third Avenue lines, and specifications were presented on May 31. A public hearing was held on June 1, but it was decided to postpone further consideration until the operation of the West Farms branch of the subway would show what it could do toward relieving the East Side elevated lines. The next hearing was held on June 28, 1906, and all the members, except the Comptroller, voted against the application. Nevertheless, another hearing was granted on Nov. 1, 1906, on the application of May 31, 1905, and the matter again referred to the Committee on Plans and Contracts.

PROPOSED CHANGES IN THE EAST SIDE AND BRONX ELEVATED RAILWAYS

To understand the extent of the changes proposed by the Interborough Rapid Transit Company, reference should be made to the accompanying Fig. 7, which shows the present trackage layout in Manhattan and Bronx boroughs. Fig. 8 has been prepared to show the gaps in the third track. The only third track now available for express service is the Third Avenue section from Forty-Second to 129th Street. The other third-track sections shown are now used for storage. The proportions between the middle track length and that of the rest of the structure are also given on Fig. 8.

The company offers to install a middle track on the Second Avenue line all the way from East 122d Street and Chatham Square, and a middle track from Park Row and Pearl Street (this section of Pearl Street is practically at right angles to the part traversed by the line to South Ferry) extending to the City Hall terminus. The Third Avenue line would have a continuous middle track from 129th Street and Second Avenue along the former street to Third Avenue, and thence south to Canal Street and the Bowery. It should be noted that of the 14.64 miles of middle track thus secured, 8.33 miles already exist in the form of storage tracks and the express track on part of Third Avenue.

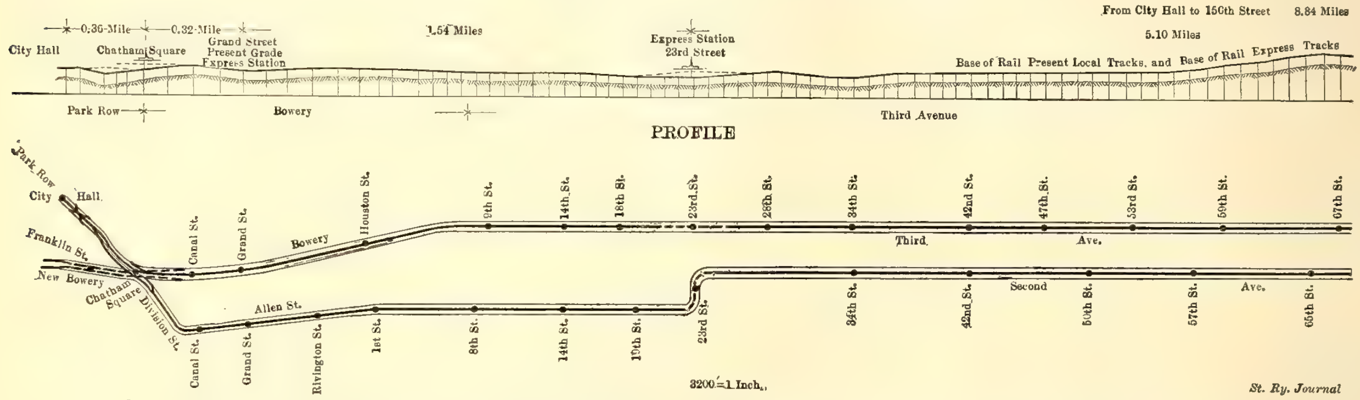


FIG. 7.—PROFILE AND PLAN OF PROPOSED EXPRESS TRACKS ON PRESENT EAST SIDE ELEVATED RAILWAYS

There would also be the following four-track sections on Manhattan Island: The first, shown in plan in Fig. 7, extends for the 0.15 mile between Canal Street and Chatham Square; the second from Chatham Square along Park Row to Pearl Street, which is within a few feet of the northern ends of the City Hall station platforms, and a third section from Chatham Square along the New Bowery to where the South Ferry line enters Pearl Street. The detail of the proposed Chatham Square layout is given in Fig. 14.

It is proposed to have in the Bronx division a four-track line from East 154th Street and Third Avenue extending across a double-deck bridge over the Harlem River to East 122d Street and Second Avenue in Manhattan Borough. The section from East 122d Street to Harlem River is shown in detail in Fig. 13.

THE PROPOSED ELEVATED RAILWAY EXPRESS SERVICE

In connection with its petition the company presented details of the express service contemplated from the City Hall via the Second and Third Avenue lines. From these it appears that no changes would be made in the locations of any of the present main tracks except between Chatham Square and City Hall, between Second Avenue and East 122d Street and Third Avenue and East 150th Street.

At City Hall a station is to be provided with four platforms for the accommodation of three tracks. Two of these would be for inbound trains, one for the Third Avenue line and one for the Second Avenue line, over which local

and express trains of each road would come into the station. All trains would leave on the middle track, extending to Pearl Street.

There would be four tracks northward from Pearl Street, two for each line. The south-bound track of the Second Avenue line would be elevated to pass over the north-bound track and descend to the grade of the other tracks just north of James Street, where separate inter-track stations would be provided for both lines to take the place of the present Chatham Square station north of Chatham Square. The two stub tracks now forming the station tracks of what is known as the Chatham Square pocket would be raised to a steeper grade and would be continued at a high level across Chatham Square to avoid the present grade crossings and enable the Second Avenue line to be continued to City Hall at the present grade of the Chatham Square tracks. These overhead tracks would accommodate such Third Avenue trains as ought to be run to and from South Ferry, the remaining Third Avenue trains being run to City Hill over the Bridge. These tracks would be run inside of the present main line tracks in the Bowery and New Bowery.

At Chatham Square an express track would run from a connection with the Third Avenue City Hall tracks on approximately the same grade northward through the Bowery over lattice cross-girders resting upon the tops of all present columns to a connection with the present middle track at Fifth Street and Third Avenue, continuing to 129th Street and Third Avenue, passing then over 129th Street at an elevation to avoid grade crossings at the terminal switches at 129th Street and Third Avenue to a connection with the west upper grade track of the proposed double-track bridge over the Harlem River. This express track would have a station at Grand Street on a level with the present station, and station platforms at Twenty-Third Street and 125th Street 11 ft. above the present station platforms to allow access to express trains across the present main tracks. To reach the proper elevation, the grade of the express track would rise from the grade of the present tracks for a length of

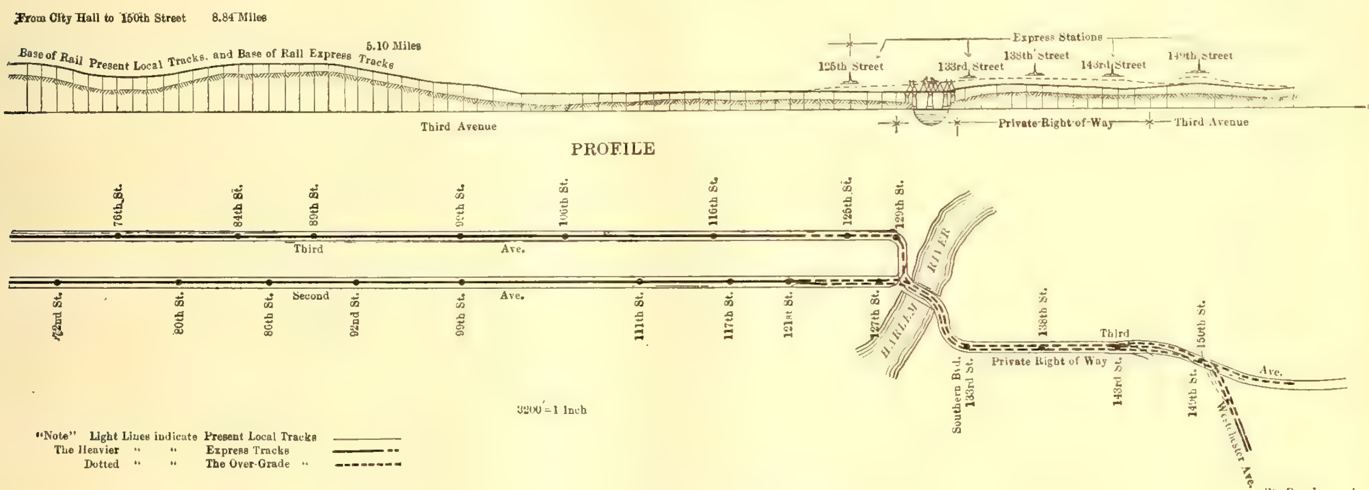


FIG. 7.—PROFILE AND PLAN OF PROPOSED ELEVATED TRACKS—(CONTINUED)

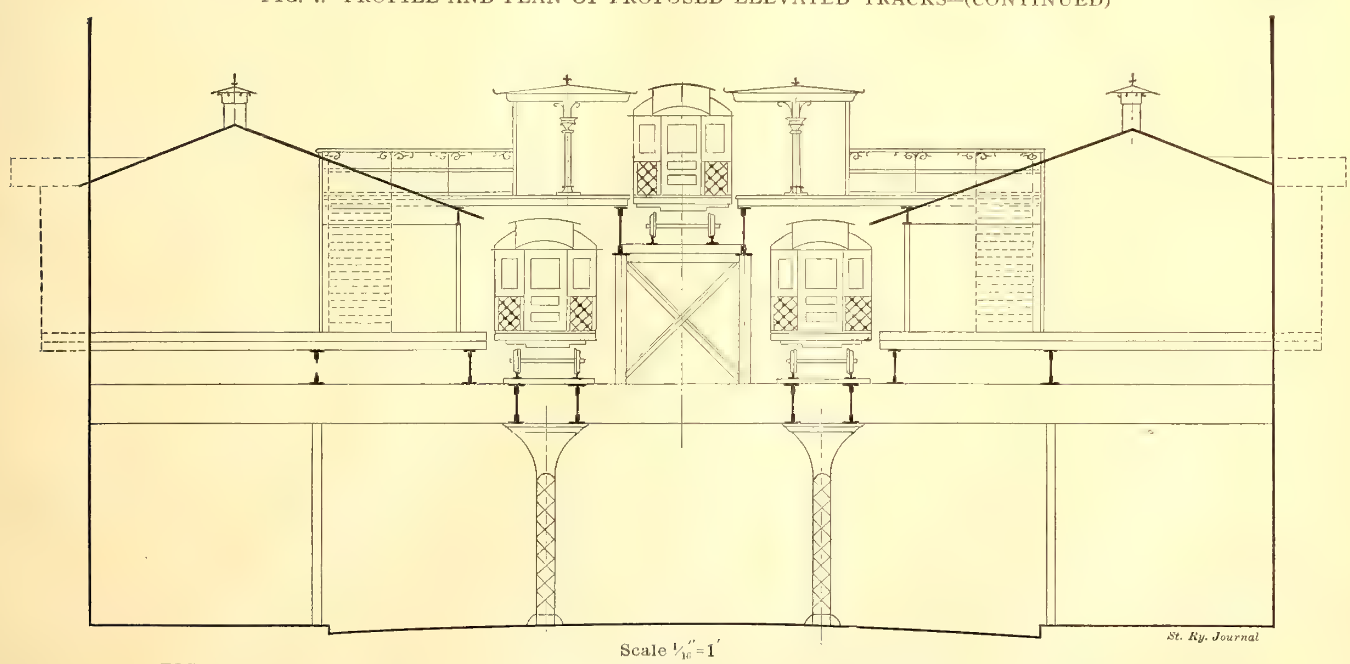
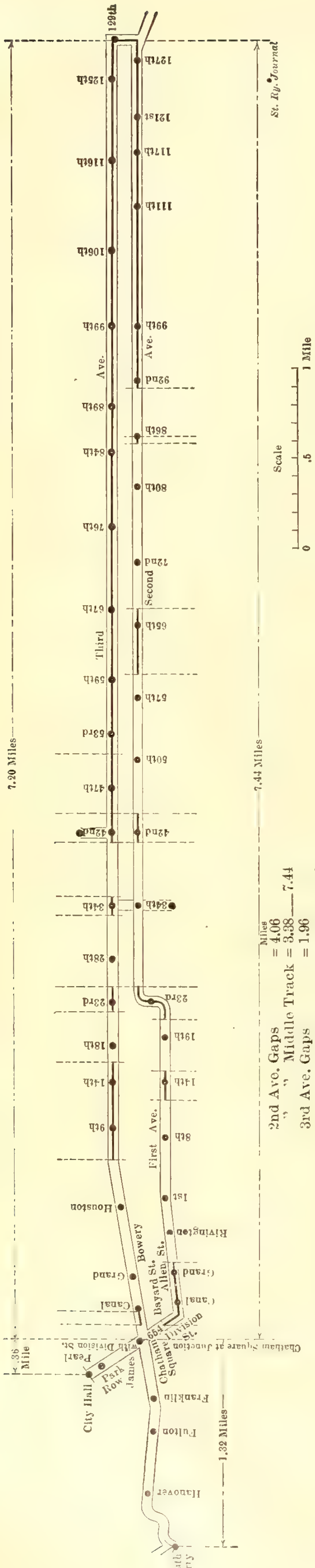


FIG. 9.—SECTION SHOWING PROPOSED EXPRESS STATION IN MANHATTAN BOROUGH

present tracks. The overhead tracks mentioned would have an upper grade station over the present Second Avenue station, from which they would descend to a connection with the present tracks through New Bowery at a point just north of Franklin Square to enable them to pass under the Brooklyn two blocks at each end of the station. From the 125th Street express station the track would be extended on the higher grade to the bridge as already mentioned.

To obtain express service on the Second Avenue line, the present middle track on Division Street, just east of Chat-



Miles
2nd Ave. Gaps = 4.06
" " Middle Track = 3.38 — 7.44
3rd Ave. Gaps = 1.96
" " Middle Track = 5.24 — 7.20

FIG. 8.—THE PRESENT TRACK LAYOUT ON THE EAST SIDE ELEVATED LINES, SHOWING THE GAPS IN THE THIRD TRACK

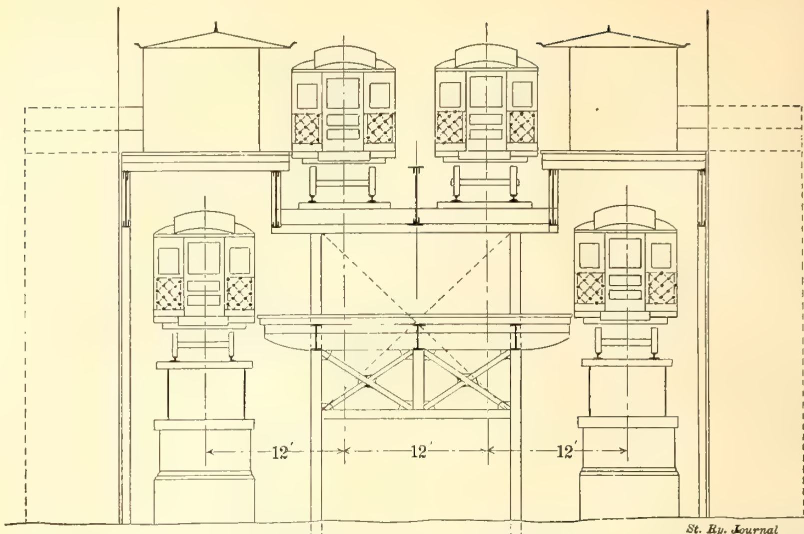
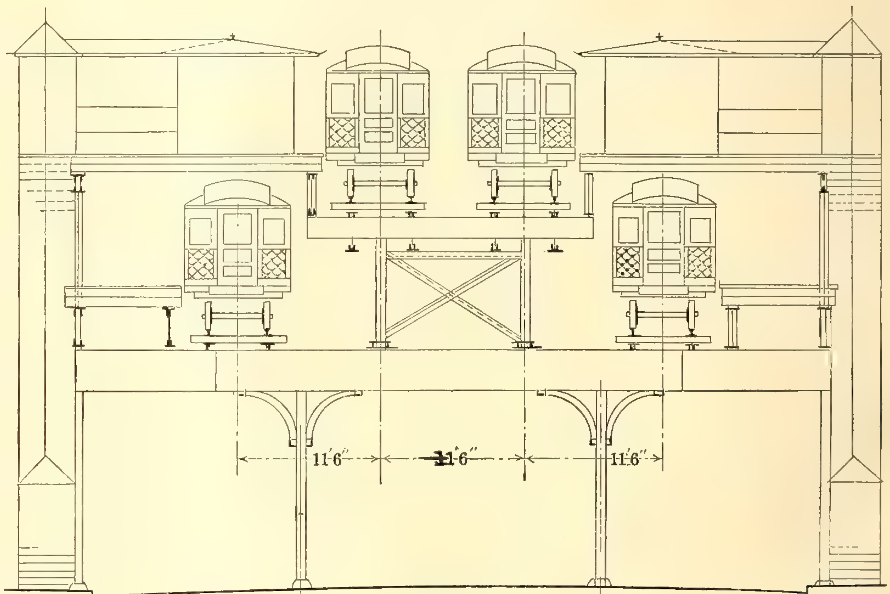


FIG. 10.—CROSS SECTION OF PROPOSED ELEVATED STRUCTURE AT 138TH STREET, BRONX BOROUGH



Scale $\frac{1}{16}$″=1′

FIG. 11.—CROSS-SECTION AT 125TH STREET, ON THE SECOND AVENUE LINE

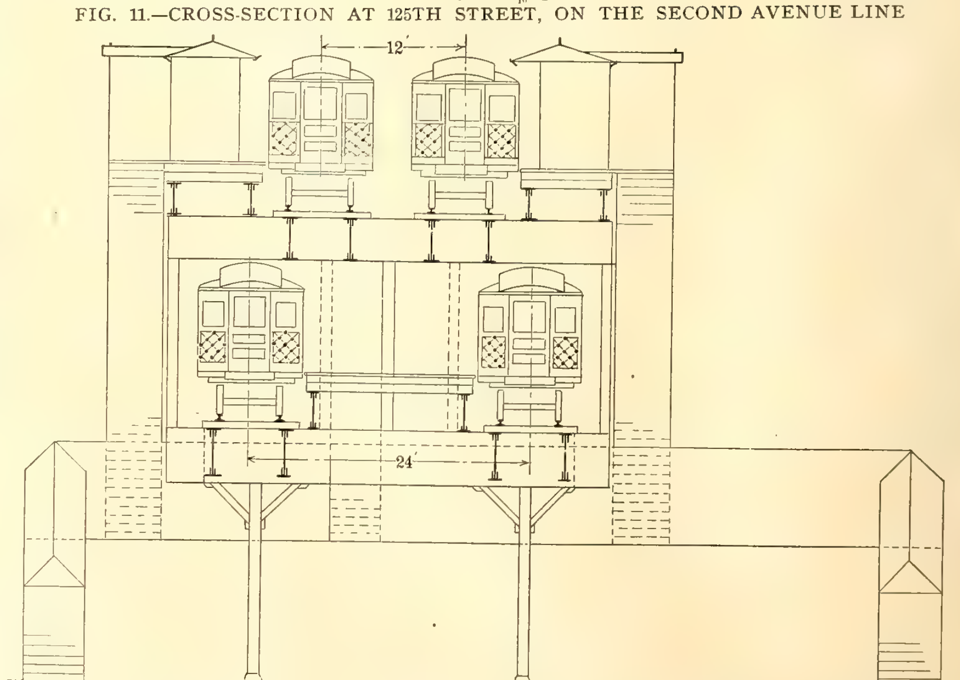


FIG. 12.—CROSS SECTION OF PROPOSED DOUBLE-DECK STRUCTURE AT 149TH STREET THIRD AVENUE, BRONX BOROUGH

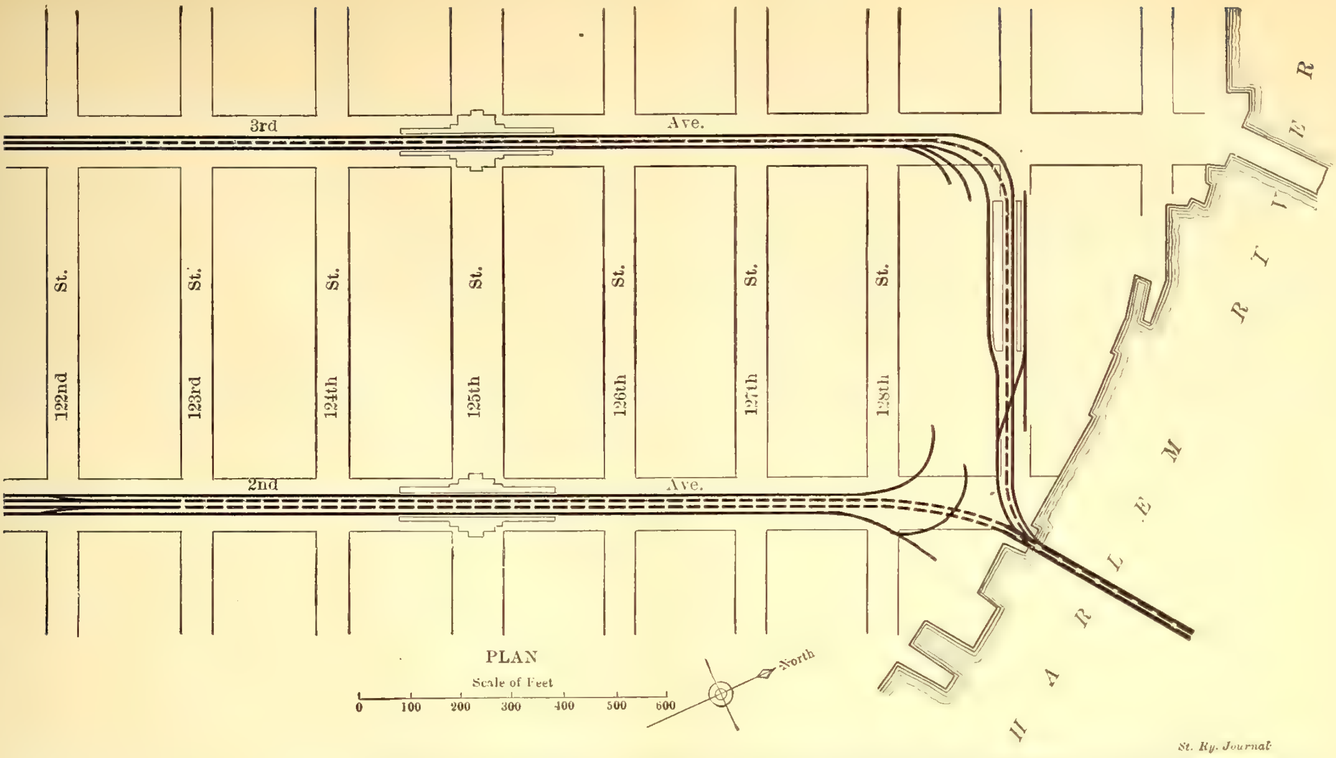


FIG. 13.—PROPOSED LAYOUT OF SECOND AND THIRD AVENUE ELEVATED TRACKS APPROACHING THE HARLEM RIVER

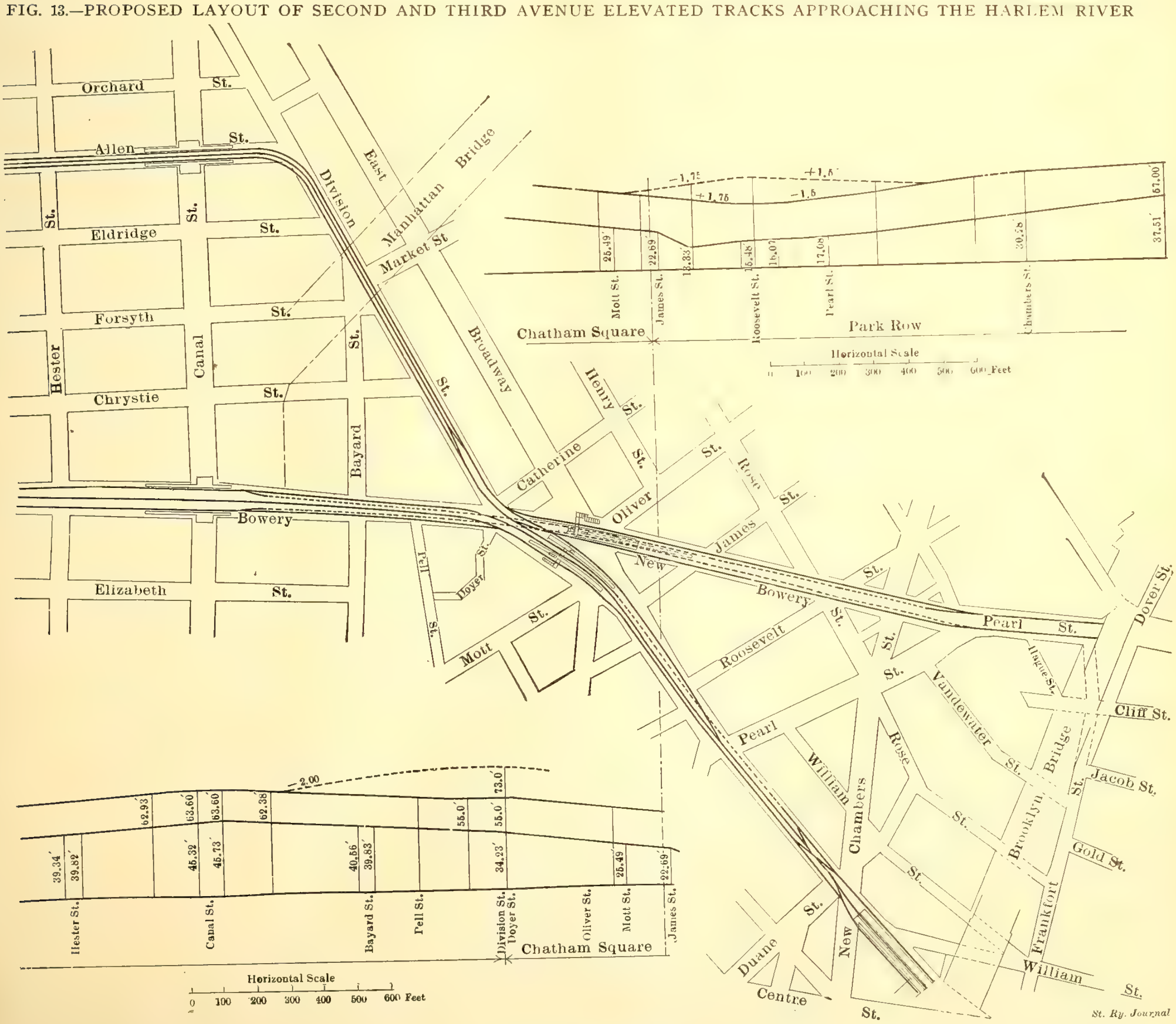


FIG. 14.—PROPOSED TRACK LAYOUT IN THE VICINITY OF THE CHATHAM SQUARE JUNCTION AND THE TERMINAL AT BROOKLYN BRIDGE

ham Square, would be connected by cross-overs with the present main tracks and the gaps in this middle track from Grand Street Station to Ninety-Second Street filled in to make a continuous middle track to 122d Street, at which point the structure would be made for four tracks, the two inner tracks rising to an elevation of 11 ft. at the proposed express station at 125th Street and continuing thence to an upper grade to and across the Harlem River to permit the east local track to pass under the same to the terminal at 129th Street and Third Avenue without a grade crossing. The express track would be provided with an express station at Twenty-Third Street between First and Second Avenues, elevated like those on the Third Avenue line.

The proposed double-track bridge across the Harlem River would carry two tracks on each deck. The lower tracks would perform the service of the present main tracks, and the upper pair be a continuation of the two interior Second Avenue tracks already mentioned. The present tracks of the Bronx or suburban line south of East 145th Street, located on right of way, would be spread to permit the two upper grade tracks to be located between them and continued to 150th Street and Third Avenue, where they would deflect to the east and descend on a grade connecting with the present tracks of the Westchester branch at Brook Avenue. Connections would be made between the upper grade tracks and the present suburban line tracks at 147th Street and Third Avenue, north bound, and 154th Street and Third Avenue, south bound.

PROPOSED SUBWAY SYSTEMS FOR THE EAST SIDE

By a decision of the Appellate Division of the State Supreme Court last July, the New York Board of Rapid Transit Commissioners was given permission to decide and place contracts within two years on any advisable number of certain subway routes approved by the courts. However, only a portion of these routes could be built with the city's money alone, since their estimated total cost of $450,000,000 (including equipment) is nine times the amount the court suggested as available for such purposes within the next two years. As the court pointed out: "This will enable them, within the period named, in view of the then existing condition of the city's finances, to determine just what routes should be built, and after that time they should be required, if able to construct other routes, to renew their application to this court. This will render null and void our approval of all routes not selected and contracted for within the said two years." It should be understood that these financial limitations do not apply if private capitalists are willing to build the approved routes under the provision of the Elsberg law granting a twenty-year franchise.

Under the limitations thus imposed, the Rapid Transit Commissioners have been obliged to consider only the most essential routes. Of those suggested for the East Side-Bronx traffic, the Third and Lexington Avenue routes, shown in Fig. 15, are being favorably considered. These subways, if built, would take most of the long-haul business from the Madison, Lexington and Third Avenue surface lines, besides relieving the Third Avenue elevated railway.

The main line of the proposed Third Avenue subway, known as Route No. 2, would begin as a two-track subway on private property south of Southern Boulevard, between Third and Lincoln Avenues in Bronx Borough, through private property to a tunnel under the Harlem River to Third Avenue and East 129th Street in Manhattan Borough, thence as a four-track subway through Third Avenue and the Bowery to Chatham Square. From the Square the lines

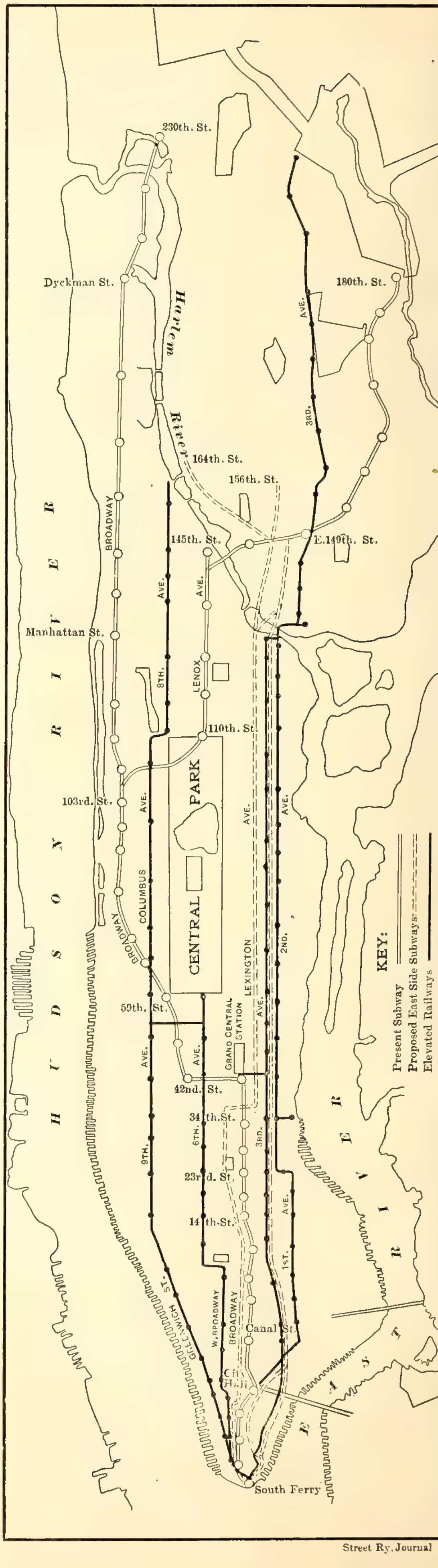


FIG. 15.—MAP OF MANHATTAN AND BRONX, SHOWING THE ROUTES OF THE PRESENT ELEVATED RAILWAYS AND SUBWAY, AND THE TWO PROPOSED EAST SIDE SUBWAYS

would run as follows: One two-track subway through New Bowery, Pearl, Broad, South and Whitehall Streets to Battery Park and around the present subway loop, thence to a terminal under the park; a second two-track subway from Chatham Square, through Park Row, Nassau Street, Broad Street to Pearl Street. There would be two cross-town spurs with the proposed Seventh and Eighth West Side subways and several feeders in the Bronx.

The proposed Lexington Avenue subway is known as route No. 5. It would begin at several points in the Bronx, converging at Lexington Avenue and East 129th Street in Manhattan Borough. These branches would be made up as follows: A four-track subway through Third and Morris Avenues, terminating at East 149th Street to connect with the present West Farms subway; a two-track subway running north by east through Park Avenue to East 156th Street; a two-track subway from East 149th Street and Park Avenue, running in a general northwesterly direction to East 164th Street; a one-track loop between the two branches last mentioned, and two short double-track spurs running respectively northeast and southeast from Park Avenue and 138th Street. From East 129th Street the main line would proceed as a four-track subway down Lexington Avenue to East Thirty-Fifth Street, west through East Thirty-Sixth Street, thence through Fifth Avenue and Broadway to Chambers Street, from where the line would be continued as a two-track subway under Broadway, Vesey Street, Church Street, rinity Place and Greenwich Street to Battery Park. In addition the Lexington Avenue subway would be connected to the present subway at Forty-Second Street and Park Avenue; a four-track spur from near East Forty-Second Street to a point between East Thirty-Sixth Street and East Thirty-Seventh Street, continued as a two-track line to Fifth Avenue and East Thirty-Fourth Street, which would connect with another branch beginning between East Thirty-Sixth Street and East Thirty-Seventh Street on Lexington Avenue. At Broadway and Chambers Street there would also be a one-track loop under City Hall Park.

TRANSFERS BETWEEN ELEVATED AND SURFACE LINES IN PHILADELPHIA

Free transfers to and from the Market Street elevated road and the intersecting cross-town lines in West Philadelphia will be given by the Rapid Transit Company when the elevated road and subway line are placed in operation. Six tickets for a quarter will be sold, and they will be good on either the elevated or surface lines. To relieve the holiday rush, the temporary loop west of City Hall was placed in operation on Dec. 8, when the day schedule of cars went into effect. Other plans for better service in connection with the elevated railway and the surface lines are in contemplation.

DETAILS OF STATION TRAFFIC ON THE NEW YORK SUBWAY

The publication of the New York Rapid Transit Commissioner's 1905 report has released the detail figures of the New York subway station travel. These should prove especially interesting in connection with the articles published in the present and preceding issues on the East Side-Bronx transportation problem. The figures selected are for June and December, 1905, and for December, 1904. The comparatively small effect of the subway in relieving the East Side transportation problem in New York has already been discussed in the article mentioned, nevertheless it is interesting to point out here that between December, 1904, and December, 1905, the ticket sales on the subway increased from 8,796,952 to 13,715,946.

STATEMENT SHOWING THE NUMBER OF PASSENGERS CARRIED FROM EACH STATION OF THE NEW YORK SUBWAY DURING THE MONTHS OF DECEMBER, 1904, AND JANUARY AND DECEMBER OF 1905.

Opening Oct. 27, 1904.	Dec., 1904.	June, 1905.	Dec., 1905.
City Hall	181,830	52,445	73,900
Brooklyn Bridge	1,548,881	1,145,922	1,717,380
Worth street	100,501	80,620	139,428
Canal street	149,509	123,490	222,232
Spring street	171,277	133,965	261,180
Bleecker street	180,620	146,114	260,500
Astor place	307,562	207,995	465,660
Fourteenth street	549,650	379,460	766,900
Eighteenth street	219,907	140,750	302,980
Twenty-third street	379,625	274,280	571,300
Twenty-eighth street	191,013	112,910	274,630
Thirty-third street	174,590	127,100	280,860
Grand Central	607,125	534,000	855,240
Times square	451,720	286,960	655,640
Fiftieth street	165,840	126,530	244,470
Columbus circle	231,820	148,600	325,549
Sixty-sixth street	149,180	100,590	193,200
Seventy-second street	209,940	140,590	287,460
Seventy-ninth street	137,604	89,810	186,480
Eighty-sixth street	160,473	101,660	209,342
Ninety-first street	86,560	55,364	112,630
Ninety-sixth street	219,145	166,360	300,180
One Hundred and Third street	197,279	137,840	256,760
Cathedral parkway	84,133	66,794	129,757
Columbia University	70,730	46,670	95,820
Manhattan street	81,359	90,520	151,600
One Hundred and Thirty-seventh street	44,480	47,428	83,762
One Hundred and Forty-fifth street	138,780	104,578	175,036
Opening Oct. 28, 1904.			
One Hundred and Fifty-seventh street	76,404	102,538	140,950
Opening Nov. 23, 1904.			
One Hundred and Tenth street, Lenox avenue	228,952	206,470	331,800
One Hundred and Sixteenth street, Lenox avenue	345,408	278,430	487,720
One Hundred and Twenty-fifth street, Lenox avenue	303,051	236,645	478,740
One Hundred and Thirty-fifth street, Lenox avenue	241,973	211,910	347,560
One Hundred and Forty-fifth street, Lenox avenue	52,520	45,730	83,380
Opening July 10, 1905.			
Mott avenue	......	......	41,260
Third avenue	......	......	230,110
Opening Nov. 26, 1904.			
Jackson avenue	101,949	121,115	164,310
Prospect avenue	93,852	116,326	197,520
Simpson street	32,003	38,967	51,035
Freeman street	60,513	74,089	117,684
One Hundred and Seventy-fourth street	11,594	15,071	19,395
One Hundred and Seventy-seventh street	30,135	47,600	65,470
One Hundred and Eightieth street	27,465	82,050	60,480
Opening Jan. 16, 1905.			
Fulton street	......	412,448	616,835
Opening June 12, 1905.			
Wall street	......	149,840	366,711
Opening July 10, 1905.			
Bowling Green	......	......	132,340
South Ferry	......	......	171,400
Sum total, including miscellaneous	8,796,952	7,313,986	13,715,946

CLUB BUILDING PURCHASED FOR ST. LOUIS RAILWAY MEN

The residence at 1411 South Grand Avenue, St. Louis, is to be converted by the United Railways Company into a clubhouse for its employees. A hall 100 ft. x 100 ft. will be built in the rear of the present structure for dancing purposes. At the west end will be a stage 25 ft. deep. The addition will cost $18,000. The house itself will be furnished throughout to provide reception rooms, parlors, library and reading rooms.

SUGGESTIONS ON RAPID TRANSIT WITH PARTICULAR REFERENCE TO ROLLING STOCK—I.

BY JOHN P. FOX

In the STREET RAILWAY JOURNAL for April 1, 1905, the writer discussed the subject of "Car Designs and Carrying Capacity," and compared a number of existing and possible car types with a view of bringing out the best features of each. He then endeavored to combine these in a car which could meet in the most satisfactory way the severest conditions of rapid transit service. As this article considered only the seating capacity of different cars, and did not take account of standing passengers, of the time to operate doors and give signals, and other practical matters of operation, it may be interesting to consider more in detail the practical working of a number of car types, and include this time all the factors that enter into the situation. The great difficulty found in handling crowds with the present cars in the New York subway suggests a place and conditions about as severe and varied as could be found, and, as specific recommendations are always more valuable than those which are general in character, the writer will consider the adaptability of each of various types of cars to the New York subway conditions. In this comparison it will be necessary to refer to existing practices on the New York subway and other roads, if faults are to be avoided in the future. The writer would be only too glad to have any of his mistakes corrected, and hopes that any criticisms which he may make of existing methods will be understood as being friendly and in no carping spirit.

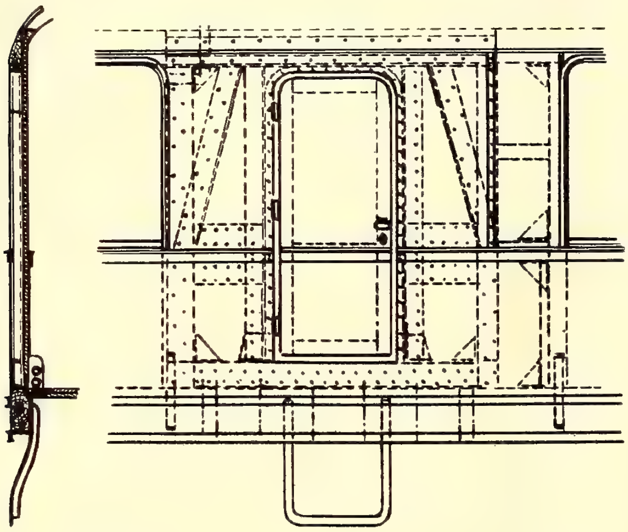


FIG. 1.—EMERGENCY DOOR IN GERMAN VESTIBULED CAR

A good many persons have expressed surprise that center doors, such as previously adopted on the Brooklyn Bridge and Boston Elevated cars, were not provided in the present New York subway cars. It has been claimed that the need of platform men to operate such center doors has been overcome by pneumatic operation, that proper stability in car construction can be secured with center doors, and that the open spaces at curved platforms necessary with them have been successfully filled in Boston by ingenious movable bridges. One answer to this is that at the time the subway was built the New York public was used to the Manhattan or end-door car, and other things being equal, an existing or well-known type of car is preferable to one radically new. Again, at the time the present type of car was selected there was no indication that the amount of transferring between local and express trains at express stations would be anywhere near as great as it has since proved to be. This transferring is a large factor in accentuating the inadequacy of the present doors. The most important question now, however, is not what should have been done in the beginning, but what can be done now to relieve present congestion and the often exasperatingly long stops, with their hindrance to operation as well as their inconvenience to the public. At the same time, it is also important for the future to determine what center-door cars would have accomplished if they had been adopted in the subway. Two test runs will therefore be made on paper with different types of cars, including the Boston Elevated cars, as the best examples working in this country of the center-door type of car.

THE CENTER-DOOR CONSTRUCTION

For some time the writer was one of those who thought the Boston Elevated type would have greatly reduced the station stops in New York, and was so convinced of this as even to consider whether the present cars could not be reconstructed so as to allow one or more doors to be cut in their sides. The proposition of cutting through the main trusses without fatally weakening the cars seemed hopeless, until an illustrated account appeared of how the very thing had been done in Germany. It was a case of cutting an emergency doorway in the wood and steel side of a vestibuled steam car, and, as shown in Fig. 1, steel sections were added about the opening so as to carry all the compression strains above the door. Fig. 2 illustrates the struts used about the wide doorway of a German mail and baggage car. Without considering the question of expense or desirability or appearance, it seems now as though the plate girders of the subway steel cars might be cut through safely as in Fig. 1, and the subway wooden cars treated as in Fig. 2. But as no need for such surgery really exists, the discussion of this point will be left to those car designers who do not wish to be outdone by the Germans.

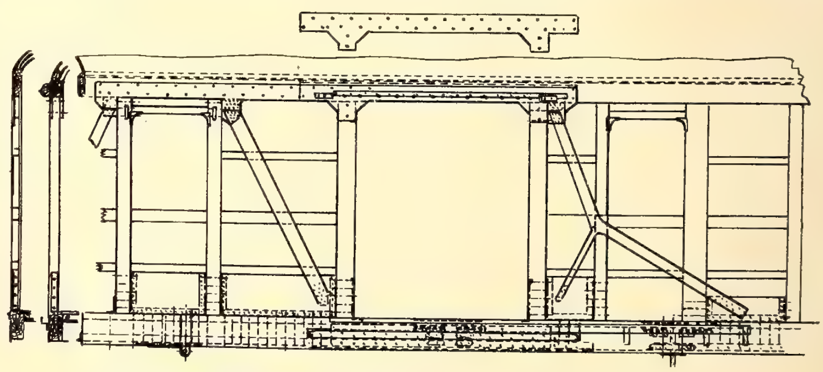


FIG. 2.—SIDE FRAME OF GERMAN MAIL AND BAGGAGE CAR

It may be an interesting digression in this connection to look at four other examples of German car construction. Fig. 3 is the plain, longitudinal section, and cross section of the underframe of a Prussian side-door railroad car, with a wooden body above, such as is commonly used in Europe. Fig. 4 illustrates a Prussian vestibuled car, showing the ingenious German method of making the whole side of the car serve as a truss, with extra steel plates at the car ends in addition to the plates covering the whole side. The ad-

vantage of this treatment of the side was evident in the case of a German-built vestibuled car which the writer measured, in which the walls were only 2 ins. thick including the inside finish. It will be remembered that the new Great Northern & City steel cars in London also have the whole side treated as a truss, and, in spite of a center door, the weight of the body is 16 per cent less than with the previous wooden type. Fig. 5 is another Prussian vestibuled car, with continuous side plate girders as in the subway cars. Fig. 6 illustrates a Bavarian vestibuled car, with a steel truss plank.

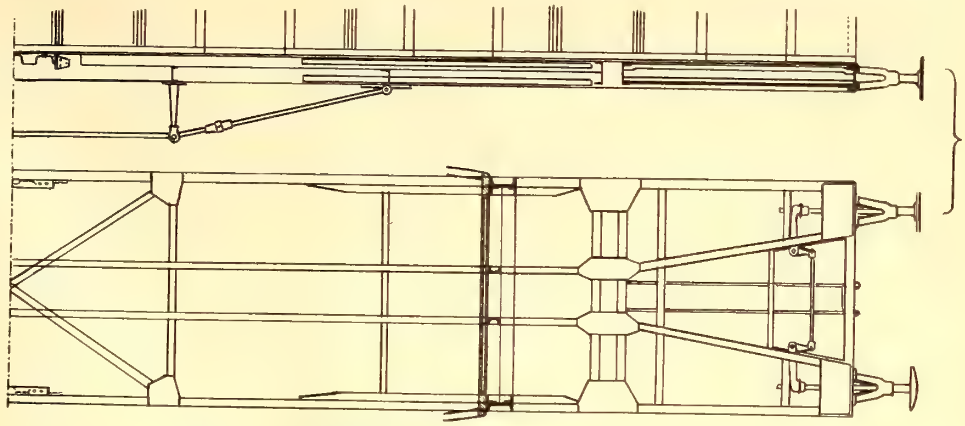


FIG. 3.—UNDERFRAME OF PRUSSIAN SIDE-DOOR CAR

EFFECT OF TWO SIDE DOORS

If side doors could be inserted in the New York subway cars, the best arrangement would appear to be to add two doors to each side as in Fig. 7. This leaves the diagonal braces undisturbed, and gets the doors nearer each end than if placed in the very center, so that the distance each guard has to see to operate his doors is reduced. If one door were placed on one side of the center post, it would allow 64 seats in the car, and two doors wherever placed would allow 56 seats if set facing each other. This arrangement of seats, if properly carried out, allows more standing passengers than at present, for if the seats are made compact so that people must sit up straight, and, as is commonly the practice in Europe, persons can stand between the seats, especially if suitable posts and handles are added. The present cars can hold 120 seated and standing passengers each, but the proposed arrangement can hold about 150 equally comfortably, or 110 with the aisle and all four doors on either side wholly clear, where the present cars would only hold about 66 passengers before some one was in the way. With a car as in Fig. 7, each guard would of course stand, as now, between the cars, and operate an end door on each adjoining car and also the nearest side door on each car. On the other hand, a single wide center door as in Boston would require the removal of the middle posts of the car. Moreover, the form shown in Fig. 7 has two obvious advantages over a center door, viz: in bringing the openings nearer to the guard as already pointed out, and in allowing more passengers to pass through, because the wide Boston center door at the quickest allows only two passengers through in 1.3 seconds, while the minimum rate observed for two single doors would permit two passengers to pass through in 0.8 of a second. The car suggested in Fig. 7 has one unavoidable inferiority over the Boston Elevated cars, in the solid partitions in the end of each motor car. These have been removed in the Boston cars, as well as in the New York trailers, so that the guard has a better view of the center doors, although the motorman's cab is greatly reduced. Perhaps such inside partitions would not be serious, and on the Metropolitan District cars in London, which have pneumatic center doors, the inside openings are even narrower than in New York.

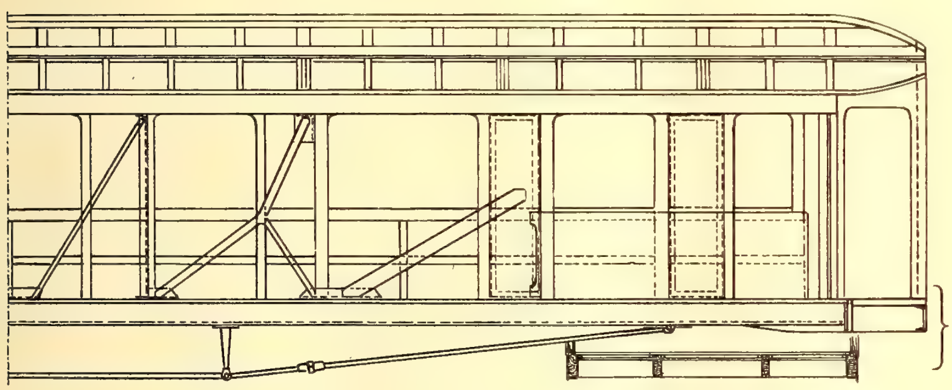


FIG. 4.—FRAMING OF A PRUSSIAN VESTIBULED CAR

EFFECT OF SIDE DOORS ON LENGTH OF STATION STOPS

Any one who knows the remarkably short stops of the Illinois Central cars with twelve side doors would naturally expect that the addition of two doors to each side of the New York cars would greatly reduce the length of all station stops. But before advocating such alterations it would be well to study carefully the actual results of opera-

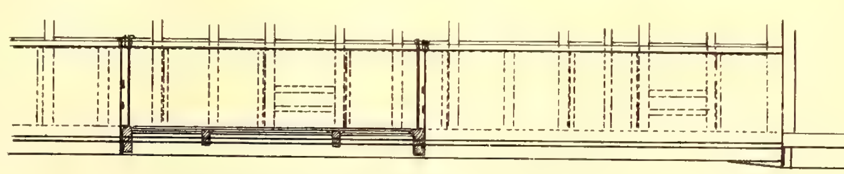


FIG. 5.—PLATE GIRDER CONSTRUCTION OF A PRUSSIAN VESTIBULED CAR

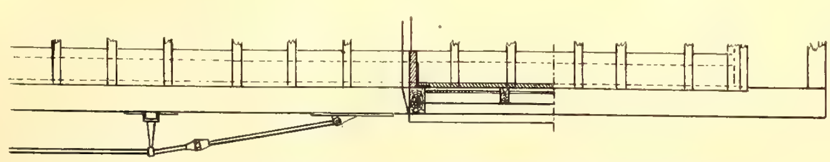


FIG. 6.—CONSTRUCTION OF A BAVARIAN VESTIBULED CAR

tion of the Boston Elevated cars. An account of these cars and their early performances was given in the STREET RAILWAY JOURNAL for April 1, 1905, where it will be remembered a marked reduction in stops was shown with the new trains with pneumatic end and center doors, over the old trains with platform gates and center doors opened only by plat form men at terminals throughout the day and at most of the other stations during rush hours only. The writer had greatly admired the Boston improvements, and was much disappointed at the results of further investigations. When the Boston stops were timed at different periods of the day it was soon noticeable that they were undesirably long, especially during the slack hours, in spite of the improvement noted over the older type. As these figures accumulated, it became evident that the Boston stops, excluding those at terminals, were longer than the local stops in the New York subway below 116th Street, including the stops of express trains at local stations on two-track sections. The results finally collected are given in Table I., and it should be stated that the Boston figures are for summer travel entirely, while the New York figures were for last winter.

DELAYS WITH THE BOSTON TYPE OF DOOR

As it did not seem possible that the traffic could be heavier in Boston than in New York, the writer looked for the cause of the differences elsewhere, and found it at last in the arrangement and operation of the Boston doors. The trou-

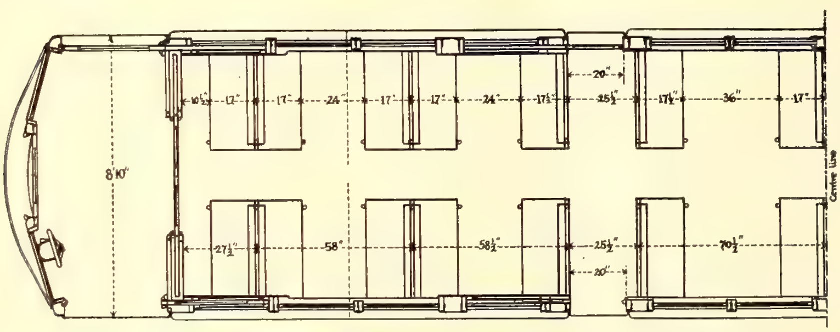


FIG. 7.—REMODELED NEW YORK SUBWAY CAR. FIFTY-SIX SEATS

ble is that the forward guard has to operate four air valves at each station, and while he can open the doors quickly in

TABLE I.—LOCAL STOPS IN SECONDS.

	Boston Elevated.	New York. Subway.
Average rush hour stop	29.	25.
Average slack hour stop	24.6	14.3
Longest rush hour stop	68.	72.
Shortest rush hour stop	16.	9.
Longest slack hour stop	54.	30.
Shortest slack hour stop	13.	4.

pairs, moving a handle with each hand, for reasons of safety he usually closes the doors one at a time, carefully watching the entrances for any late comer who may try to crowd through at the last minute. All this takes time, although it was rather surprising at first to find stops of 13 seconds and over with no passengers getting on or off. It is this latter condition that constituted the principal reason for the long stops in Boston.

The Boston doors move at different speeds which are largely independent of the number of passengers passing through the doors. Some times of closing, observed by the writer, are given in Table II.

As the New York subway car doors are hand-operated, the speed of movement depends mostly on the activity of the guard. Often the doors are wide open by the time a train is stopped. Sometimes the starting signal is given before all the doors are closed. The average time taken to close a single door is about one second, and varies from perhaps 0.7 second to 2 seconds. The latest type of sliding door can be opened or closed by hand in as short a time as 0.3 of a second, with a surprising ease of movement.

TABLE II.—BOSTON ELEVATED CARS. TIME TO OPEN AND CLOS DOORS SINGLY IN SECONDS.

	END.		CENTER.	
	Open.	Close.	Open.	Close.
Average	2.33	2.30	2.46	3.28
Maximum	5.	7.	4.	4.80
Minimum	1.	.70	1.80	1.

It seems hard to make the Boston doors move at just the right speed, and in extreme cases it has taken as long as 5 seconds to open and only 0.7 of a second to close a door. While it is safe to have doors open at any speed, 2 seconds seems about as fast as it is safe to close them, and the most desirable mechanism appears to be one giving a uniform velocity that can be instantly checked or reversed. If automatic electric signals are in use, a mechanism that closes too slowly at the end is evidently as undesirable as one that closes too fast for safety.

When a Boston train stops at a station, then, a minimum time of about 13 seconds is occupied in opening and closing the doors and in getting the power on. Possibly this might be reduced to 10 seconds with faster doors and quicker guards. Of course passengers can pass in or out some during this time while a guard is closing a door elsewhere. The 13 seconds is taken up roughly thus: Three seconds on the average to get all the doors open, 2 seconds to close each of the four doors, and 2 seconds for the motorman to release brakes if necessary and get started. Only the forward guard has four doors to operate; all the others have three, so the movements of the former generally determine the length of stop.

The minimum stop of 4 seconds timed by the writer in the New York subway shows that manually-operated doors and hand signals can be very quick, but the 3-second minimum stop of an Illinois Central train is still more remarkable, with the twelve doors to each car to be opened by passengers and closed by hand by the guard. The latter has the advantage in this car of having to look in only one direction and of closing all his doors at once instead of singly at four places as in Boston. The Boston Elevated officials were quick to see the advantages of the Illinois Central type of car, and perhaps might have tried it if their other type had not been already fixed.

As the New York doors are often open by the time a train stops, 5 seconds seems a fair average as a minimum time to close doors and start the train. It is clear now why the Boston stops are the longest in spite of the center door, for, unless the number of passengers getting on or off at a station is over about 40 to a single car, the Boston cars cannot make up for the handicap of 8 seconds.

LENGTH OF STOPS WITH DIFFERENT KINDS OF CARS

For comparative purposes it will be assumed that persons

pass through single-end doors at the rate of one a second, which is about the average. It will be remembered that a wide end door as found in New York is no quicker than an ordinary door, because people crowd up to it, or line up close each side, thus narrowing the opening. At the center of a car, however, as in Boston, a wide door is more effective, as already pointed out, and the time per passenger passing through will be assumed at 0.75 of a second, though the actual average is about 0.93 of a second.

It may be well to point out here that the rate of movement of people through doors assumed in this article is exceeded regularly in the rush hours with the Brooklyn Bridge cars.

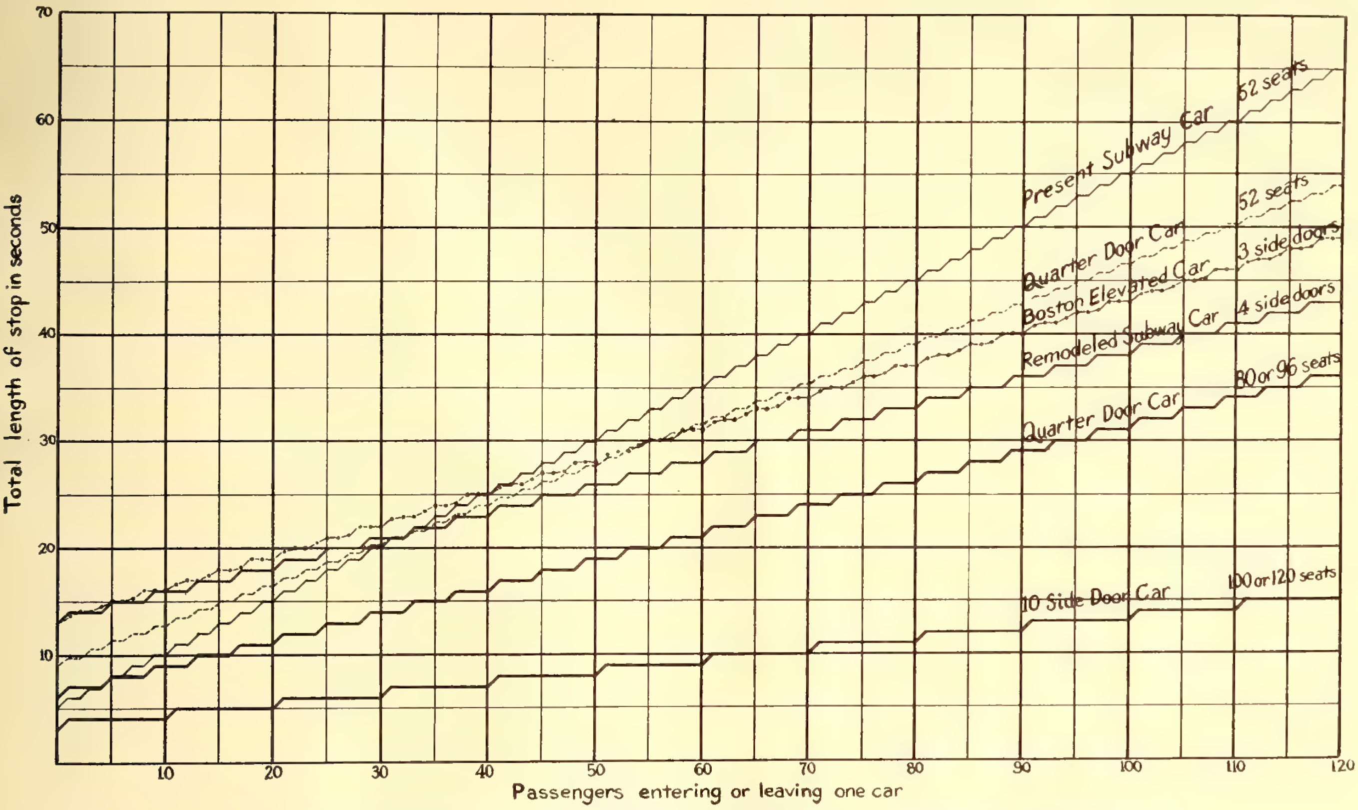


FIG. 8.—TOTAL LENGTH OF STOP WITH DIFFERENT NUMBERS OF PASSENGERS

TABLE III.—ESTIMATED STOPS IN NEW YORK SUBWAY IN SECONDS—Express Run.

STATION.	Passengers Per Car.			Present New York Cars.	Boston Elevated Cars.	Remodeled New York Cars, 4 Doors.	Remodeled New York Cars, 2 Doors.	Side-Door Cars.	Quarter-Door Car, 120 Places.	Quarter-Door Car, 112 Places.	Quarter-Door Car, 168 Places
	Getting Off.	Getting On.	In Car After Start.								
South Ferry	0	5	5	.....	.....	.....	.....	.....	.....	.....	.....
Bowling Green	0	15	15	13.	18.	17.	13.	5.	15.	15.	10.
Wall Street	0	20	40	15.	19.	18.	15.	5.	16.50	16.50	11.
Fulton Street	0	30	70	20.15	22.09	21.	20.	6.	20.40	20.40	14.
Brooklyn Bridge	10	40	100	33.25	29.93	26.	30.	8.	30.15	30.15	19.
14th Street	20	40	120	48.	38.80	28.70	36.40	9.	41.25	56.20	21.
Grand Central Station	40	40	120	65.	49.	34.20	47.40	11.	54.	81.	26.
72d Street	20	0	100	25.	25.	18.70	16.40	5.	24.	50.	11.
96th Street	50	30	80	47.95	38.95	34.	45.	11.	41.45	41.45	27.
103d Street	15	0	65	13.72	18.45	17.	13.	5.	15.52	15.52	10.
110th Street	15	0	50	13.08	18.05	17.	13.	5.	15.08	15.08	10.
116th Street	15	0	35	13.	18.	17.	13.	5.	15.	15.	10.
Manhattan Street	10	0	25	10.	16.	16.	10.	4.	15.	15.	9.
137th Street	10	0	15	10.	16.	16.	10.	4.	15.	15.	9.
145th Street	10	0	5	10.	16.	16.	10.	4.	15.	15.	9.
157th Street	5	0	0	.....	.....	.....	.....	.....	.....	.....	.....
Total stops	...	...	...	337.15	343.27	296.60	292.20	87.	333.35	401.30	196.
Local Run.											
Brooklyn Bridge	...	20	20	.....	.....	.....	.....	.....	.....	.....	.....
Worth Street	...	20	40	15.	19.	18.	15.	5.	16.50	16.50	11.
Canal Street	...	20	60	15.	19.	18.	15.	5.	16.50	16.50	11.
Spring Street	...	20	80	15.70	19.42	18.	15.	5.	17.03	17.03	11.
Bleecker Street	...	20	100	18.	20.80	18.05	15.10	5.	18.75	20.20	11.
Astor Place	...	20	120	25.	25.	18.75	16.50	5.	24.	50.	11.
14th Street	100	20	40	68.50	51.10	43.	65.	15.	56.63	56.63	36.
18th Street	...	20	60	15.	19.	18.	15.	5.	16.50	16.50	11.
23d Street	...	20	80	15.70	19.42	18.	15.	5.	17.03	17.03	11.
28th Street	...	20	100	18.	20.80	18.05	15.10	5.	18.75	20.20	11.
33d Street	...	20	120	25.	25.	18.75	16.50	5.	24.	50.	11.
Grand Central Station	100	20	40	68.50	51.10	43.	65.	15.	56.63	56.63	36.
Times Square	...	20	60	15.	19.	18.	15.	5.	16.50	16.50	11.
50th Street	...	20	80	15.70	19.42	18.	15.	5.	17.03	17.03	11.
59th Street	...	20	100	18.	20.80	18.05	15.10	5.	18.75	20.20	11.
66th Street	...	20	120	25.	25.	18.75	16.50	5.	24.	50.	11.
72d Street	40	10	90	41.15	34.69	26.75	31.45	8.	36.10	49.80	19.
79th Street	...	10	100	12.	17.20	16.15	10.25	4.	14.20	16.	9.
86th Street	...	10	110	13.50	18.10	16.30	10.50	4.	15.30	22.	9.
91st Street	...	10	120	20.	22.	16.69	11.15	4.	20.25	44.	9.
96th Street	20	20	120	.....	.....	.....	.....	.....	.....	.....	.....
Total stops	...	...	...	459.75	465.85	398.27	393.15	115.	444.45	572.75	261.

Persons board these cars at the end platforms as fast as two in a second, instead of one a second, and enter the wider center doors about as fast. While this speed slows down somewhat as the space in the cars becomes filled, even the last passengers to get on may take very little time, as when they are pushed into the car by the platform men just as the train starts. Such quick movement is hardly possible elsewhere, except after long and expensive training of the passengers until all are as expert as football players. Neither on a 54-second headway, twenty five-car trains could furnish 40,000 seats an hour.

Fig. 8 shows the estimated length of stop for different types of cars with different numbers of passengers passing through the doors, including the time to operate the doors and start the train, that is, from a full stop to a start, and it will be seen that the New York cars are quicker than the Boston till 39 passengers are handled per car, and slower above 42. It is evident then that if the Boston cars were

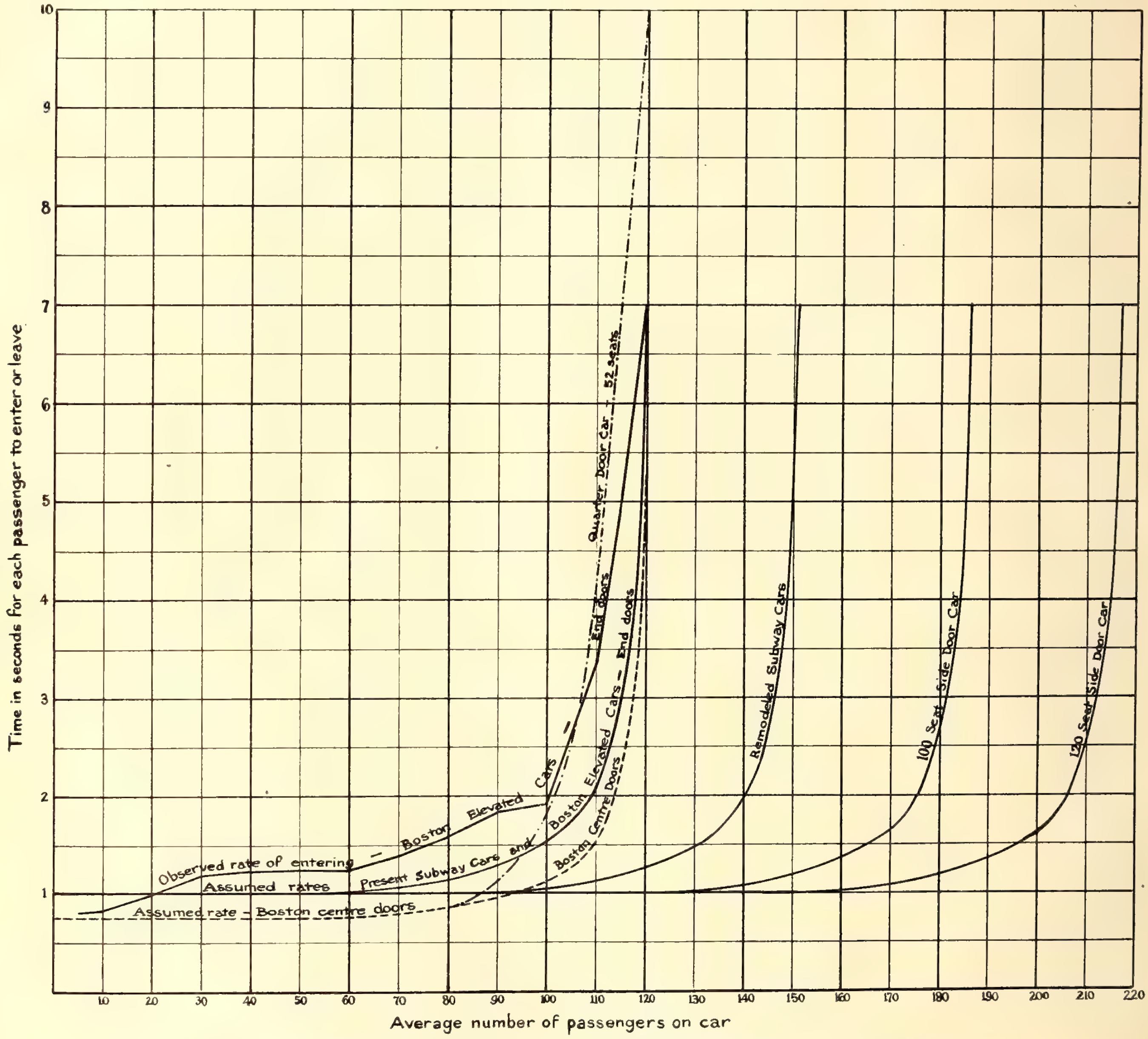


FIG. 9.—RATES OF PASSENGER MOVEMENT WITH DIFFERENT DEGREES OF CAR CONGESTION

is it really desirable, for it invites accidents without limit in the tremendous crush and pushing, in the starting of trains with persons still boarding; and in the rapid closing of doors and gates with cars in motion, a stuck door occasionally may have to be left open. Nor is it strictly necessary, because side-door cars seating 120 passengers each could be used, and loaded or unloaded in about half the time, with people moving just twice as slow. With such trains, consisting of five cars, as at present, and of the same length, run on one minute headway, the seating capacity of the bridge trains would be 36,000 persons an hour, which is about the present maximum traffic. If trains could be run in use in the New York subway they would probably make shorter stops at the express stations, at least during rush hours, and longer stops at local stations, especially during the slack hours. Subway cars with two additional doors in each side have been assumed to require 13 seconds to operate doors and signals, the same as the Boston cars; but they would be slightly quicker in handling passengers otherwise, as already pointed out, and so would be as quick as the present subway cars in handling 31 passengers, and quicker after 34 per car.

Fig. 8 makes no allowance for the slowing down of passengers' movements in and out of a car that is crowded.

The writer made a brief study of the effect of such crowding in Boston, and the observed results are given in Fig. 9. The number of passengers entering one door and their average time were found, while the number of passengers in the car was counted before and after each station stop, giving the average number of passengers on the car. While more data are desirable on this point, it has been again assumed that the total number of passengers that can be easily carried and handled on the New York and Boston cars is 120, and in the other cars considered a similar allowance of standing room per passenger has been taken. With 115 passengers on a Boston car, it took 14 seconds for two more passengers to get on, which shows the working limit of the capacity of this type of car had been about reached. The same curve has been taken for both the New York and Boston end doors, and a similar curve has been drawn for the Boston center doors. Now the "remodeled" New York car with four doors and 56 seats has standing room for 95 passengers, or a total capacity of 151 places, and an aisle and doorways which would be clear till 110 are on board. It is evident that with this car the slowing down movement would not begin as soon as with the two other types.

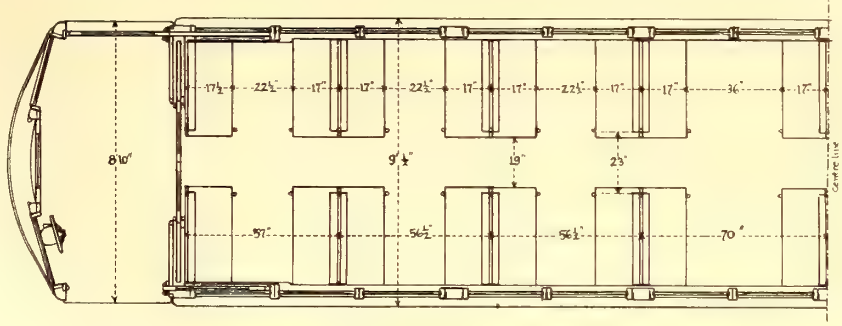


FIG. 10.—RESEATING IN PRESENT SUBWAY CARS. SIXTY-FOUR SEATS

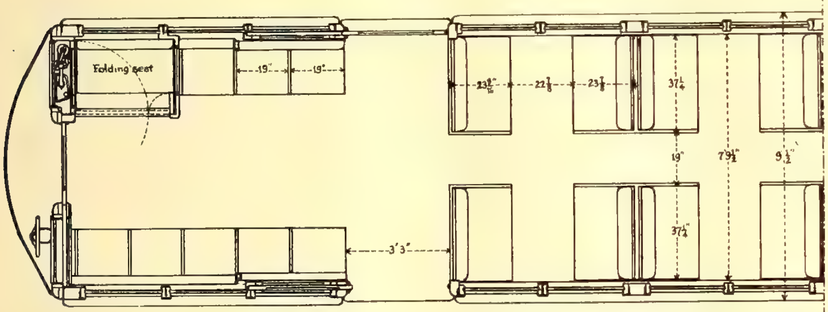


FIG. 11.—QUARTER-DOOR CAR. FIFTY-TWO SEATS

Before considering other cars, it might be well to try the three already taken up on assumed runs in the subway, both express and local. The number of passengers getting on and off at stations has been varied so as to get a large range of conditions. The rates of passenger movement have been taken from the curves, and the resulting stops are given in Table III., which shows how the Boston Elevated cars would gain over the present subway cars at the express stations, but would lose more time elsewhere, and this loss of course would be greater with any less traffic.

The remodeled car with four doors comes out better than might be expected, gaining over the other two cars in having more entrances and less congestion. Whether this gain would be sufficient to warrant the expense of inserting the four new doors to every car seems doubtful, especially as a far simpler change might reduce the time of stopping just as much. This change is shown in Fig. 10, and simply consists in making all the seats face each other, with space between and proper posts and handles for standing passengers, which would raise the total capacity of the car to say 151 persons, and the resulting reduction of congestion in aisles and entrances ought considerably to reduce the stops with the heaviest crowds. The estimated stops of this type are given in Table III. as the fourth car. The fifth car is of the side-door type, with ten or eleven doors each side, and 100 or 120 seats. It will be described and illustrated later, and is merely referred to now for the stops. The doors, which are all connected to one operating rod, would be opened by the time the train has stopped. For closing 3 seconds are allowed, as the guard operates all the doors with one movement and has to look only in one direction, instead of two or four. The passengers in all these cases are supposed to be distributed along the platforms at the doors. If the side-door stops as estimated seem too short, the reader should turn to the table of Illinois Central stops given on page 589 of the JOURNAL for April 1, 1905, where one of 3 seconds will be found, two of 5 seconds, and where the average of the thirteen on the run is 7.61 seconds, though the passengers had to open their own doors and the trainmen were in ignorance of the test. On the Liverpool Overhead Railway last year the writer found stops even during the rush hour as short as 3 seconds, though the cars have swinging side doors and starting signals are given by hand and not by bells. Still, no one can hope to predict exactly how side-door cars would work in the New York subway, and any estimates must be open to correction.

OTHER TYPES OF CARS WITH TWO SIDE DOORS

Another type of car that should be considered now is the one desired originally by the engineers of the Rapid Transit Commission. As stated not long since by the present chief engineer, the commission suggested to the operating company that it adopt a car with no vestibule and doors 6 ft. or 8 ft. distant from each end, but that this type was not considered practicable by the company because likely to require too many men at stations to operate the doors. If the type had been adopted, it might have been planned as in Fig. 11, in which the doors are a quarter of a car length

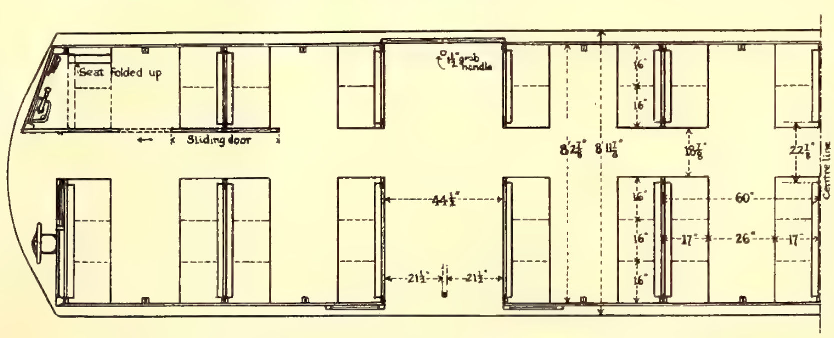


FIG. 12.—IMPROVED QUARTER-DOOR CAR. EIGHTY SEATS

from each end, with twice as many cross seats as now, with longitudinal seats at the car ends, and motorman's cabs and folding seats as on the Manhattan elevated cars, the total number of seats being 52 as in the present subway cars. The doors would be operated by the guards from between the cars as now.

In seeing what the stops of such cars would be on our sample subway runs, it seems safe to count the quarter doors (as the writer called them in his previous article) as equal in capacity to the center doors of the Boston cars, being away from the ends of the car, so that the rate of passing through will be assumed at a passenger every 0.75 of a second. For the safe closing of the doors, 3 seconds each does not seem too much to allow. Then if the doors are open by the time a train stops, and 3 seconds is allowed for the bell signals as used on the present cars, the minimum stop with no passengers would be 9 seconds. As seen from the curves in Fig. 8, these 9 seconds would make the stops of this quarter-door type longer than those of the present subway cars until a movement of 31 passengers per car was reached. Another disadvantage of this type is the reduction of standing room by the introduction of more cross seats, which would cut the total capacity of the car, compared with the others, down to 112 places. This would slow down the movement of passengers when the car was nearly full somewhat as suggested by the curve in Fig. 9, so that the rate of the Boston side doors would not hold to the end. Disregarding at first this slowing down, and supposing the car to hold 120 passengers, its estimated stops in Table III. will be seen to come out at the end just a trifle better than the present subway cars. But if the reduced standing capacity affects the stops as suggested by the curve in Fig. 9, increased delay at express stations would make the type the slowest of all considered, as shown in Table III.

Fig. 11 represents the quarter door type as it might or probably would have been built before the subway was opened. In the light of recent experience, the type could be much improved, as illustrated in Fig. 12. Here compact cross seats are used so that passengers can stand between them. There is also a thin wall construction described later, which would allow five seats across the car in place of four, without exceeding the present width. This car would accommodate 80 seated and 52 standing passengers when the aisles and doors are clear on one side, or 88 standing passengers with all space occupied, giving a total capacity of 168. By widening the car above the station platforms, the present clearances in the subway would allow six seats across with an aisle, or a car with 96 seats and space for 100 more to stand. The doors in Fig. 12 have been made double not only to allow quicker movement, but also greater safety, on account of the introduction of a vertical grab-handle post in the middle. The main object of this post, however, is to make the wide opening of the door act as two single doors by dividing the crowds and thus increasing the capacity of the opening over the ordinary center door, through which passengers too often pass in the middle and not two abreast. This post is set back from the door enough to keep people away from them while the doors are being closed. The Metropolitan District cars in London have similar doors pneumatically operated, though without any dividing post.

The stops of this third type of quarter-deck car are given in the last column of Table III., and make the best showing except for the side-door type. Automatic electric signals are assumed, cutting 3 seconds off the stops, and there would be no slowing down of movement with the largest crowds here considered. But if the Interborough Company had originally adopted a quarter-door type, it would, as stated, probably have been like the first form shown in Fig. 11., which, as shown, would not have been any quicker than the present cars. If then there had been no choice except between the Boston Elevated type, the quarter-door type, and the present subway type, it would appear that no great mistake was made in keeping the standard form of car already in use on the elevated lines. Nevertheless the seat arrangement of Fig. 10 seems better in every way than the one adopted, and it would be interesting to see it at least tried now in the subway, though the passengers might give some trouble about keeping out of the aisles and standing between the seats.

TABLE IV.—COMPARATIVE CAPACITY OF CARS FOR THE NEW YORK SUBWAY.

Type.	Fig.	Seats.	With Standing Passengers. Aisles and Doors Clear. Standing.	Aisles and Doors Clear. Total.	Aisles and Doors Filled. Standing.	Aisles and Doors Filled. Total.
Present cars	..	52	14	66	68	120
Remodeled, with 4 side doors	7	56	54	110	95	151
Remodeled, without 4 side doors	10	64	54	118	87	151
*Side door car No. 6000	..	100	33	133	86	186
*Side door car No. 7000	..	120	33	153	97	217
Quarter door, 1st type	11	52	8	60	60	112
Quarter door, 2d type	12	80	52	132	88	168
Quarter door, 3d type (wide)	..	96	60	156	100	196
Boston elevated cars	..	48	10	58	72	120

* These cars will be described later.

CARRYING CAPACITY OF TYPES OF CARS UNDER CONSTRUCTION.

In Table IV. is summarized the holding capacity of the types of cars under consideration.

TABLE V.—COMPARATIVE DATA FOR RUNS IN NEW YORK SUBWAY.

EXPRESS RUN.—SOUTH FERRY TO 157TH STREET.

	Present New York Cars.	Boston Elevated Cars.	Remodeled New York Cars. 4 Doors.	Remodeled New York Cars. 2 Doors.	Side-Door Cars.	Quarter-Door Car, 120 Places.	Quarter-Door Car, 168 Places.
Assumed time, including stops sec.	1,800	1,800	1,800	1,800	1,800	1,800	1,800
Stops sec.	337	343	297	292	87	333	196
Time, excluding stops sec.	1,463	1,457	1,503	1,508	1,713	1,467	1,604
Stops, per cent of length with present cars	100%	102%	88%	87%	26%	99%	58%
Speed, including stops m.p.h.	21.18	21.18	21.18	21.18	21.18	21.18	21.18
Speed, excluding stops m.p.h.	26.06	26.15	25.35	25.27	22.25	26.00	23.78
Per cent reduction in speed over present cars	0	+0.35%	—2.72%	—3.03%	—14.62%	—0.23%	—8.75%

LOCAL RUN.—BROOKLYN BRIDGE TO 96TH STREET.

	Present New York Cars.	Boston Elevated Cars.	Remodeled New York Cars. 4 Doors.	Remodeled New York Cars. 2 Doors.	Side-Door Cars.	Quarter-Door Car, 120 Places.	Quarter-Door Car, 168 Places.
Assumed time, including stops sec.	1,560	1,560	1,560	1,560	1,560	1,560	15.60
Stops sec.	460	466	398	393	115	444	261
Time, excluding stops sec.	1,100	1,094	1,162	1,167	1,445	1,116	1,299
Stops, per cent of length with prsent cars	100%	101%	87%	85%	25%	97%	59%
Speed, including stops m.p.h.	14.84	14.84	14.84	14.84	14.84	14.84	14.84
Speed, excluding stops m.p.h.	21.05	21.15	19.92	19.85	16.02	20.73	17.80
Per cent reduction in speed over present cars	0	+0.50%	—5.40%	—5.70%	—25.00%	—1.52%	—15.44%

If the stops of the trains in the New York subway could be reduced, one way to utilize the advantage would be to reduce the maximum speed and thus cut down the current consumption. This would reduce the temperature of the subway and thus lessen the rate at which it will inevitably become hotter from year to year.

Comparative figures for different station stops, but based on the same schedule speed, are given in Table V.

The economy of the side door car is very apparent from the preceding table. It would be interesting to know the relative current consumption for the different types of cars on the test runs, but the matter needs further study. From approximate figures, however, it appears that on the express run the side door cars might use about 12 per cent less current than the present cars, while on the local run, the side door cars might save as much as 46 per cent of the current. While such economy, if confirmed, might be found to such an extent only in the rush hours, it suggests the need of further practical trial of side door cars, to see especially if they might not cause a sufficient reduction in operating expenses and cost of maintenance to make it profitable to substitute them, in time at least, for the present car bodies.

(To be Continued.)

THE ELECTRIC RAILWAYS OF GERMANY AT THE CLOSE OF 1906

BY A GERMAN ENGINEER

The electric railway companies in Germany with but few exceptions are in a prosperous condition. Many railways which were unable five years ago to earn their operating expenses have since recovered and are paying dividends ranging from 1.2 per cent to 5 per cent. For those roads which are operating under unfavorable conditions the average annual increase in traffic has been at least 3 to 4 per cent during the last five years. For most of the roads the increase has amounted to from 6 to 7 per cent, in quite a few cases it has reached 10 per cent, and in exceptional instances even more than 30 per cent. It is natural that such steady increase in business for a number of years should wipe out the earlier losses and convert poorly paying roads into profitable enterprises. Had all the stockholders foreseen this condition several years ago many of them would not have disposed of their securities at 50 per cent loss, as they did, but would have held them up to the present time to sell at an advance of 25 per cent.

There is, however, another cause for this favorable turn of affairs. The Prussian law of 1892 relative to the building of street and interurban railways was a great incentive for the construction of such lines. This development continued uninterruptedly for some six years, the promoters being so anxious to take advantage of it that they fairly fell over each other in offering to the municipalities all kinds of returns, including maintenance of the pavements, free transportation to municipal employees, the purchase of current from the municipal power station at high prices, etc.

Reaction, of course, was inevitable, as the expense of electric railway construction and operation had been underestimated in most instances. Large concerns which had built as many as a score of railway systems or holding companies which had guaranteed the interest payments on railways taken over fell into financial difficulties and had to reduce their nominal capital sometimes to one-third of the original amount. Instead of receiving dividends the stockholders in these corporations were assessed on their stock to make up for operating deficits, and the public lost confidence in electric railway investments. One notable feature was that the city lines lost money in freight handling, although this was one department of their business which they hoped would be especially profitable.

Naturally the vicissitudes of these earlier companies had the wholesome effect of discouraging the construction of competing lines, so that the natural increase in traffic which a new railway always creates has come to reward the pioneer companies after years of unprofitable operation. Another cause for the present prosperity lies in the fact that the burdensome conditions formerly imposed have been considerably ameliorated, such as the municipalities sharing the cost of paving and reducing the price for current purchased. Another factor contributing to the better state of affairs has arisen from the policy quite commonly followed by the railway companies of not extending their systems unless those to be benefited (generally the municipalities) would guarantee 4 per cent on the money invested. Traffic has also been increased by the gradual connection of neighboring systems.

STATISTICS

Great caution has also been shown in later years in the building of new street railway systems, the increase in the number of companies between 1903 and 1904, for instance, being only 10, or from 212 to 222. It is probable that not more than six new lines were built in 1905, and probably another six in 1906. In 1903 the total length of lines was 1949 km (1228 miles). In 1904 this was increased by 141 km (87.5 miles), and within the last two years the extensions have probably not been any greater. This figure, according to the method followed in Germany, represents length of route, not length of single track as with the American custom. It does not, therefore, indicate the increase in the amount of double track, which has been considerable.

As there is quite a number of different gages used in Germany it may be of interest to give a list here of their comparative number and lengths:

GAGE.	PRUSSIA.		REST OF GERMANY.	
	Number of Roads.	Per Cent. of Total.	Number of Roads.	Per Cent. of Total.
1.437 m. or 4 ft. 8½ ins.	49	31.2	7	10.8
1 m. or 3 ft. 3.4 ins.	97	61.8	42	64.6
750 mm. or 29½ ins.	2	1.3		....
600 mm. or 23⅝ ins.	2	1.3	1	1.5
Mixed gage	3	1.9	3	4.6
Miscellaneous	4	2.5	12	18.5
Total	157	100	65	100

Standard gage is now favored, whenever possible, because of the difficulty of designing motors for narrow-gage cars. Of course, in extensions of present systems it is necessary to retain the old gage.

There are still a few steam lines devoted largely to light freight, operated as carriers in connection with the State steam railways, and a few horse railways in towns where the small amount of traffic would not justify electrification, or where the municipalities demand exorbitant terms for their consent. One of the most common of these demands is that the streets should be widened at the railway's expense—a process often costing more than the entire track construction. This accounts for the peculiar fact that even on many large systems small sections are still operated with horses.

This is not unlike the situation on certain of the downtown lines of the Chicago Union Traction Company.

Of all the Prussian street railways operated at the end of 1904, 148 were used exclusively for passenger transportation, 4 exclusively for freight, and 70 for mixed service. Of these 70 lines 28 conducted limited freight service only, and 15 confined their business to express packages. Eight railways still have two classes of passenger cars.

An ever increasing percentage of the mileage operated is now given by trailers. In 1905 the motor-car mileage increased 6.8 per cent, but as the total increase over the preceding year was 8.3 per cent for all cars it appears that the trailers have grown in popularity. The 1905 receipts of the street railways in Prussia are estimated at $27,000,000, which is considerably more than the preceding year.

Since the street railway companies have done little in the way of extensions recently, they have been able to devote more attention to improvements and betterments, a matter which, according to German standards, had been somewhat neglected in earlier years. This was all the more necessary as the higher costs of operation had not always been accompanied by a corresponding increase in net receipts.

FARES

It is well known that in every country the amount of fare charged is largely dependent upon the standard small coin in common use. In the United States this is 5 cents, because 1 cent would be too low and a 5-cent piece is next in value. In England the common small coin is a penny (2 cents), in France it is 10 centimes (2 cents), and in Germany 10 pfgs. (2⅜ cents). From this it will be seen that the American railway capitalist has the best of the bargain, for even if the operating costs are greater in the United States than in Germany, still 5 cents is more than double 10 pfgs.

As has been noted in former issues of the Street Railway Journal, this is one great reason why the single or uniform fare system has been successful in America and unsuccessful as a rule in Europe, where it has caused a great deal of trouble. Nearly all the German railways which have tried the uniform fare system (of course on the 10 pfg. basis) and which were not required by their franchises to continue it, have discarded it for a considerably higher zone fare. It is noteworthy that the municipal lines were the first to increase fares. According to their idea it was all right to force a private corporation to accept a 2½-cent uniform fare, even at a loss, but it was otherwise with public corporations. This action of the municipalities has not failed to react favorably for the private street railway corporations, so that the improvement in fare charges has contributed not a little to the healthier state of the industry. Commutation tickets, which are sold extensively by the street railway companies in Europe, have in particular been considerably increased in cost. Formerly commutation tickets were sold at a reduction of from 50 per cent to 75 per cent of the corresponding number of single fares, but the minimum figure has been doubled, and even if some passengers have been lost the great majority have been retained at the higher fare.

POWER

Another factor that has done much to improve the financial condition of the companies is the increased attention now given to the sale of power. In former years there was very little public demand for electricity, but to-day it is not uncommon to find electric lights in the smallest villages and electric motors employed for a large variety of farming and manufacturing work. Many small manufacturers have realized that if there is any possibility of competing successfully with large manufacturers it is in the application of electric drive for their machines.

Up to a short time ago the impression was general that small power stations were unprofitable. This has been disproved by an investigation made by General Secretary Dettmar of the German Electrotechnical Society, which led to the conclusion that the smaller power stations such as those existing in cities of 1000 to 5000 population are the most profitable. All of Mr. Dettmar's statistics came from stations in operation at least two years, newer ones being left out, as the interest and depreciation charges for the first year are so much more liable to error. Of the sixty-four stations compared thirty-two showed a surplus of 8 per cent on the capital invested, after paying interest and dividends, and the others averaged a surplus of 5 per cent. There was but one station which showed a loss and that amounted to but 0.6 per cent. A closer investigation of this particular case showed that the loss was due to high cost of management, and to an excessive investment charge, In the thirty-two power stations first mentioned the average cost of the labor and management was 15.9 per cent, and in the other thirty-two stations 20.2 per cent of the total expenses. In a single case it was 40 per cent. Further it was determined that the less profitable stations were not necessarily in the smaller cities, as the average number of inhabitants of the towns served by the more profitable stations was 3350 and of the others 3550. The former had an average income per inhabitant of 8.32 marks ($2.08) and an average investment per inhabitant of 32.9 marks ($8.25). The corresponding figures for the less profitable stations were 6 marks ($0.50) and 53.3 marks ($13.32). Eleven stations showed a surplus of over 13 per cent, which is certainly remarkable.

Mr. Dettmar also made an investigation for cities from 5000 to 10,000 inhabitants. Of thirty-six stations in this class the highest surplus was 23.7 per cent, the lowest 5.5 per cent and the average 10.2 per cent. The cost of management and labor varied between 9.1 and 28 per cent of the total expenses and averaged 14.9 per cent. The investment per inhabitant ranged between 15.5 marks ($3.88) and 79 marks ($19.75), and averaged 37.3 marks ($9.40). It is interesting to add that the companies were successful even in towns with gas plants. In cities of 10,000 to 20,000 people the average income was 10.6 per cent. From these statistics it is apparent that even the unprofitable undertakings could be bettered by not permitting the wages charge to exceed 20 per cent of the total cost. If this is not possible in small towns a practical mechanic should be engaged instead of a higher-priced engineer. The employees should also be used for other work when not engaged in taking care of the power station, and more attention should be given than heretofore to such outside work as the sale of motors, switches, wattmeters, etc. Another improvement would be effected if rubbish were used as an auxiliary fuel. Even the operation of ice machines can be made a source of income. In one city of 10,000 inhabitants power was profitably sold for machinery making about 185,000 lbs. a month. Central station matters of this character unfortunately have not been discussed very widely in German technical literature. How much these small earnings from side lines can affect the total is apparent when one considers that the average capital invested in one of the smaller power stations in Germany is only 150,000 marks ($37,500), so that an annual net increase of 3000 marks ($750) means 2 per cent of the investment.

ROLLING STOCK

Returning now to the subject of street railways, there has been considerable increase in the number of cars in Germany, particularly as double-truck cars have gradually fallen into disuse except in Berlin. Single-truck cars with rather longer wheel base are now preferred. These wheel bases now vary from 3.6 meters (11 ft. 10 ins.) to 2.5 meters (8 ft. 2 ins.), instead of 1.7 meters (5 ft. 2 ins) to 1.5 meters (5 ft.) as formerly. A radial movement of the axles on curves is secured by allowing a gap of about 1 in. between the journal boxes and the pedestals. The early short wheel base trucks were satisfactory enough while the track was new, but now they are so shaky that a longer wheel base has gradually come into use. This is especially true of trailers, because there are some problems in motor suspension with long-base radial trucks which have not been satisfactorily solved. In Austria and Hungary, however, particularly in Buda Pest and Vienna, greater success seems to have been met in adopting the long wheel base truck for motor-car operation.

The installation of train or simultaneous acting brakes is making progress, though a large number of railways are still using the ordinary hand brake and the short-circuiting or magnetic brake only for emergencies. The air brake has not been adopted to any considerable extent, the German railways believing that it has no advantages over the electric brake, while costing more for installation and maintenance. Detailed statistics on this point will be found in the report on braking presented at the Milan convention of the International Street Railway Association by Mr. Scholtes, of Nurnberg, and published on page 432 of the STREET RAILWAY JOURNAL for Sept. 22, 1906.

The Leipzig street railway system has adopted a rope brake based on the principle of the hand brake and friction drum. One end of a braided hemp rope, which is wound around a drum on the car axle, is fastened to the brake rod and the other end to the brake handle. This arrangement has been found well adapted both for motor cars and trains with trailers. The initial cost is said to be only 200 marks ($50) and the maintenance required very little. This rope brake may also be actuated by a small solenoid.

The most common form of car lightning arrester is the well-known Siemens horn type, which is favored for its low cost of installation and maintenance as well as reliability.

The trolley wheel is still used to a much greater extent for current collection than the bow, but most of the new lines are being equipped with the latter, as its advantages are becoming more apparent. The greater use of the wheel may be ascribed to the fact that the owners of the trolley bow patent, Siemens & Halske, built fewer lines than the other electrical firms. Several companies have changed from the wheel to the bow, but none from the bow to the wheel. The advantages of the bow lie in the simplification of the overhead suspension and the greater safety in operation, because the bow accommodates itself to changes in direction and cannot jump off the wire. While the wheel advocates claim that the bows wear out faster, their statements have never been proved by figures. In any event, the greater safety afforded should outweigh a considerable amount of increased wear even if it does exist.

TRACK CONSTRUCTION

In track work no company is installing to-day grooved rails weighing less than 40 kg per meter (80 lbs. per yard), and in many cases sections weighing 50 kg to 60 kg per meter (100 lbs. to 120 lbs. per yard) are employed. The usual height of rail up to the present has been 150 mm (6 ins.) for a rail having a base of the same dimension, but as the paving blocks used in Germany are mostly 7.1 ins. deep it is necessary to disturb the track foundations when repairing the paving. This increases the cost of keeping the track in condition. Lately, however, the railway companies have begun to remedy the evil by adopting the old "Goliath" or high rail. For instance, Hamburg is now using a rail 180 mm (7.1 ins.) high, and Munich 210 mm (8¼ ins.) high with an 180 mm (7.1 ins.) base. The new Munich angle plate weighs 59 kg (130 lbs.), is 640 mm (25 ins.) long and has twelve bolt holes. With this construction two cross-ties are used at every joint, while the rest of the track is laid without cross-ties, as is common throughout Germany. The Munich track, including ties and joints, weighs 138 kg per meter (276 lbs. per yard).

The rail length is also constantly increasing. Formerly 10-m (32-ft. 10-in.) lengths were the most common, though some pieces were 12 m (39 ft. 6 ins.) long, but to-day lengths up to 18 m (59 ft. 1 in.) are not uncommon, and lengths less than 10 m (32 ft. 10 ins.) are never laid.

The continued increase in the use of asphalt pavements in cities costs the railway companies a great deal of money. The municipalities prefer it as it costs no more than the best stone paving, and is noiseless. From the standpoint of the railways, however, asphalt is not a good pavement because it does not adhere to the rail; it thus allows water to percolate into the roadbed and injure it. The tendency of vehicles to use the rails is an old story. Many of the wagons are not quite of the same gage as the track, with the result that one of the wheels tends to run very close to the rail and peel off the asphalt. Originally most of the railway companies agreed to pay a fixed sum to the paving contractors for annual maintenance. The contractors, however, inserted a clause to the effect that they would not be responsible for damage to paving caused by loose rails, and that they would make no repairs unless the track was first placed in satisfactory condition. This clause proved a pitfall for the railway companies, for the track could not be repaired without renewing the asphalt, which had to be done at the company's expense. It is not likely that many railways have renewed contracts of this kind.

The municipalities have consistently refused to permit stone or wood paving between or alongside the rails, but since municipal operation has been started on a large scale the communities "have dispensed with the laws which they themselves have made." In other words, the municipal roads are frequently paved along the rails with one or two rows of Australian hardwood. Experiments along these lines have not yet been carried on long enough to reach definite conclusions, still it would seem that this innovation will cause a reduction of the maintenance cost of paving. The difference in cost between rail and track in Germany is made clear by the fact that two lengths of rail 40 ft. long cost about 300 marks ($75), but by the time these rails have been installed and are ready for service the expense has been increased to 3500 marks ($875).

The rail joint problem, while still giving trouble, is assuming more definite shape. The Falk joint has not been installed for several years, and the general tendency is to favor either the Goldschmidt thermit method or the Melaun rail joint. The cost of both of these joints is about the same, namely 45 marks to 50 marks ($11.25 to $12.50) per weld or joint when installed in large numbers.

The great evil in German railway practice has been the absence of standards. It is not uncommon for a large rail-

way to have six kinds of motors, brakes or cars. This trouble is being partially remedied by the consolidations of manufacturing companies, but great improvements cannot be expected until the railway companies themselves get together on the subject. One step in this direction has recently been made by the German Street and Interurban Railway Association, which has prepared the track work specifications published elsewhere in this issue. Work is also under way for the adoption of similar standards for car parts and the overhead work.

EMPLOYEES

It may be of interest to give some figures relative to power consumption per car-kilometer. In general the power required for single-truck cars weighing 7 tons to 9 tons varies between 400 watt-hours and 600 watt-hours per car-kilometer (666 watt-hours to 1000 watt-hours per car-mile). In exceptional cases the consumption has been as low as 350 watt-hours per car-kilometer (583 watt-hours per car-mile), and as high as 700 watt-hours per car-kilometer (1166 watt-hours per car-mile). Most of the city lines average 833 watt-hours to 900 watt-hours. Owing to the high cost of power in many localities (3 cents per kw-h. to 3.75 cents per kw-h), a great deal of attention has been given to this subject. Three types of current checking instruments for cars are in vogue, namely, wattmeters, current-time recorders and current-distance recorders. The wattmeter is the most accurate and most widely used instrument, but it is expensive, and requires frequent calibration to insure reliability. However, semi-annual calibration has been found sufficient to keep the errors within 3 per cent, which is accurate enough for the purpose. The cost of such wattmeters ranges from $17.50 to $27.50, to which must be added the expense of installation and maintenance. Despite this all railways employing these meters say they have saved money by their use.

The current time recorder is a more rugged instrument, which indicates only the length of time the current was in circuit. Although useless for accurate measurements their moral effect is good. In Frankfort, for instance, the power consumption has fallen 20 per cent since their installation. The current distance recorder, which measures the distance traveled while power is on, was tried in Hamburg and one or two other places, but was abandoned as impracticable.

There is still a great difference of opinion whether motormen using least current should be rewarded or extravagant ones punished. On some systems, as in Hamburg and Magdeburg, about one-third of the men receive extra pay in proportion to the power saved. An additional incentive is to give a high annual premium to the best motormen. It would seem that without some premium system the men would gradually return to wasteful methods.

Within the last year there has been considerable improvement in the wages of car men, but it is still common to pay the motorman more than the conductor. For this the following reasons are given: The motorman has greater responsibilities, his work is more exhausting, as he must keep his attention fixed on other street traffic, and he does not receive any tips from passengers. The tips to a conductor are often equal to his regular wages. Other railway companies have adopted the practice of paying the same wages to both the motorman and conductors, and alternate them in both positions every week or month. Most of the large railways pay monthly and give fourteen days' notice in case of discharge, while other railways pay daily. The customary monthly wages on the larger systems are as follows: One month under instruction, $18.75 to $20; six months on trial, $22.50; up to the close of the second year, $23.75 to $25; between three to five years, $26.25; five to ten years, $27.50 to $28.75; ten to fifteen years, $30 to $32.50. In addition bonuses which may amount to $3.50 to $3.75 extra a month are paid when the runs exceed a certain mileage. Some companies furnish uniforms free, while others pay only part of this cost.

Conductors are usually paid $22.50 a month, and their positions are in high demand, particularly on lines with zone fares, because the conductors can earn from 25 cents to $1 a day extra from tips. It is a peculiar fact that the tips are more numerous on the lines patronized by working people than on those running through the wealthy districts. A conductor who has been disciplined would rather pay a fine of 10 marks, or $2.50, than be transferred from a lucrative line to a poor one.

A number of companies has installed independent pension systems for their employees, in addition to those required by law. In Berlin, Hamburg, Munich and perhaps a few other cities these funds are carried as a special account, while the smaller companies insure their risks in pension insurance companies. Considering the large pensions required by law of the public service corporations in Germany, only the most prosperous companies can afford to establish supplementary payments. While from 4 per cent to 5 per cent of a workman's wages would suffice for keeping up a fund for pensioning him at old age, 10 per cent really is needed because the pension is also paid to his widow and children. Where the railways have such auxiliary systems the company pays at least half and the employee the rest. Some companies have not adopted these pension systems because their franchises will expire in a few years and the municipalities who will take over the systems have not signified their willingness to carry on this beneficial work.

AUTO 'BUS COMPETITION

There has been a remarkable development in the automobile omnibuses, the public seeming to believe that they will prove a universal cure for all transportation troubles. Small undertakings are springing up everywhere like mushrooms, and auto-bus factories are stocked with orders for more than a year in advance. This reckless development is really a waste of money, as the maintenance cost of autobuses is so high in Germany that many of these undertakings will not succeed even where there is a reasonable amount of traffic and no street railway competition. This idea of enormous profits to be made by auto-bus lines reminds one of the great activity which took place in street railway construction after the Prussian railway law of 1892, and mentioned earlier in this article. Of course, the practical man recognizes that a railway often is built not with the idea of immediate profit, but primarily to develop a certain territory. The average small promoter does not understand this and confuses gross receipts with net profits. This lack of knowledge has resulted in the creation of many small auto-bus undertakings, most of which have already failed. The greatest responsibility for this condition lies with the automobile manufacturers, who have failed to give the public the truth with regard to the maintenance cost and probable income. It is a fact that some of the greatest companies in this line have told their clients that the operating cost per car-kilometer would not exceed 34 pfgs. ($0.14 per car-mile), including depreciation and 4 per cent interest on the investment, whereas the actual expenses are much more. At the same time, the manufacturers try to create the impression that an omnibus, seating for in-

stance thirty-eight passengers, would carry that number for 75 per cent of the total distance, while the experience of German street railways operating under like conditions shows that even 30 per cent is a high figure. The whole subject has been very carefully taken up from the statistical side by General Secretary Vellguth of the German Street and Interurban Railway Association.* The figures cited in Mr. Vellguth's article make pleasant reading for the owners of street railways, since he shows that the auto-bus cannot be operated at anywhere near the same cost. It is curious to note that the German railways have not regarded the auto-bus development from the competitive side, but rather have endeavored to exploit the new vehicle themselves. About a dozen lines own two or three and the Grosse Berliner Strassenbahn has ordered sixty to make possible an exact study of costs. A further drawback to the development of auto-buses in Germany is the increase in the cost of gasoline, which is now about 9 cents to 10 cents per kilogram, even when purchased in large quantities. This has encouraged the use of alcohol engines.

ACCOUNTING

As is well known, street railway accounting has been worked out in Germany to quite a degree of refinement. In the early days of electrification the operators had all they could do to adapt themselves to the rapid changes in apparatus. In recent years, however, a great deal of attention has been given to the subject. The German Street and Interurban Railway Association, for example, has worked up a form of accounts suitable for all companies, at the request and at the expense of the Prussian Minister of Public Works.

The International Street and Interurban Railway Association's accounting system, which was developed at an earlier date, has met with more success within the last few years than formerly. To-day there are probably fifty to sixty systems in Europe using this method. As noted in previous issues of the STREET RAILWAY JOURNAL, the International Association's system is based on the Dewey system, with ten main accounts and with the subsidiary accounts classified under the decimal system. It may be added here that all those who have used this system report favorably as to its convenience.

INTERURBAN LINES

In conclusion, it is of interest to note that there are now several interurban electric lines in Germany. They are not electrifications of old steam lines, but are long extensions of the city railway systems. These roads are not built under the street railway law, but are given the same kind of franchises, including the privilege of freight haulage, as on the old "secondary" steam railways. Hence the line of demarcation between city and the "secondary" railways is beginning to disappear. Such extensions are frequently built with the assistance of the communities affected, which guarantee interest on the bonds and present the right of way.

* See STREET RAILWAY JOURNAL, Nov. 17, 1906.

SPECIFICATIONS FOR TRACK MATERIAL ADOPTED BY THE GERMAN STREET AND INTERURBAN RAILWAY ASSOCIATION

The German Street and Interurban Railway Association (Verein Deutscher Strassenbahn und Kleinbahn-Verwaltungen) has recently adopted specifications for track material which are of unusual interest, as they call for what the association considers the minimum qualifications that should be embodied in material manufactured and sold at a reasonably low cost.

(1) RAILS

Material: Grooved rails are to be made of ingot steel according to the manufacturer's own methods, but the buyer may demand information as to the method and chemical analysis employed.

Strength, Tenacity and Density: The purchaser reserves the right to test completed rails for strength, tenacity and density; tensile and pressure tests shall be used for measuring strength, the drop test for measuring the tenacity and the acid test for the density. In general, pieces cut off the ends of the rails and free from defects must be used for all tests.

The tensile strength of the rails must be at least 70 kg per square millimeter (99,570 lbs. per square inch) with at least 10 per cent elongation. The test pieces shall be 200 mm (8 ins.) long and 20 mm (0.8 in.) thick. For the pressure test, hardened cast-steel balls of 19-mm (0.76-in.) diameter are to be used under a pressure of 50,000 kg (110,000 lbs.). The depression thus caused in the rail must not be less than 3.5 mm (0.14 in.) or more than 4.5 mm (0.18 in.). In the drop test the supports of the rail should be 1 m (39.37 ins.) apart. The blows of the drop hammer are to be delivered on the rail midway between these supports, and are to be continued until the rail has been bent to a depth of 160 mm. (6.4 ins.) to 80 mm (3.2 ins.) or 60 mm (2.4 ins.), according to the height of the rail. The momentum of the blow given can be chosen at will. The pieces after the test must show no cracks or breaks.

Sections: The variations in the profile from the sections specified shall not be more than those given below. The rail maker shall supply the tools necessary for taking these measurements. In height, for rails up to 160 mm (6.4 ins.) in height, variations of 0.5 mm (0.02 in.) are allowed, and for higher rails, 0.75 mm (0.03 in.) either way; in width of head, 1 mm (0.04 in.); in base of rail, up to 2 mm (0.08 in.) for rails 160 mm (6.4 ins.) wide at the base, and 3 mm (0.12 in.) for wider bases. For compound rails the variation in the width of the head must not exceed 0.5 mm (0.02 in.).

Tests: It is understood that 0.5 per cent of the total order is at the disposal of the buyer for test purposes. Should the first test prove unsatisfactory, a second and if necessary a third test shall be made on rails in the same lot. Should these later tests also prove a failure, all rails of that particular heat will be rejected. Irregularities on the rails arising during rolling, and scale, may be chipped off provided they do not exceed 1 mm (0.04 in.) thickness or affect the ends of the rail or top or sides of the head.

Holes: All holes for angle bolts must be bored, but any other holes may be punched out. The burr from punching is to be carefully cleaned off. The holes for the angle plates are allowed to vary in diameter within 0.5 mm (0.02 in.) either way, and those for the bond terminals may be 0.2 mm (0.008 in.) less than specified.

Length of Rails: In the length of rails a variation of 3 mm (0.12 in.) is allowed.

Curved Rails: Curved rails are to be bent cold at the mill and a drawing furnished afterward guaranteeing the accuracy of the work. The gage of the curved rails must be less than the straight track to which it will be connected. The joints must be so placed that the line connecting opposite joints must be exactly at right angles with the axis of the track.

Marking: All rails are to be rolled with the foundry symbol, the year and the casting number. Curved rails are to be marked in white oil paint with the number, radius and length. On rails partly curved, the lengths of the curve and of the straight part are to be indicated. The head of the outer rail of the curve must be painted white and the inner one red. If the rails are part of crossings, switches or other special work, they are to be painted red and their purpose and the place where they are to be used, indicated. Rails shorter than standard must have the length marked in green paint.

Weight: The weight of rails may be 3 per cent more than specified, but payment will be made only for overweights up to 1 per cent. Nothing additional for overweights will be paid if the rail is bought at a specified rate per running meter.

Guarantees: All rails must be guaranteed for five years from the date of commencing operation, and ties, switches, crossings and smaller miscellaneous track equipment for two years. Material proving defective within the guaranteed time must be replaced.

(2) ANGLE PLATES AND ACCESSORIES

Angle Plates: Angle plates may be either of mild steel or hard steel. If made of mild steel the tensile strength should be 40-50 kg per square millimeter (56,890 lbs. to 71,117 lbs. per square inch), with an elongation of 20 per cent; if of hard steel they must have a tensile strength of 50-60 kg per square millimeter (71,117 lbs. to 85,340 lbs. per square inch), with a 15 per cent elongation. Half-joints are to be made of the same material as the rails and under the same conditions. Holes in angle plates can be punched, the variation in the position of the holes may be 0.5 mm (0.02 in.). The bonds for the return circuit may be 0.2 mm (0.008 in.) smaller but never larger than specified.

Angle plates for curves must be bent to the same radius as the rails themselves and be plainly marked with the curve radius.

Tie-Rods: The tie-rods and bolts for the tie-rods and angle plates are to be of mild steel having a tensile strength of 38-50 kg per square millimeter (54,000 lbs. to 71,117 lbs. per square inch), with 20 per cent elongation. The manufacturer must guarantee these parts for two years. One in every 500 of these parts may be tested.

(3) T-RAILS

The specifications for T-rails are similar to those for the ordinary grooved type, with the following exceptions: For lines with light traffic (a) the tensile strength must be 60-70 kg per square millimeter (85,340 lbs. to 99,570 lbs. per square inch); medium traffic (b), 65-75 kg (92,452 lbs. to 106,862 lbs. per square inch); heavy traffic (c), 70-80 kg (99,570 lbs. to 113,787 lbs. per square inch); all for a minimum elongation of from 15 per cent to 10 per cent. The corresponding drop tests are to allow the following bending distances; for (a), 100 mm (3.9 ins.); for (b), 80 mm (3.2 ins.); for (c), 60-mm (2.4 ins.).

The pressure tests with 19-mm (0.76-in.) diameter steel balls under 50,000 kg (110,000 lbs.) should give the following depressions: For (a), 5.5 mm (0.22 in.); for (b), 5 mm (0.2 in.), and for (c), 4.5 mm (0.18 in.). The variations in the width of the rail base must not exceed 0.5 mm (0.02 in.) in rail bases up to 120 mm (4.8 in.).

(4) TIES, TIE-PLATES, CLAMP-PLATES AND BOLTS

Ties: Metal ties and their accessories are to be of mild steel with a tensile strength of 38-50 kg per square millimeter (54,048 lbs. to 71,117 lbs. per square inch), with 20 per cent elongation. The surfaces of the ties on which the rails rest must be placed smooth. The ties may vary 0.5 and 2 mm (0.08 in.) in height and width. The position of the holes may vary 1 mm (0.04 in.) from that specified and 0.5 mm (0.02 in.) in diameter. It must be possible to bend the ties cold under a hammer or in a press so as to flatten them in their longitudinal direction and bend them into a loop whose diameter is 80 mm. One piece in every 500 may be used for testing.

Tie Plates and Clamp Plates: Tie plates and clamp plates must have a plane supporting surface and must correspond to the specified dimensions. They may vary 1 mm (0.04 in.) in length and breadth, 0.5 mm (0.02 in.) in thickness, 1 mm (0.04 in.) in distance between holes, and 0.5 mm (0.02 in.) in diameter of holes.

Bolts: The thread of the bolts must be cleanly cut and the manufacturer must guarantee them for 2 years.

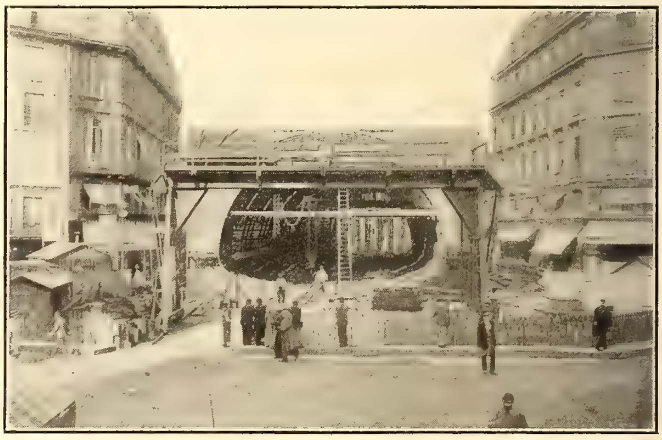
(5) DELIVERY

Concerning deliveries, special agreements are to be made.

THE ELECTRIC TRACTION SITUATION IN FRANCE AT THE END OF THE YEAR 1905

BY OUR REGULAR CORRESPONDENT

The tramway situation in Paris and France generally may be considered to be satisfactory during the present year. Only a very few small lines show insignificant decreases in traffic, and the majority of lines certainly show large increases. In addition, the near future will probably see a considerable extension of the interurban connections in France. The progress made along the lines of motor omnibuses will undoubtedly turn a certain number of what might be doubtful paying tramway schemes into motor omnibus lines, and even where tramway lines may be laid it is not sure whether it will not be found advantageous in certain



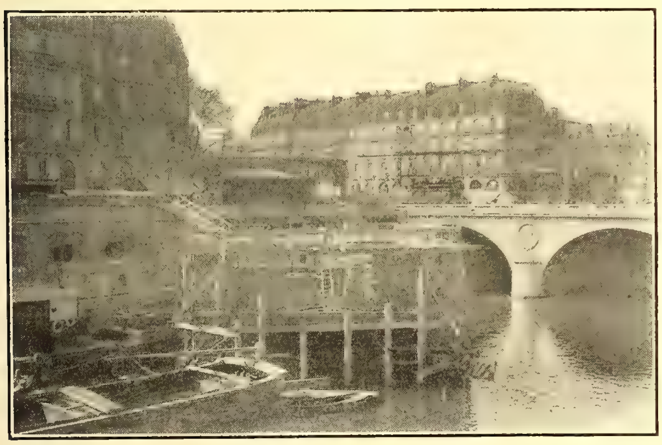
PART OF TUNNEL UNDER CONSTRUCTION ON SHORE

cases to place in service tramways propelled by petrol motor engines in lieu of the overhead trolley and electric motor. In fact there has been formed in Paris recently a powerful combination which has for its object the examination and promotion of likely schemes for motor omnibus traffic where the district is too sparsely inhabited or presents constructional or natural difficulties against the establishment of an electric tramway. It is of interest to note that the Darracq-Serpollet Company, well-known promoters of steam-driven vehicles (Serpollet engines have been used

for many years on tramways) are interested in this scheme.

In Paris itself the surface traction question appears to resolve itself more and more into two distinct branches, that concerning omnibus traffic and that connected with traffic on rails. At present they are rather intimately connected in the General Omnibus Company, which exploits both tramway lines and omnibuses. The concessions of this latter company expire in 1909-1910. Their renewal is causing and has caused immense difficulties towards a satisfactory solution of the problem of future transport within Paris. The municipal commission appointed two years ago, for the consideration of the matter and to originate proposals for the future régime of the tramways and omnibus lines of Paris, has recently been dissolved by the Prefect of Police, since their labors had been unattended with any tangible results in the two years of the existence of the commission.

The caisson work now being finished in connection with the tunneling beneath the Seine for the No. 4 line of the Paris Metropolitan Railway is being watched with a deal of interest on all sides. The caissons which are destined to form the sections of the tunnel beneath the bed of the river were constructed on floating erections and when ready for lowering were towed to the spot above their final position. Other caissons for the part nearest the river banks on the shore side were constructed ready in position and lowered into their destined hole which was dug as the caisson construction was progressing. The work has caused a certain amount of unavoidable traffic obstruction, but on the

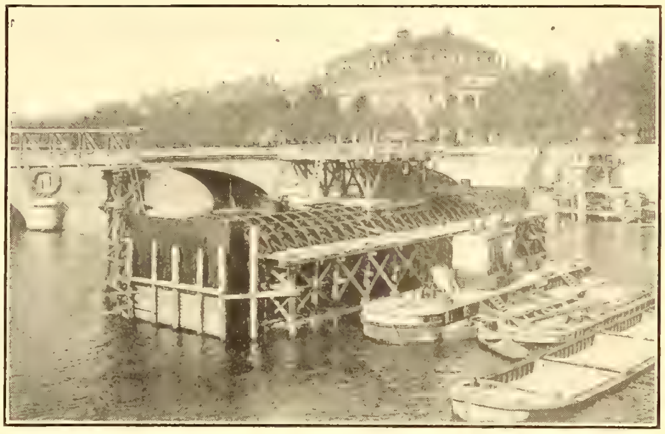


SINKING A TUNNEL SECTION IN THE SEINE NEAR THE SHORE

other hand certain of the sections of caisson destined for the two arms of the Seine below which line 4 passes were of very large size.

The Metropolitan Railway continues to be one of the matters of foremost interest in Parisian traction matters. The line has achieved great success, despite initial difficulties and lack of experience. The net profits are not decreasing, as was feared on some sides, on the inauguration of new lines. The net receipts per kilometer of track in 1901 reached F. 130,580 for a length of 13 km; in 1904 they were F. 200,400 for a length of 26 km, and in 1905 F. 202,927 for a length of 32 km. The receipts for 1906 will in all probability exceed the figure as is inferred from the reports for the first nine months of 1906, which show an average receipt per kilometer of F. 201,000, against F. 199,000, representing the average of the first eight months of 1905. Two main reasons explain this result, the first being the reduction of working expenses and the other is the creation of new traffic on existing lines. This latter factor generally evades all valuation, but is illustrated by such an example as this: On line 1 the average daily receipt was F. 23,000 in 1901 and increased to F. 28,000 in 1903 by the sole addition of line 2. The opening of line 2 (south) similarly raised the daily receipts of line 1 by F. 5000 per day.

The important engineering scheme for the uniting of the two shores of the English Channel has been receiving renewed attention both in France and in England. It may



SINKING A TUNNEL SECTION IN THE MIDDLE OF THE RIVER

be taken for granted that French public opinion and financial circles are ready for the immediate floating of the company to undertake the work. There is actually a bill before the British Houses of Parliament for the necessary authorization to start the work and form the necessary company. Since the Anglo-French approachment in 1906 there has been less hostility shown to the proposals on the English side of the channel and there are serious probabilities of the bill passing into law. It is therefore interesting to note that the capital of the company would be raised equally in France and in England and would amount to $40,000,000. It is estimated that the annual number of passengers would amount from the opening of the tunnel to 1,300,000 and the annual receipts from all sources to $7,700,000. The annual expenses, as calculated by British as well as French authorities, would amount to $2,000,000, and the balance available for dividends is estimated to be sufficient to pay 9 per cent. The tunnels, of which there would be two, would be 18 ft. in diameter and bored through the chalk bed which extends from shore to shore, running to a thickness in places of over 80 ft. The length of the submarine part of the tunnel would be 24 miles and the approaches 6 miles. Two generating stations would be erected, one at either side of the channel, and there would run in the two directions fifty electrically-operated trains daily. The rolling stock of the principal European lines would be accommodated in the tunnel, the construction of which does not appear to present any skill beyond the resources of the modern engineer in tunnel practice. The construction of the tunnel is estimated to require nine years, and its completion would reduce the passage to India from London by twenty-six hours. The scheme, which has been smoldering for the past thirty years, having been first proposed in 1875, has never seen brighter prospects of fulfilment. It would be known as the Caldover Tube.

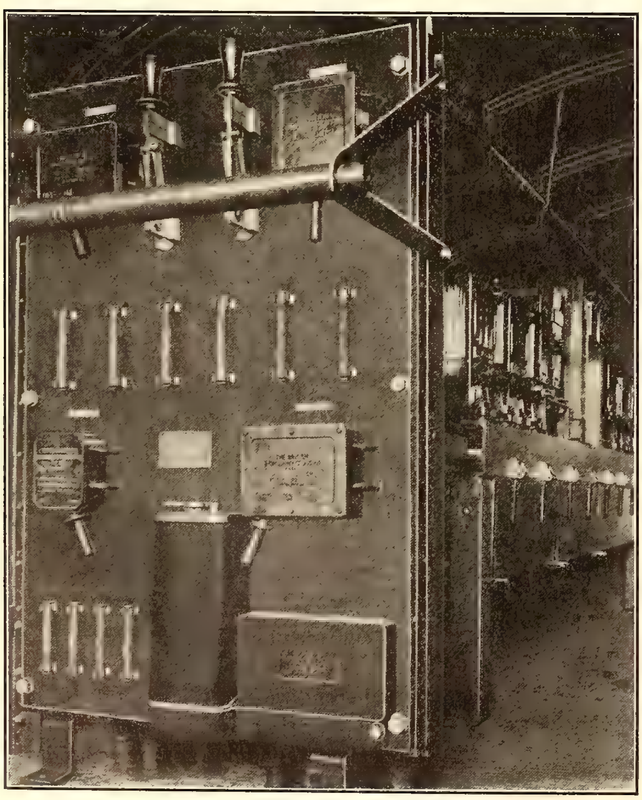
The French government has voted the purchase of the Ouest Railway, of France, one of the largest but worst-paying networks of the country, whose practice and management has been under constant criticism.

THE GREAT NORTHERN, PICCADILLY & BROMPTON RAILWAY

The rapid transit facilities of London received a noteworthy addition on Dec. 15, 1906, which marked the inauguration of train service on the Great Northern, Piccadilly & Brompton Railway. This is the second of the subways controlled by the Underground Electric Railways Company, to whom it is leased at a yearly rental of 4 per cent of the paid-up capital of the original company. The latter was a Yerkes consolidation of the Brompton & Piccadilly Circus Railway Company and the Great Northern & Strand Railway Company. The length of the line is 9 miles and its cost is estimated at £7,206,000, or about £800,000 per mile.

Graduated fares have been adopted for this railway, the maximum fare for the whole distance of 9 miles being 4d., and the lowest fare between any two stations, 1d., as experience seems to show that the graduated fare is more successful and meets the wants of the London traveling public much better than the uniform fare for any distance. The average fare works out at about 0.77 of a penny per mile, so that the rates are very reasonable.

The new railway extends from Hammersmith, in the southwest of London, to Finsbury Park in the northeast.



PART INTERIOR VIEW OF MOTORMAN'S CAB

The station at Hammersmith is on the surface and it also serves as a station for the District Railway Company. The new line runs practically parallel with this railway as far as South Kensington, but at that point it diverges in a more northeasterly direction, running underneath Knightsbridge, Hyde Park corner, Piccadilly, Leicester Square, Covent Garden, Russell Square, King's Cross, and so on to Finsbury. It will therefore be seen that it taps an area which hitherto has been totally unserved by railways of any kind, and it should therefore make a most valuable acquisition to the service of transportation from the southwest to the northeast, and as a radiating medium from the busy center

TYPE OF CARS USED ON THE GREAT NORTHERN, PICCADILLY & BROMPTON RAILWAY

of Piccadilly Circus or Leicester Square, which may be termed the center of the West End shopping district and theater life in the evening. Connection will be made with the Baker Street & Waterloo tube (described in the Street Railway Journal of April 7, 1906), at Piccadilly Circus. From Holborn there is a spur line running south to the Strand which ought to be invaluable for the large masses of people who have business in that portion of the city, and who up to the present moment have the greatest difficulty in reaching the northern suburbs. The great main railway stations at Euston, St. Pancras and King's Cross will also be made much more accessible, and when the other tube, the Charing Cross, Euston & Hempstead Railway, is completed about next June, London will have unequaled electric railway service. In addition to the connection with the Baker Street & Waterloo Railway, this tube will communicate with many other railways, with the Great Northern Railway at Finsbury Park and King's Cross; with the Euston Extension of the City & South London Railway (London's first tube) at King's Cross; with the Central London Railway (the original "Twopenny Tube") at Holborn; with the Charing Cross & Hempstead Railway (in construction) at Leicester Square. Besides these, the Surrey Street Station will be only 1200 yards from the Temple Station on the District Line, and connection will also be made at Earl's Court with the District Railway for trains to Wimbledon.

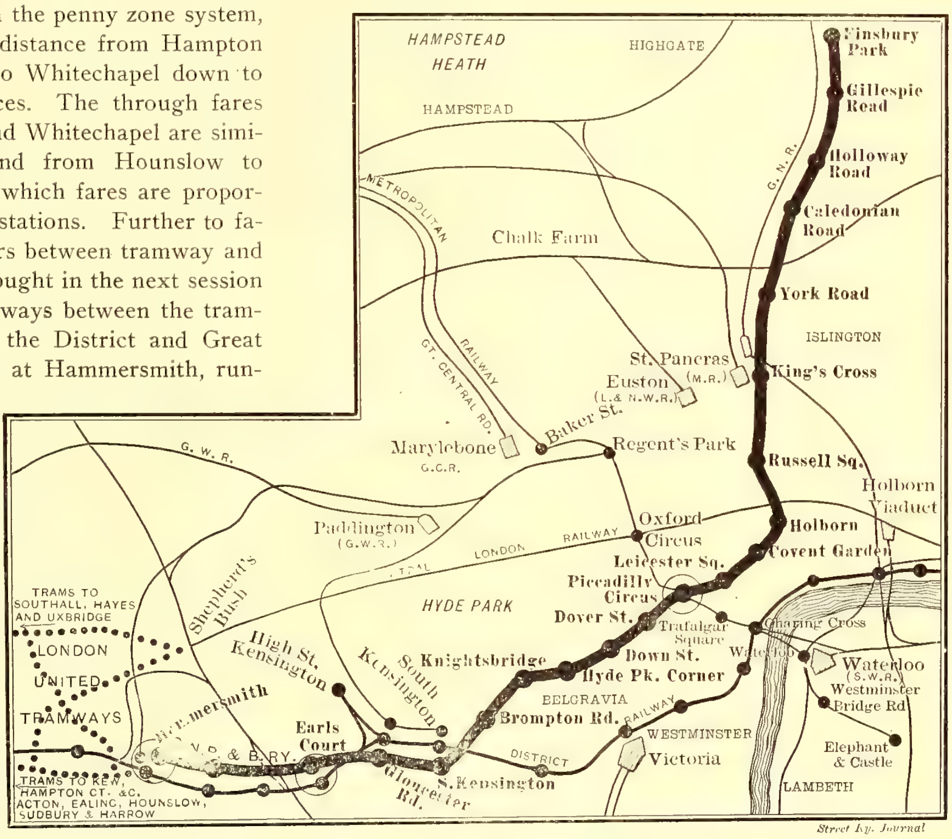
Interchangeable tickets at through fares will be issued to passengers wishing to continue their journey by the Metropolitan & District, Great Northern & City, Baker Street & Waterloo Railways, and (when completed) by the Charing Cross, Euston & Hempstead. For the first time in England it has been found possible to arrange through bookings between railways and tramways, and by agreement with the London United Tramways Company a novel method of working has been devised, the simplicity, economy, and convenience of which cannot but commend themselves to intending travelers. With the object of in-

ducing tramway passengers to continue their journeys by the various systems directly or indirectly controlled by the London Underground Electric Railway Company and to enable them to accustom themselves gradually to the innovation, the tramway routes selected for the initial experiment are those converging at Hammersmith from Uxbridge, Hounslow, and Hampton Court respectively. Under the through booking arrangements with both the District and the Great Northern, Piccadilly, and Brompton Railways the tramway fare from Hampton Court to Hammersmith, hitherto 6d., will be reduced to 5d., the fares from Uxbridge and Hounslow to Hammersmith remaining as at present—5d. and 4d. respectively. When the Surrey-Side section of the London United Tramways is completed through bookings will also be put in force between Surbiton, Kingston, etc., and the District Railway by way of Wimbledon. The interchangeable fares are arranged on the penny zone system, and range from 9d. for the whole distance from Hampton Court to Finsbury Park, and 8d. to Whitechapel down to 2d. and 3d. for intervening distances. The through fares from Uxbridge to Finsbury Park and Whitechapel are similarly 9d. and 8d. respectively, and from Hounslow to Finsbury Park the full fare is 8d., which fares are proportionately less between intermediate stations. Further to facilitate the interchange of passengers between tramway and tube and vice versa power is to be sought in the next session of Parliament to construct foot subways between the tramway terminus and the stations of the District and Great Northern and Picadilly Companies at Hammersmith, running under the Broadway and entering the stations at platform level. The only novel feature of the through tickets is that they will contain two punching spaces, one for the tram fare and the other for rail fare.

The construction of this railway is practically the same as that of the "Bakerloo" tube, described in the April 7, 1906, issue of this paper. There are two iron tubes, each having a diameter of 11 ft. 8 in., and 12 ft. on curves, made in the usual way by boring through the London clay by Greathead cutting shields, and fitting in cast-iron segments. The ventilation has, however, in this newest tube been given the most careful consideration, and there are installed nineteen exhaust fans of 5-ft. 6-in. diameter, each of which is capable of exhausting 18,500 cu. ft. of air per minute, or a total of 21,000,000 cu. ft. per hour, so that the atmosphere of the tunnels will be changed entirely many times during the twenty-four hours. This railway reaches considerable depth at places, the deepest station being at Covent Garden, where it is 123 ft. below the surface; at Piccadilly Circus the depth is 102 ft.; at Holborn, 114 ft., and at Russell Square 110 ft. At South Kensington one of the tunnels is directly above the other, the lowest platform at that point being 78 ft. below the street. The usual large Otis elevators have been provided, and at Hollaway Road a novelty has been introduced in the shape of a moving spiral staircase, the success of which will be watched with great interest. The constructional work was carried out under the direction of J. R. Chapman, engineer-in-chief and general manager, and H. H. Dalrymple, acting as engineer of the tunnels.

The track work and bonding are similar to that originally adopted for the Baker Street & Waterloo Railway. The middle portions of the ties rest on a rigid concrete foundation while the ends under the rails rest on a loose packing of crushed granite to secure elasticity. The ties are of slow-burning Australian Karri wood. The rails were laid in 45-ft. lengths of standard 90-lb. bullhead section furnished by Bolckow, Vaughan & Company, who also supplied the steel conductor rails supported on Doulton insulators in the tube portions of the line. The special work at crossovers and car sheds was furnished by Hadfield's Steel Foundry Company.

The station buildings, lighting and interior decorations do not differ materially from the other subways mentioned, but the station platforms are 350 ft. long, as compared with



ROUTE OF THE GREAT NORTHERN, PICCADILLY & BROMPTON UNDERGROUND RAILWAY

291 ft. in the "Bakerloo" and 325 ft. in the Central London tubes.

Power for this line will be furnished from the great Chelsea station, which was fully described in the STREET RAILWAY JOURNAL of March 4, 1905. The three-phase, 11,000-volt current transmitted from this station is changed to 600-volt direct current in sub-stations, located at Holloway, Russell Square and Hyde Park. The western end of the line receives power from the same sub-stations which supply the District Railway at South Kensington and Earl's Court. The three-core, lead-covered transmission cables to the new stations were supplied by the British Insulated & Helsby Cables (Ltd.). The station equipments are similar to those installed on the Baker Street & Waterloo Railway and are of Westinghouse manufacture.

The signaling system, which is of the Westinghouse electro-pneumatic type, has in every signal box an illuminated diagram to indicate automatically the exact position of every train in the section controlled from that particular box. It will also be possible to telephone from any train

to the manager's office, as the two bare telephone wires installed throughout the tunnels, can be used from the cars by employing connecting devices carried on each train.

The car house, repair shop and terminal yard is at Lillie Bridge, West Brompton. The car house is 1312 ft. long and 78 ft. 6 ins. wide. Pits are provided for all of the eight tracks. As it was considered impracticable to lay the conductor rails inside the car house, the cars are moved by plugging in a twin flexible cable attached to a pair of overhead wheels.

The rolling stock consists of 72 all-steel motor cars and 144 trailers. They are finished with no rivet heads showing, to give them the appearance of wooden cars. The resemblance to the interior of a wooden car is secured by using a 1-16-in. thick non-inflammable mahogany paneling over asbestos millboard. The cars measure 49 ft. 1½ ins. over all in length and 8 ft. 4 ins. in width. They have both cross and longitudinal seats. The motor cars seat 46 and the trailers 52 passengers, giving a seating capacity of 300 for a six-car train, including four trailers. As the platforms are 350 ft. long, seven-car trains can be used when necessary.

The electrical equipment was furnished by the British Thomson-Houston Company. Owing to the limited space available on these cars, all of the control apparatus, including the contractors, reversers, main circuit-breaker, etc., is mounted in the motorman's cab. The other side of the cab, which is not shown in the figure, contains the compressor and Westinghouse air brakes and other apparatus.

The elevators before mentioned are especially interesting owing to the care taken to secure absolute safety to passengers. If an elevator is over-run it is brought to a standstill by two oil buffers in a stroke of 8 ins.

REGENERATIVE CONTROL FOR RAILWAY MOTORS

At a meeting of the Manchester (Eng.) Association of Engineers held on Nov. 24, 1906, Edward H. Johnson presented a paper on regenerative control under the title of "The Third Function of Electric Traction Motors." Mr. Johnson explained his use of this term by referring to the dual function of dynamo-electric machines as generators and motors, the third function being the possibility of returning to the line the current created when a motor acts as a generator instead of wasting it in braking and resistances. The differences between a standard and regenerative equipment of the type developed by Mr. Johnson, Robert Lundell and Gustaf Lang were summarized by the speaker as follows:

The motor frames are of the standard rating, type, dimensions, and construction, save an additional opening for the inspection of the extra commutator. The armature windings are divided between two commutators to yield two independent armature circuits per motor, to allow double series paralleling with but two motor units. The divided windings are so connected as to effect a balance of their electro-motive force when operating in parallel. The field windings are of the usual four-pole type, but each pole is supplied with a relatively small series, and a full shunt winding, the series turns being ample for the purpose of compounding, but not to give in full value the simple series excitation; hence the shunt coils are arranged to be connected in parallel, and made to serve as series turns when full series excitation is required. The field changer is a circuit controller, made to operate automatically through a solenoid and a retractile spring or gravity. Its function is to convert the motor characteristic from series to compound, and vice versa. It is controlled through a thumb switch in the handle of the platform controller, and may be considered the key to the system.

The excess voltage preventer is a switch, adjusted to deprive the motors of their shunt excitation in case of accidental loss of trolley contact, thereby preventing the excessive rise of voltage which would ensue from the unopposed voltage development of the motors acting as generators.

The mechanical power brake consists of the following parts: The usual wheel and track shoes with their accompanying system of leverages, a specially-constructed spiral band to grip the axle frictionally or a shaft driven thereby, and thus exert a pull on the brake levers and a solenoid carrying a core, which imposes a drag on the free end of the spiral, and thus brings the brake into action; the function of the solenoid, of course, is to pick it up and hold it when the brakes are not required. Contacts for controlling the solenoid are placed in both the platform and the automatic controllers, and in a special emergency switch conveniently placed for both motorman and conductor.

Mr. Johnson then described his system in greater detail and presented some data derived from a number of tests to demonstrate the saving in power when representative control is used under certain conditions. He also reiterated several other claims, such as the reduction in maintenance, saving in original power installation, better braking, etc.

TRADE MARK AT MINNEAPOLIS

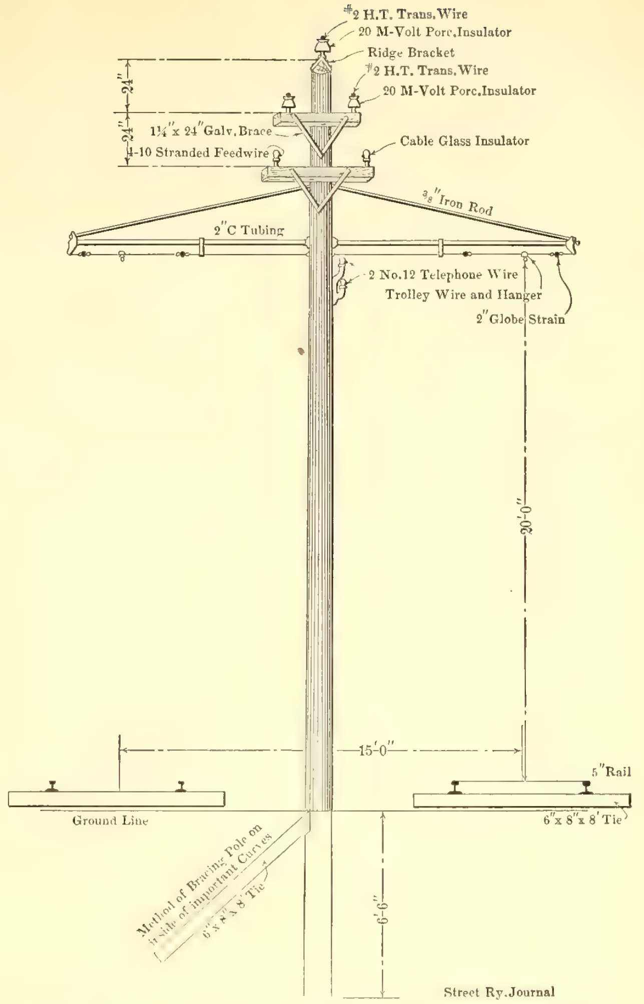
The general passenger department of the Twin City Rapid Transit Company, of Minneapolis and St. Paul, has just announced the adoption by the officials of a trade mark which will hereafter be seen on all printed matter, blanks, time tables, newspaper advertising and other forms of publicity the company will issue.

Practically every steam road and steamship line in the country is distinguished by its trade mark, and the prominent electric lines are falling into line in this respect. The Twin City Rapid Transit Company, appreciating the advertising advantages of such a symbol, started some weeks ago to secure a design for a trade mark. Looking over the wide range of trade marks the company discovered that nearly every geometrical form had been appropriated, circles, squares, ovals, shields, diamonds, flags, banners and the whole family of patterns that lent themselves readily to an attractive mark. Many suggestions were offered for complicated designs which meant much study, for pictures of cars and tracks, of "Minnie" and "Paul" and a host of other ideas serious and silly. A good trade mark seemed to be defined as a striking design that would look equally well if printed as small as a dime or as large as the top of a barrel, a design that would look well if printed in one color or two

TRADE-MARK JUST ADOPTED BY THE TWIN CITY RAPID TRANSIT COMPANY

colors, something that told its story at one glance, and yet so simple as to be remembered and admit of being drawn from memory by those who saw it; also a design that would wear well and improve on acquaintance; and so with the many problems involved the passenger department finally worked up the trade mark shown herewith.

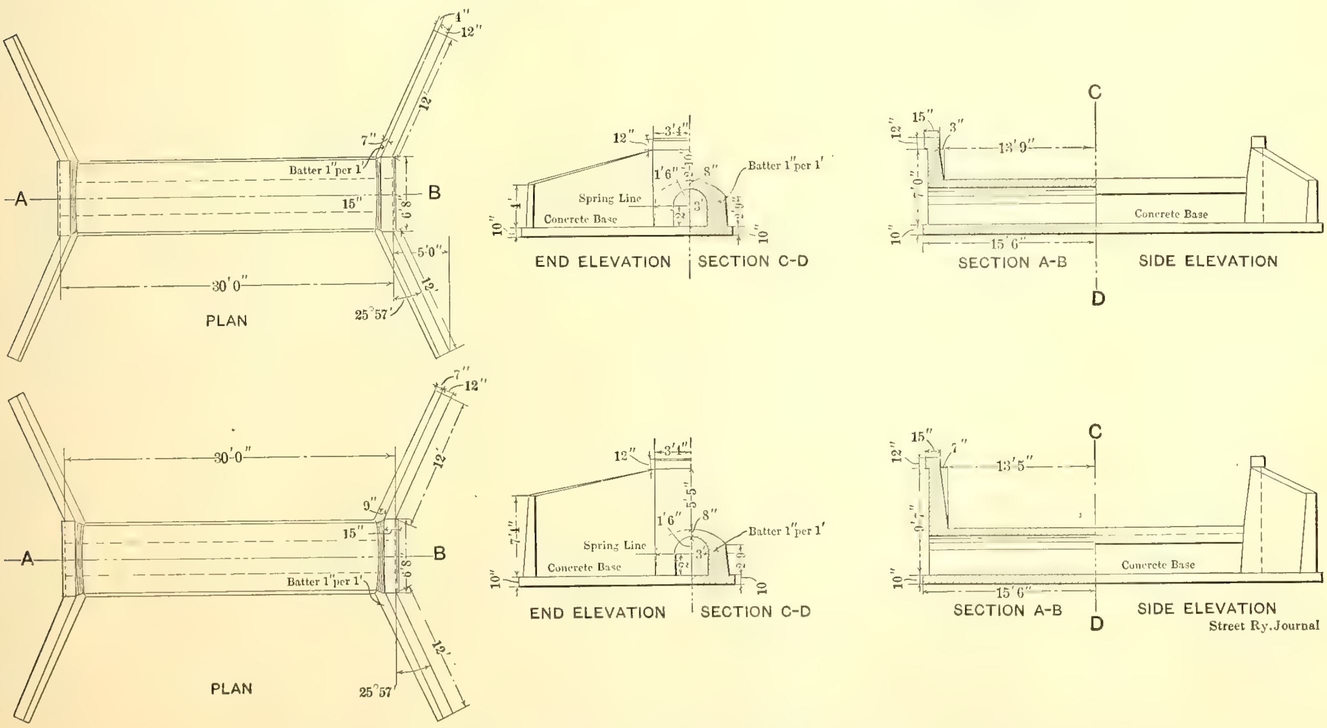
It represents a Spanish mission window which is typical of the Spanish mission architecture to be employed in all the company's buildings at Big Island Park, the new Lake Minnetonka resort. The words "Twin City Lines" include all the Twin City Rapid Transit properties, local lines, suburban lines, steamboat lines, in the same broad way as "New York Central Lines" and "Pennsylvania Lines" include their many rail and boat properties. "Twin City Lines" is practically the nickname the public gives all the Twin City properties, and it is a sweeping, characteristic title, sure to prove popular and easy to remember, and it will look well on the flag of the company's fleet of twelve Lake Minnetonka boats, on a conductor's button or on any other place the company chooses to place it. For the most part it will always appear with the center red and the border white and black. It is a strong, simple, effective design, artistic, well proportioned and clever, and worthy the progressive, up-to-date company it will advertise; besides, it is different, no other transportation company having a design just like it.



STANDARD OVERHEAD CONSTRUCTION AT OKLAHOMA CITY

CONSTRUCTION WORK AT OKLAHOMA CITY

In making extensions to its system the Oklahoma City Railway Company, of Oklahoma, follows a policy which the conditions in cities of slower growth would hardly warrant. Instead of building into already populated portions of the city, extensions are pushed out into practically unsettled outskirts, and the line constitutes the reason for the construction of homes. Past experience has shown that it is a matter of but a year or so until the population follows the line to such an extent as to make it a paying one.



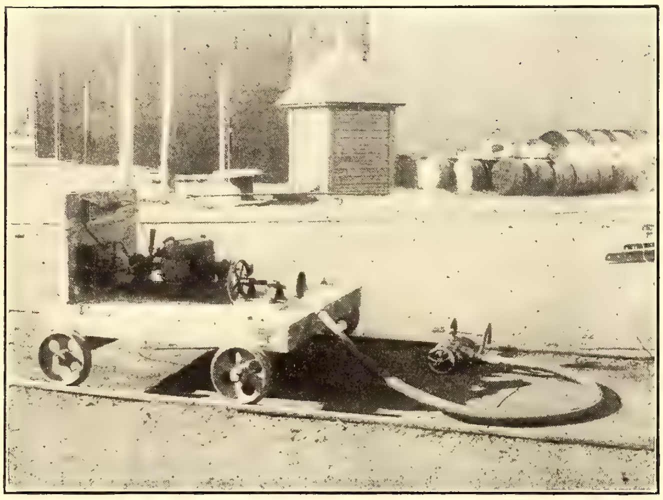
OKLAHOMA CITY STANDARD CONCRETE ARCH CULVERT, 3-FT. SPAN

Through the courtesy of Anton H. Classen, president of the system, this publication is enabled to give a short account of the extensions now being made by the company.

A line is being extended north to North Oklahoma City,

5½ miles. The proposed terminal is at the present time a very small settlement, and the region between it and Oklahoma City is almost devoid of houses. After the construction of the line, however, it will in all probability be but a matter of a year or two until the whole route is built up. Already a large portion of the building sites near the route have been purchased by prospective builders of homes.

It is the intention within a season or two to extend the line north from North Oklahoma City to Britton, 7½ miles distant from Oklahoma City, and eventually this line will probably form a portion of a 30-mile interurban system between Oklahoma City and Guthrie. At present the track is laid to Belle Isle, 4½ miles from the city. At this point an artificial lake is being made and a pleasure resort will be built up. The lake, which will contain 111 acres, is being made by throwing up between two hills a wide embankment which will form a roadbed for the electric line. At the north end of the embankment the tracks will be laid over a spillway formed of a concrete arch having a 30-ft. span. The arch is being reinforced by a series of ribs made of old steel rails. The rails are bent to a curvature corresponding to that of the arch, and are spliced together in pairs. When in position the joints in the rails will be at about the middle point of the archway. Double track is being laid to Belle Isle. Beyond this point a loop about one-half mile across is being built.



MOTOR-DRIVEN TRACK DRILL AT OKLAHOMA CITY

The track is laid with 70-lb. rails and the other details of construction are correspondingly heavy. The maximum curvature is 4 degs. The right of way has been acquired and the roadbed is being built with a view of constructing a highway on either side of the tracks. All of the culverts underneath the roadway are of concrete and of a design shown in drawings on page 31.

The overhead work is of center-pole bracket type. The poles, which are of pine, 30 ft. long, with 8-in. tops, are treated with a creosote and zinc solution. A cross-arm immediately over the brackets carries direct-current feeders. Two of the wires of a three-phase high-tension system will eventually be carried on a cross-arm above the feeder arm and the third wire will be carried on a pin on top of the pole.

The high-tension wires at 2300 volts will feed a sub-station containing a motor generator set of 250-kw capacity, which will probably be located at North Oklahoma City.

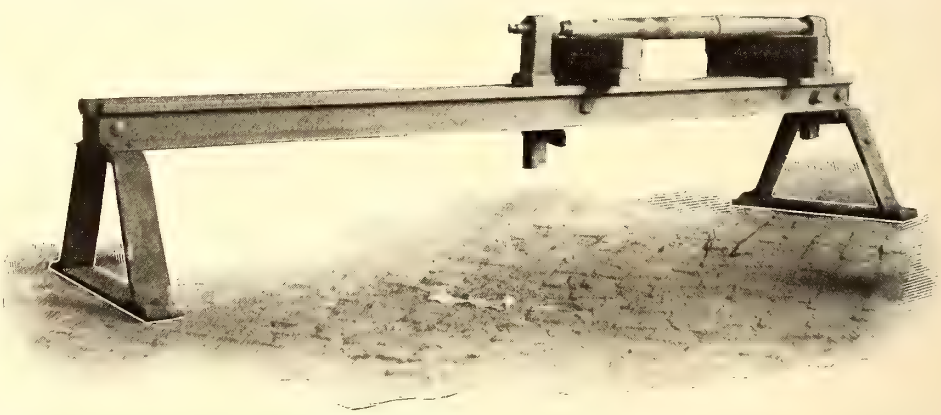
In drilling rails for bonds the Oklahoma City Railway Company employs a motor-driven track drill which in itself may be a good suggestion to other systems having a small motor that is not in use. The accompanying illustration gives a very good idea of the device. The motor, which is of 2 hp, was the first one employed in driving the machinery in the company's shops, and until put into service on the track drill had been out of use for several years. The rheostat also was a discarded one.

With the exception of the grading, which is done under contract, the railway company is doing all of the construction work on the new extension. The work is under the immediate supervision of Charles W. Ford, general superintendent of the system.

A DEVICE FOR STRAIGHTENING SHAFTS AND AXLES

It is customary in many shops to straighten axles and armature shafts in turning lathes, but lathes were not built to withstand such rough usage as they are sometimes subject to when used to straighten shafts and axles, and many have been injured by employing them for this purpose.

To prevent lathes receiving such abuse in the shops of the Denison & Sherman Traction Company, of Denison, Tex., the device illustrated has been constructed. The bed is made of two rails, bolted together. What might be termed the head stock is stationary at one end. The tail stock is adjustable. A portion of the flanges of the rails is cut away to allow the tail stock to be fastened in positions corresponding to the lengths of axles and armature shafts of both car and air motors. Both the head and tail stocks are fastened in position by wedges which pass through portions projecting below the flanges of the rails.



BED USED IN STRAIGHTENING ARMATURES ON THE DENISON & SHERMAN RAILWAY

The work of straightening axles and shafts is very much facilitated by a kerosene oil torch. This consists of a tank holding 6 gals. or eight gals. of oil provided with a small air pump. The burner is placed on a hose which is connected to the tank.

The Portland Railway, Light & Power Company is planning to erect five buildings in the vicinity of its different car houses, to be fitted up as club or recreation rooms for the employees.

SENSATIONAL DEVELOPMENTS IN CLEVELAND—CLEVELAND ELECTRIC AGAIN TO SELL SEVEN TICKETS FOR A QUARTER

Last week was marked by the most sensational move that has yet taken place in the street railway controversy at Cleveland. The Forest City Railway Company endeavored to lay a temporary track between the Superior Avenue viaduct and the Public Square under cover of darkness in order to circumvent the restraining order preventing the use of the Cleveland Electric tracks. After the City Council adjourned Wednesday evening, the Board of Public Safety was called together and a permit issued to the company to do the work. Everything had been made ready beforehand, and soon after 12 o'clock Thursday morning a large number of men were on the scene, as well as wagons loaded with rails, temporary poles and other material. It is even said that a number of the wagons were stationed on Rockwell Street in the rear of the City Hall and others placed at convenient points near Superior Street, so that they could be called out as soon as the permit was secured. In any event, they were on the ground in a very few minutes after the permit had been issued.

THE POLES UP AND THE RAILS ON THE GROUND

The tracks across the viaduct belong to the city. The first work, therefore, was making the connection between the temporary tracks and the city tracks at the corner of Superior Avenue and West Ninth Street. In order to do this considerable pavement had to be torn up and replaced. From that point east the rails were laid on top of the pavement, just south of the Cleveland Electric tracks. This is claimed to be free territory, but the Forest City was denied the immediate use of the old company's tracks by a temporary restraining order, which has not had a hearing yet. The decision will depend upon the evidence of legality of all the measures passed by the City Council since Mayor Johnson is alleged to have become interested in the company. In order to get cars to the Square at once, a temporary track seemed necessary to the management, as the courts are taking time to sift matters to the bottom.

Partially bolted together, the rails were held in position by strap-iron ties, and although the entire roadbed was in terrible shape, it was thought by the engineer that cars could be run over this track until a decision was had in the injunction case. The illustrations shown here will give some idea of the difficulties that would have met a motorman in getting his car over such a line. From appearances the rails and other material had seen hard usage before, and this would have made the work even more difficult. Crooked and disjointed, with ties as the joint connections, the track's rails probably would have been inclined to slip with a heavy load on them and the trouble, it seems, would have overbalanced any advantage that might have been gained through the use of the street.

A trolley wire was stretched from a post at the viaduct to the flag pole in the Public Square. It was supported by poles made of two scantlings spiked together lengthwise, with an arm of the same material at the top, supported by a brace which was strengthened by blocks at either end. The poles were set in barrels of ashes that had been placed beside wagons heavily loaded with the same material. Nailed to the wagon boxes, ropes from the tops of the poles to the ends of the wagons served to steady them when the heavy wire was suspended. No other material was at hand, so the trolley was fastened to the arms with iron or steel wire. This improvised line presented a grotesque appearance when the city awoke Thursday morning.

A close watch had been kept of the movements of the company, however, and at 3 o'clock an injunction was served upon Fred C. Albers and Mayor Johnson, the latter seeming to have as much to do with the direction of the work as Mr. Albers and the engineer. The injunction was issued by Judge Keeler at the instance of I. C. Cooper, a property owner on Superior Avenue, and included the Forest City Railway Company, the Municipal Traction Company, the Low Fare Railway Company and Tom L. Johnson. Track laying had proceeded as far as West Sixth or Bank Street, when deputy sheriffs appeared and served the notices. Vice-President J. J. Stanley, of the Cleveland Electric, and Attorney Taft had arrived on the grounds a few minutes before that time. Mr. Johnson, although questioning the right of Mr. Cooper to bring injunction proceedings, at once announced that the work would be stopped.

THE IMPROVISED TRACK COMPLETED

Thursday afternoon Attorney Tolles filed another application for an injunction against the Forest City Railway Company, at the instance of property owners and merchants

along the streets. This asked for the removal of the rails and debris along the street, as it prevented people from reaching the stores and diverted traffic from the street, as well as made it impossible for them to get wagons to their front doors. On Saturday this petition was amended in such a manner as to demand that the company be prevented from building a temporary track along the street, with an order for the immediate removal of the rails that have been laid and the poles and wagons that had been placed on the street. It alleges that there is no pressing necessity for a temporary track on the street and that, if the courts so decide, the company will be able to reach the Public Square in a regular way.

This latter petition was intended to cover the action taken at a called meeting of the City Council Friday morning, when the Forest City Railway Company was given a permit to place temporary tracks on Superior Avenue, by a vote of 27 to 5. This action was taken at the suggestion of Mayor Johnson, it is said, in order to block the effect of the injunction that had been granted. So the second petition, asking that the company be prevented from building and operating a temporary track on that portion of the street, stops that movement also. The legal skirmish is interesting in the extreme.

The hearing on the Cooper injunction was begun before Judge Beacom Saturday forenoon, and President Dupont and Engineer Bunning, of The Forest City, were placed upon the stand. Mr. Dupont stated that it was the intention to replace the temporary pole construction with iron poles, but that the track would remain on top of the pavement, with plank crossings at the street intersections. Mr. Bunning said he was in charge of the work Thursday morning and that Mayor Johnson was there simply as a spectator. An affidavit concerning the question of danger resulting from such temporary construction from E. P. Roberts, of the Roberts & Abbott Company, of Cleveland, was submitted. The arguments in the case, together with the consideration of the petition of Attorney Tolles, were to have been taken up Monday, Dec. 31.

Two amendments have been made to the grant that is to be given the Low Fare Railway Company to get from Erie Street Cemetery to West Twenty-Fifth Street, where it will meet the Forest City Line. One is that the compensation to the Cleveland Electric for operating over a section of its track from the Superior Avenue viaduct to West Twenty-Fifth Street shall be changed from $1,500 to $5,000 per car-mile, and the other is a grant for the use of that strip of track. The original ordinance provided for the right to use Euclid Avenue from East Fourteenth Street to the Square, the two loops about the Square, Superior Street to the viaduct and Detroit Avenue to Twenty-Fifth Street. This would give the company just what it wants in the way of getting to the Square from both the east and the west. Yet the city has been urging the old company to get some of its cars away from the Square and prevent any danger of blockades there. In spite of the fact that the streets through and about that place are restricted to the use of pedestrians in the evening and that the company has re-routed many of its cars, blockades occasionally occur. It is thought that the cars of another company operating to that point would complicate matters still more.

Announcement was made Sunday that on Monday morning the Cleveland Electric Railway Company would begin the sale of seven tickets for a quarter, with transfers and transfers on transfers over the cross-town lines. This is a temporary arrangement to give both the people and the company an idea of the merits of the plan proposed by the company in settlement of the long fight that has been waged on the fare question in Cleveland. Although the officers would not state how long they expected to continue this trial, they said that 10,000,000 tickets had been printed and several million more had been ordered. As the company handles in the neighborhood of 120,000,000 fares annually, the supply on hand will last perhaps a month, and it is surmised that the trial will be continued perhaps two months.

No doubt this is a part of the general campaign being waged for a settlement of the question on the terms proposed by the company. For several months the newspapers were used to popularize the offer, but some time ago this was stopped. On Saturday, however, one of the evening papers contained a page advertisement and in the morning papers the same space was used to tell the people that they now have an opportunity of testing the merits of the plan and will be able, after satisfying themselves, to settle the question for good.

This is the third test of low fares made by the company. A few years ago six tickets for a quarter were sold for several weeks, and again when the zone system was advocated the company made a 3-cent fare within a territory bounded by Wilson Avenue on the east and Gordon Avenue on the west. The last offer is the lowest ever made in a city of the size of Cleveland, and it is claimed by the officers of the company that it is the lowest in the world, considering the length of the haul, transfers and the general service rendered. In speaking of the test President Horace E. Andrews said:

"We have decided upon this course because sentiment seems to demand it. We have had a large number of letters from people all over the city for a long time past, urging us to give a test of our offer, so that the people could have an actual demonstration of the benefits of the low fare offer as embodied in our ordinance before the Council. The average citizen is tired of the constant contentions as to the merits of various low fare schemes. We are going to give the people a demonstration under conditions exactly similar in every way to the conditions outlined in that ordinance."

It seems to be the general belief among the business people of the city that the offer of the company would meet with the approval of a majority of the people, if an expression could be gotten from them in any way. The plan to put the question to a vote was blocked and as yet no other means of securing the will of the voters has been put forward. Should the decision of the Council be finally in favor of the new companies, it is entirely possible that the people in some portions of the city would pay two fares for years. This would be in the nature of an increase that could not be offset by all the low fares they would pay after the system is established.

Having obtained the permission of the court to do so, the Forest City Railway Company on Friday and Saturday removed much of the material from Superior Avenue. The trolley wire was taken down and most of the wagons, with their ash-barrel accompaniments, were hauled away.

The Cooper injunction case was resumed on Monday, when arguments of several of the attorneys were heard. The attorneys for the Cleveland Electric Company did not bring in the question of the Mayor's financial interest in the new companies, but argued the question on the right of the company to place a temporary track on the street. The case was not finished and was taken up again Wednesday.

A NEW TYPE OF MOTOR COMPRESSOR

The National Brake & Electric Company, of Milwaukee, is now manufacturing in large numbers its new types of motor compressors, of which the most frequently used for street railway service are the A-4 and BB-2 types. One of

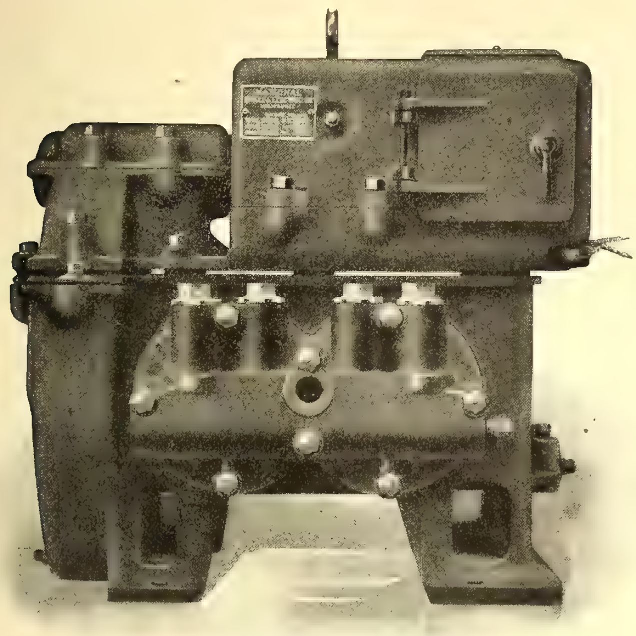


FIG. 1.—THE COMPLETE COMPRESSOR

their many distinctive features is the construction of the motor and compressor as entirely separate and self-contained units. When the two parts are assembled a very compact and rigid compressor unit is produced. In Fig. 1 is shown a complete A-4 type compressor. The crank chamber cover and motor base are separated by a ½-in. air space, which is clearly shown in the illustration. In addition to acting as an insulator of the heat radiated by the compressor the motion of the car causes a strong current of air to circulate through this space, thus rapidly carrying away the heated air. This feature greatly conduces to low-temperature operation, while the separate cover gives the required bracing and stiffening for the crank chamber casting.

The simplicity of design and construction of the compressor is shown in the phantom view Fig. 2. Referring to Fig. 2, the crank shaft is fitted with a third bearing 2 in its center, which in addition to supporting and strengthening it at the weakest point, eliminates all tendency of the shaft to fracture at the center. This third bearing also makes the operation of the compressor much quieter and gives greater freedom from vibration than is the case with two-bearing compressors. Thus the life of the pump and gearing and their efficiency are greatly increased. Removal of crank shaft and gear is accomplished by lifting them straight out of the crank chamber. As the removal of the gear from the shaft is unnecessary, greater accessibility to the pump is gained and a minimum of time consumed in dismantling and reassembling the parts. The splash system of oiling is used, the gear and crank running constantly in a bath of oil which is splashed over all the operating parts of the compressor. The gear case 1 is constructed as an integral part of the crank case instead of being cast separately.

The valve head 4 is constructed with discharge valves towards the center and the suction valves toward the outside of the head. The valves are of the solid cold-drawn tubular steel type and are interchangeable. They are seated by gravity aided by air pressure. The discharge pipe runs straight out of the valve head to the main reservoir, thus dispensing with the necessity of attaching unsightly elbows and goose-necks. Both gear and pinion are a standard herringbone pattern, cut with the greatest accuracy.

The motor of the compressor outfit is a standard four-pole machine of the enclosed type designed with an unusual liberal rating and with a view to accessibility. One of the many distinctive features of the motor is the heavy insulation employed in the brush gear. This insulation on the National motor compressor brush gear is 1¼ ins. which gives assurance against a breakdown likely to occur from the current eating through the bushing or creeping over the small oil-covered surface.

PREPARING FOR PARK BUSINESS

Marking the first of the amusement park enterprises for the new year was the opening of Parque Luna, City of Mexico, on Jan. 1, by Frederick Ingersoll, of Pittsburg, The event approached a national holiday. The guests of honor included a number of public officials and prominent members of the American colony.

At least five new amusement parks, not one to cost less than $300,000, will be installed by Mr. Ingersoll this year. Two already are under way and the grading and dredging and preliminary work on the others will be commenced shortly. One of these is at Burlington Bay, Hamilton, One. This park will contain all the features that have proved successful in the Luna Parks of Pittsburg, Washington, Cleveland and Scranton.

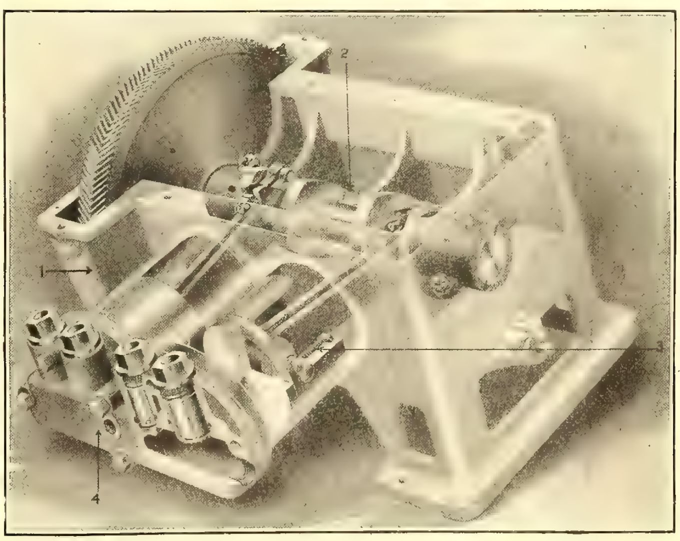


FIG. 2.—PHANTOM VIEW OF COMPRESSOR

Old Monarch Park, Cincinnati, has recently become the property of a company controlled by the same interests and will be transformed into an amusement park along similar lines.

In connection with his street railway park business, Mr. Ingersoll has already contracted for the building and installation of fifteen roller coasterrs and as many aerial swings and carousels.

MULTIPLE SCALE VOLTMETERS

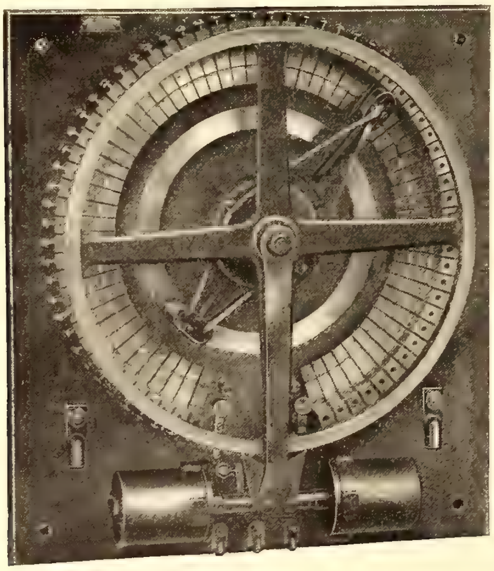
To protect its multiple-scale voltmeters against injury as a result of wrong connection, the American Instrument Company provides all of its instruments which have more than one range with a multiple-scale switch which makes it practically impossible to injure the instrument by careless connecting or through ignorance. This switch is placed on the instrument where it is easy to see and operate, as is shown in the accompanying illustration.

DIAL OF MULTIPLE SCALE VOLTMETER

Normally the indicator stands at "Open" as shown. Connection is made to the one pair of binding posts no matter what range is wanted, and the button is turned till the indicator points to the range desired and the readings are made. The switch is securely held in position for the required range until the operator is through. Then either by pushing a button or closing the lid of the instrument it is released and flies back to the open position. Thus the switch always stands at "Open" when the instrument is not in use, and it is impossible to use the low range without connections having first been automatically made to the higher ranges.

REMOTE CONTROL RHEOSTAT SWITCHES

Modern switchboard engineering tends toward making the controlling board as compact and safe as possible. To this end, remote-controlled apparatus with low-tension wiring at the switchboard has been devised. The accompanying illustration shows a simple remote-control field rheostat recently placed on the market by the General Electric Company. This new solenoid-operated rheostat has been developed to take the place of the bulky and expensive motor-driven switch, and aside from being smaller and simpler than the old type, has the advantage of having no momentum to carry it beyond the desired point of rest.



REMOTE CONTROL FIELD RHEOSTAT

The automatic rheostat is arranged so as to cut resistance in and out of the circuit by a revolving arm making contact on a series of points corresponding to divisions in the resistance. The switch arm is rotated by means of pawls which engage in the knurled rim of a wheel upon which it is mounted. The pawls are operated by a solenoid plunger to which the necessary reciprocating motion is imparted by alternately making and breaking the energizing circuits of the solenoid magnets. A single-pole, double-throw control switch is used to close the circuit in one solenoid or the other, depending upon the direction in which it is desired to turn the switch arm. Limiting switches are provided so that when the rheostat arm reaches either end of its travel it opens the operating circuit.

With the standard switches the operating solenoids are wound for ¾ of an ampere and 125 volts. Three capacities are made, namely: 50 amps., with seventy divisions; 100 amps., with sixty-five divisions, and 200 amps., with forty-six divisions. The manufacturers can also furnish special switches with solenoids wound for any standard voltage and with switches for smaller or larger capacities.

While remote-control rheostats of the type described are especially built for varying the field strength of generators, their use is not limited to this service, but they are adapted as well for cutting in and out resistance for any purpose from a distant point, where automatic "no-voltage" and "overload release" features are unnecessary.

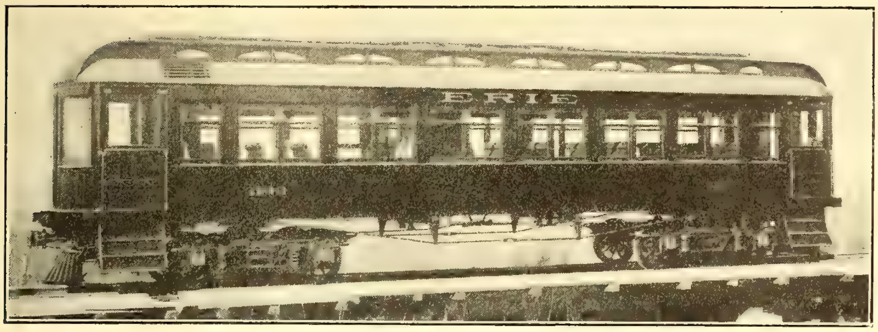
AN ODD CAR FOR YUCATAN

The car shown in the accompanying illustration is unique as being the smallest built by the J. G. Brill Company within the past twenty years. Its destination is Merida, Yucatan, to which place many similar cars of larger size have been shipped by the same builders, one car in particular being very sumptuous in its appointments and intended for the private use of the President of Mexico. The Compania de Tranvia de Merida, which is owned by Escalante & Sons, uses about 150 cars for the 33 miles of track comprising the system. The open and closed cars in use are from 12 ft. to 10 ft. in length, but the present car, which was ordered through Thebaud Bros., of New York, is but 8 ft. in length. The seats and backs of the car are upholstered in leather; the interiors are of cherry and ash and the blinds which make up the equipment are of the same material. The length of the car over crown pieces is 14 ft. The truck used is remarkable on account of its short wheel base, which is but 4 ft.

CAR FOR YUCATAN

CARS FOR ROCHESTER DIVISION OF THE ERIE

As the progress in the electrification of steam roads is being watched with much interest, the cars recently built by the St. Louis Car Company for operation on the Rochester division of the Erie Railroad, now being equipped with



EXTERIOR OF ELECTRIC CAR FOR ERIE RAILROAD

electricity, will no doubt be of special interest. Combination passenger and baggage and passenger and smoker types were built. They measure 51 ft. 4 ins. in length over all and

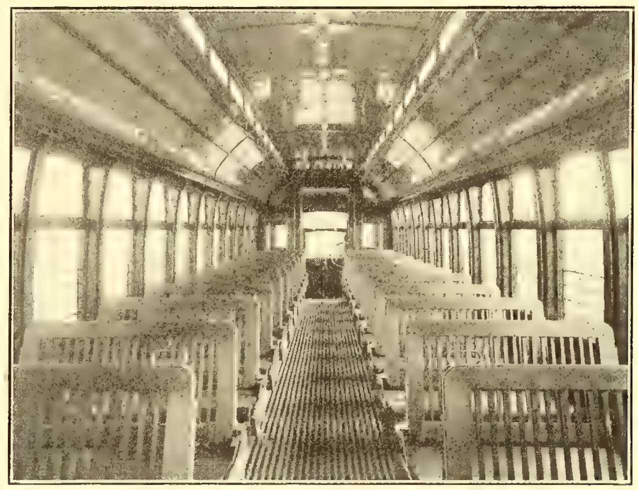
INTERIOR OF ELECTRIC CAR FOR ERIE RAILROAD

are 8 ft. 8 ins. wide. The vestibules are provided with trap doors closing the step openings and end doors. The motorman's cab is formed in the left side of the vestibule by swinging open a door which is hinged to one of the front vestibule posts. When this door is swung open it extends across to the door post of the car body and separates the motorman's cab from the remainder of the platform. When closed this door folds back over the control apparatus. Immediately behind the motorman is a switch cabinet lined with transite and provided with an iron door, which contains the pump, light and control fuses.

The interior of the car is finished in mahogany. The ceiling is of the semi-empire type and the deck sash are glazed with leaded art glass. The rattan seats of the smoking compartment, and plush ones in the passenger compartment are of the St. Louis Company's reversible type with pedestal bases and automatic foot rests. The heater wires are in pipe conduits, and the light wires in asbestos molding.

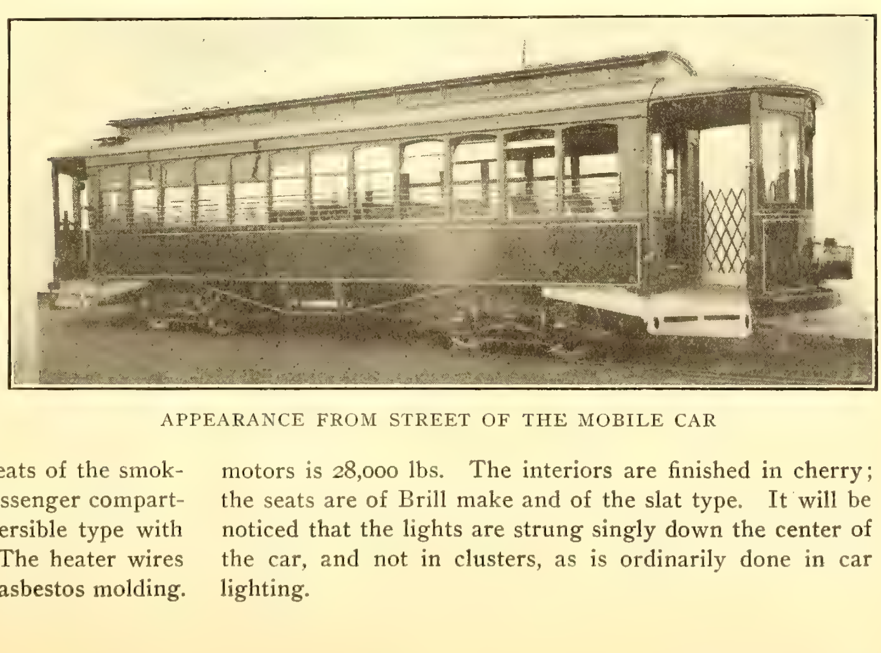
MORE SEMI-CONVERTIBLE CARS FOR MOBILE, ALA.

An article in the Street Railway Journal of April 7 of last year commented upon the strong favor in which the semi-convertible car was held in Mobile, the article going on to describe both single and double-truck cars of the Brill type which had lately been placed on the lines. The American Car Company has now completed an order of six 30-ft. 10-in. double-truck semi-convertible cars of the same type for the Mobile Light & Railroad Company, and in addition there is now in course of construction at the St. Louis works six single-truck cars of the same character. Over the vestibules the double-truck cars measure 40 ft. 10 ins.; width over the sills, including sheathing, 8 ft. 2 ins. The other dimensions are: Height from the floor to the ceiling, 8 ft. 1/4 in.; height from the track to the under side of the sills, 2 ft. 10 ins.; size of the side sills, 4¾ ins. x 7¾ ins.; end sills, 5¼ ins. x 6⅞ ins. The same kind of truck is employed



INTERIOR OF NEW SEMI-CONVERTIBLE CAR FOR MOBILE

as formerly, namely, the No. 27-G with a wheel base of 4 ft. 6 ins. The weight of the car and the trucks without the



APPEARANCE FROM STREET OF THE MOBILE CAR

motors is 28,000 lbs. The interiors are finished in cherry; the seats are of Brill make and of the slat type. It will be noticed that the lights are strung singly down the center of the car, and not in clusters, as is ordinarily done in car lighting.

LEGAL DEPARTMENT*

OBLIGATION TO REPAVE

In the Legal Department of this journal for Sept. 26, 1903, treating of "Police Power and Roadbeds," a test was suggested for the validity of ordinances imposing obligations upon street railway companies. "If the company be merely required to perform acts in and about its tracks and roadbed which are rendered necessary by the existence of the track, the burden so imposed is legitimate. If, however, it be attempted to shift upon a street railway company a duty of paving or cleaning, which has no essential relation to the roadbed, and which would exist if there were no railway, the ordinance must be condemned." We said at the time that all the authorities were not reconcilable in support of such test, but that it ought to be generally accepted as the proper one.

The tendency of the most recent cases upon the duty to repave must be reckoned with; certainly the courts seem disposed to hold street railway companies responsible for doing their full share in keeping up with the march of improvement. In Mayor, etc., vs. Harlem Bridge, etc., Ry. in the New York Court of Appeals (New York Law Journal, Nov. 26, 1906), it was held that the provisions of the charter of a street surface railroad requiring the company to pave between its tracks and for 1 ft. outside thereof, apply to an extension of its lines, constructed pursuant to an amendment of the original act, although the amendatory act was silent on the subject of paving.

It was further held that a charter provision requiring the company "to keep the surface of the street inside the rails and for 1 ft. outside thereof in good and proper order and repair and conform the tracks to the grades of the streets or avenues as now they are or may hereafter be changed by the authorities" imposes a duty upon the road to cooperate with the city authorities in keeping its part in a condition corresponding with the rest of the street, even though that necessitates the laying of a new pavement by the company.

In the opinion the court discusses previous cases arising in the courts of New York and other States, and the whole trend of the discussion is toward the liberal construction of charters and other statutory provisions so as to recognize the right of municipalities to compel street railways to keep the parts of the street occupied by them in conditions appropriate to the progress of the community.

A still more radical decision in the same line was that by the Supreme Court of Pennsylvania in City of Reading vs. United Traction Co. (64 Alt., 446). The suit was by the city of Reading against one of its street railway companies to recover the cost of paving with asphalt the spaces between the rails and to the limit of the sills. The street pavement had not previously been of asphalt, but the jury found that that sort of paving had become necessary and proper, and that the portion of the street used by the defendant had been out of repair. It was laid down that the portions of the street occupied by the railroad must be kept in order by it, although there was no express contract or statutory direction to that effect, and the company was held liable to reimburse for the expense of placing the street in and about the tracks in good repair and reasonable correspondence with the rest of the street, through the use of a new form of pavement, in the absence of any contractual provisions to the contrary. This case would seem to extend the previous common law rules on the subject.

* Conducted by Wilbur Larremore, of the New York Bar, 32 Nassau Street, New York, to whom all correspondence concerning this department should be addressed.

CHARTERS, FRANCHISES AND ORDINANCES

ILLINOIS.—Injunction—Prosecution for Crimes—Municipal Corporations—Street Railroads—Regulations—City Ordinances—Prosecutions for Penalties—Municipal Ordinance—Invalidity—Remedy at Law—Multiplicity of Suits.

1. A court of equity has no jurisdiction to interfere with prosecutions for criminal offenses, whether under a statute applicable to the State at large, or under an ordinance in force only in a particular municipality.

2. Chicago Municipal Code, Secs. 1958, 1959, as amended Oct. 23, 1905, requiring street railways under penalty to furnish sufficient cars to prevent overcrowding, to keep them above a certain average temperature, to keep the track in such condition as to prevent unnecessary noise and jarring, etc., was within the power conferred on the city by Cities and Villages Act, art. 5, Sec. 1, cl. 42 (Hurd's Rev. St. 1905, c. 24, Sec. 62), giving cities power to regulate the occupation of street railway companies.

3. Chicago Municipal Code, Secs. 1958, 1959, as amended Oct. 23, 1905, requiring the running of a sufficient number of street cars to prevent overcrowding, the furnishing of heat therein, etc., was within the police power of the city.

4. The mere invalidity of a city ordinance, under which certain street railway companies were prosecuted to recover penalties for violation thereof, affords no ground for the issuance of an injunction to restrain such prosecutions.

5. Where the invalidity of a city ordinance under which many suits for separate penalties were brought against certain street railway companies had not been determined at law, and its invalidity was uncertain, such railroads were not entitled to maintain a bill of peace to restrain the prosecution of all the suits but one.

6. Where two street railway companies in different parts of a city furnished practically all the street railway service thereof, they were not entitled to maintain a suit in equity to restrain a large number of prosecutions for violations of a city ordinance regulating such service, and to have the ordinance declared void because the maintenance of such bill would prevent a multiplicity of suits, for the reason that there were other persons and corporations operating street railway lines in outlying districts, interested in the proceedings but not charged with a violation of the ordinance.—(City of Chicago vs. Chicago City Ry. Co. et al., 78 N. E. Rep., 890.)

INDIANA.—Eminent Domain—Railroad Right of Way—Damages—Benefits—Trial — Instructions — Misleading Instructions—Future Damages—Extent of Right to Use of Property—Railroads—Right of Way—Use—Compromise Verdict.

1. In a proceeding to condemn land for an interurban electric railway, no deduction should be made for benefits accruing to the landowner from the construction and operation of the road.

2. In a proceeding to condemn land for a railroad right of way, the court charged at defendant's request that if the jury found inconvenience and danger to the owner of the adjoining land and his family in crossing the track and right of way to exist, they might consider the same in estimating damages. There was evidence on all the points suggested in the instruction, and the jury was charged, at plaintiff's instance, that they should find no damages for defendant until they could agree that a preponderance of all the evidence in the case justified them in believing that a particular sum would be a fair measure of compensation. Held that defendant's instruction was not objectionable for failure to expressly confine the jury's consideration of matters "shown by the evidence" to exist, and as authorizing the allowance of speculative and fanciful damages.

3. Where a railroad right of way was sought to be condemned diagonally through a farm consisting of 65 acres of land in one body, damages should be considered and assessed for the entire farm.

4. In a proceeding to condemn land for a railroad right of way, an instruction that if the jury believed that certain additional tracks and cars would be an additional damage to defendants, then the probability of the laying of such tracks and running of the cars was an element of damage for which they were entitled to award compensation, was not misleading for failure to require that the jury should believe such facts "from the evidence."

5. In a proceeding to condemn land for a railroad right of way, all damages present and future arising from the proper construction and operation of the railroad must be recovered,

and such damages not recovered in that proceeding cannot be recovered in a subsequent action.

6. Where an interurban railroad company condemned land for the right of way, it acquired the right as against adjoining landowners to construct additional tracks on such right of way, and to run any number of cars thereon in the proper management of its business.

7. Where, in a proceeding to condemn land for a right of way, the jury were directed to consider the difference caused by the appropriation between the cash market value of the remaining land immediately before the appropriation and its cash market value immediately thereafter; to consider the farm as it then was, and that the damages should be assessed for the farm as a whole, etc., another instruction that defendants had no right to lay water pipes or to construct private drains across the right of way without plaintiff's consent, which was an element of damage for consideration, was not objectionable for failure to confine the jury to the consideration of such pipes and drains as shown by the evidence to be reasonably and properly necessary in the use of the land for farming.

8. Where, in a proceeding to condemn land, the only issue was the amount of damages, it was not error to refuse an instruction that while each juror should be open to influence by argument of his fellow jurors, he should not, while holding an intelligent belief, agree to a compromise verdict which did violence to his belief, the court having charged at plaintiff's request that the burden of proof being on the defendants, the jury should not agree or find damages for defendants until they could find that a preponderance of all the evidence sustained the sum found to be a fair measure of damages.—(Union Traction Co. vs. Pfeil et al., 78 N. E. Rep., 1052.)

KENTUCKY.—Eminent Domain—Laying Tracks in Street—Injury to Property—Compensation—Appeal—Admission of Evidence—Harmless Error.

1. Evidence, in action for damages to property caused by laying car tracks in street in front of such property, examined, and held to justify denial of peremptory instructions for defendant.

2. In an action for damages to property caused by laying car tracks in street in front of such property, error, if any, in allowing witness to state how much the property was depreciated by the construction of the street car line in front of it, without confining them to its depreciation from the obstruction of egress and ingress, was harmless in view of instructions given allowing recovery of damages only if plaintiff was deprived of a reasonable use of the street as a means of egress and ingress to and from the property and limiting the amount of damages to such depreciation in value, if any, of the property in question as was due from the obstruction to the reasonable use of the street adjacent to such property for travel by vehicles in ordinary and general use to and from such property.—(Camden Interstate Ry. Co. vs. Stein, 97 S. W. Rep., 394.)

NEW YORK.—Easements—Acquisition by Prescription—Limitation of Actions—Commencement of Action—Effect—Persons not Parties.

1. An elevated railroad may acquire by prescription the easements of abutting owners.

2. An action by a tenant of an abutting owner against an elevated railroad for injuries to easements, brought within twenty years after the commencement of the operation of the railroad, does not interrupt the running of limitations against the owner, and he cannot after the expiration of more than twenty years from the commencement of the operation of the railroad maintain an action for injury to easements.—(Goldstrom vs. Interborough Rapid Transit Co. et al., 100 N. Y. Sup., 912.)

NORTH CAROLINA.—Railroads—Right of Way—Priority—Survey—Filing of Plat—Prior Location—Street Railroads—Incorporation—Attacking Validity—Collateral Attack—What Constitutes—Interurban Railway—Right of Way—Organization—When Complete—Issuance of Stock—Payment of Money—Railroads—Right of Way—Condemnation—Priority—Injunction—Ground of Relief—Actual Violation of Right.

1. Where grants of two railroad franchises are indefinite as to the exact route to be selected, the prior right will attach to that company first locating its line by defining and marking the route and adopting it by authoritative corporate action.

2. Where a right of way is clearly defined and is staked out by a company, and the route so marked is adopted by the company, the entry of an engineer and a survey is not necessary to the location as against another company seeking the same right of way.

3. The requirement of Revisal 1905, Sec. 2600, that railroad corporations within a reasonable time file a map and profile of their route and right of way with the corporation commission, does not require such a filing as an essential of a completed location of the right of way as against another company.

4. A street railway by a directors' resolution adopted an abandoned railway roadbed as its right of way between two towns, staked out such roadbed, engaged agents to secure the necessary options, some of which were secured, and subsequently, by its directors, ratified and readopted the location as staked out. Held to constitute a prior location as against a railroad company afterwards surveying a line over the same roadbed and purchasing and condemning part thereof.

5. That the capital stock of a street railway company has not been issued, and that no money has been paid thereon, and that no part of the railway is constructed within a town, are matters not open to collateral investigation in injunction proceedings to determine the right of such company to a right of way as against a rival railroad company.

6. Under Revisal 1905, Sec. 1138, defining a street railway as including a railway operated between points in different municipalities lying near each other, or between the territory contiguous to the home municipality, and providing against an extension of more than 50 miles from the home municipality, it is no objection to the right of a street railway to locate a right of way between two towns that no part of its line has been consructed in any town.

7. Under Revisal 1905, Sec. 1140, providing that the persons associated shall constitute a corporation from the time of filing a proper certificate, and Sec. 1141, giving the signers of the certificate temporary power as directors, it is no objection to the obtaining of a right of way by a street railway that its capital stock has not been issued and that no money has been paid thereon.

8. A specific right granted by the franchise of a railroad to condemn abandoned rights of way does not authorize it to condemn an abandoned right of way on which there is a prior location by a street railway.

9. Where a railroad has no express grant to condemn a right of way already located by a street railway, and no necessity exists for such a proceeding, and such right of way is only sufficient for the laying of one track, the general power of condemnation is insufficient to authorize the condemnation of such right of way.

10. Injunction will lie to protect a street railway's located right of way from interference by another company which is seeking to acquire the same by purchase and condemnation, and whose engineers are surveying with a view to immediate occupation.—(Fayetteville St. Ry. vs. Aberdeen & R. R. Co., 55 S. E. Rep., 345.)

PENNSYLVANIA. — Street Railways — Franchises — Forfeiture.

Where a street railway company obtained a franchise from a township to lay its tracks on a public road, with a provision that, when required by the township, it would remove its track from the side to the center of the road, after the road has been constructed, the township cannot declare a forfeiture of the franchise on refusal of the railway company to so move the track, where it was impossible, because the abutting owners on one side of the road would not give their consent to the construction of the track in the center of the road.—(Millcreek Tp. vs. Erie Rapid Transit St. Ry. Co. et al., 64 Atl. Rep., 901.)

LIABILITY FOR NEGLIGENCE

ARKANSAS.—Street Railways—Injuries to Pedestrians—Contributory Negligence—Last Clear Chance—Evidence—Trial—Issues—Submission.

1. Plaintiff, a woman about forty years of age and very deaf, deliberately walked on defendant's street car track after she had looked and knew that a car was coming, her only excuse being that she thought she had plenty of time to cross and kept listening for the gong, but did not hear any. She paid no attention to the car after she saw it the first time until she "heard a confusion," and saw the car was upon her. Held, that plaintiff was guilty of contributory negligence.

2. In an action for injuries to a pedestrian by being struck by a street car, evidence held to sustain a finding that defendant's motorman discovered plaintiff's peril in time by the exercise of

ordinary care to prevent running her down, and that he failed to exercise such care, warranting a recovery, notwithstanding plaintiff's contributory negligence.

3. Where, in an action for injuries to a pedestrian by being struck by a street car, defendant asked for a peremptory instruction, which was properly denied, and then asked that the court submit the question of plaintiff's contributory negligence to the jury, defendant could not object that the court erred in failing to declare that on the undisputed evidence plaintiff was guilty of contributory negligence as a matter of law.—(Ft. Smith Light & Traction Co., vs. Barnes, 96 S. W. Rep., 976.)

CALIFORNIA. — Carriers — Injury to Passengers — Negligence—Appeal—Party Aggrieved—Contribution—Torts—Joint Wrong-Doers—Statutes—Appeal—Motion for New Trial—Review of Evidence—Trial—Findings—General and Special Findings—Consistency.

1. Where a passenger on a street car, free from contributory negligence, was injured in a collision between the car and a wagon of a third person, the negligence of the third person was no defense where the street railway company's negligence, in whole or in part, caused the injury, it owing to the passenger the highest care.

2. In an action for the death of a passenger on a street car in a collision between the car and a wagon of a third person, the evidence showed that the motorman saw the wagon approaching the track, but did not check the speed of the car till he was so close to the wagon that a collision was inevitable. Held that, though it might have been the duty of the driver of the wagon to have stopped until the car had passed, the motorman did not exercise the highest care toward the passenger because he failed to stop the car, though knowing that a collision would ensue.

3. In an action for the death of a passenger on a street car, in a collision between the car and a wagon of a third person, brought against the railway company and the third person, judgment was rendered against the company and in favor of the third person. Held, that the company was not a party aggrieved by the refusal to render judgment against the third person; there being no right of contribution between the co-defendants.

4. Code Civ. Proc. Sec. 709, providing that where property liable to an execution against several persons is sold thereon, and more than a due proportion of the judgment is satisfied out of the proceeds of the property of one of them, he may compel contribution from the others, etc., does not change the rule that there is no right of contribution between joint tort-feasors, but merely gives to a judgment debtor entitled to contribution the summary remedy of using the judgment itself to enforce contribution in the manner prescribed.

5. Where, in an action for negligence, plaintiff does not move for a new trial, the court, on appeal, cannot consider the question of the sufficiency of the evidence to show negligence.

6. In an action for the death of a passenger on a street car, in a collision between the car and a wagon of a third person, brought against the street railway company and the third person, the court found that the death of the passenger was not caused by the negligence of the third person, but solely by the negligence of the company. The court further found that the driver of the wagon saw the car approaching when it was about 125 ft. distant from the point of the accident and did not stop his team until too late. Held that, as the car was operated on a street, it could not be said that the driver of the wagon did not exercise reasonable judgment in determining that he could pass the crossing before the car would reach him, and a judgment in favor of the third person was authorized.

7. The finding of the ultimate fact prevails in support of the judgment, notwithstanding a finding of probative fact which tends to show that the ultimate fact is against the evidence.—(Forsythe vs. Los Angeles Ry. Co. et al. (L. A. 1733), 87 Pac. Rep., 24.)

GEORGIA.—Trial—Instructions—Conformity to Issues—Carriers—Injury to Passenger—Evidence—Admissability—Instructions.

1. Where the plaintiff's declaration and the evidence in support of it tended to make a case of a wilful tort on the part of a street car conductor, committed on a passenger by forcibly pushing or kicking her off the car, and the evidence on behalf of the defended tended to show that after the car had stopped a sufficient length of time and signals had been given, and upon her failure to alight, it had moved on, she voluntarily stepped from the car and was injured, it was error to so charge the jury as in effect to authorize them to find in favor of the plaintiff if she was not in fact wilfully ejected from the car, but was injured by reason of negligence on the part of the conductor in not allowing sufficient opportunity for a passenger to leave the car.

2. There was no error in allowing a witness to testify that on the street where the injury occurred there was a place where street cars stopped at the crossing.

3. There was no error in charging that the jury might consider whether or not the car ought to have stopped at a given point, in determining questions with reference to the circumstances under which the conductor and plaintiff may have acted, with reference to whether the circumstances would be such as to authorize a finding for punitive damages, and generally in considering the circumstances immediately leading up to and attending the occurrence.—(Savannah Electric Co. vs. McElvey, 55 S. E. Rep., 192.)

ILLINOIS.—Trial—Questions for Jury—Conflicting Evidence—Instructions—Action Against Carrier—Injury to Passenger—Carriers—Action—Instructions.

1. Where there is evidence fairly tending to prove the plaintiff's case, its weight and sufficiency are to be determined by the jury, though the court may be of opinion that the weight of the evidence is for defendant.

2. In an action against a carrier for injuries to a passenger, the court instructed that if the jury believed that defendant failed to use such care and diligence as required, and that "by reason thereof the plaintiff was injured as alleged in the plaintiff's declaration," there should be a verdict for plaintiff. Held, that the instruction was not erroneous on the theory that the words "as alleged in plaintiff's declaration" referred to the character of the injuries, and hence that plaintiff's right to recover was not limited to proof of the negligence charged in the declaration.

3. In an action against a carrier for injuries to a passenger, the declaration alleged negligence in managing and controlling the car and in causing it to start suddenly and violently, and the court instructed that in order to entitle plaintiff to recover he must prove by a preponderance of the evidence that he was in the exercise of ordinary care, and if the injury resulted from an accident, and not from the negligence of defendant, the verdict should be for defendant, and the court also instructed that it was the duty of defendant to do all that human care, vigilance, and foresight could reasonably do to prevent an accident to plaintiff. There was no evidence introduced to prove any negligence, except that charged in the declaration. Held, that the instructions were not erroneous, on the ground that the jury might have understood that they could find for defendant, if they believed the cable machinery was defective or out of repair.—(Chicago Union Traction Co. et al. Lowenrosen, 78 N. E. Rep., 813.)

ILLINOIS.—Carriers—Street Railroads—Injuries to Passenger—Contributory Negligence—Position—Standing on Step—Appeal—Intermediate Appeal—Questions of Fact—Conclusiveness—Injury to Passengers—Care Required—Evidence—Weight and Sufficiency—Damages—Mental Suffering—Trial—Instructions—Damages—Applicability to Issues—Personal Injuries—Earning Capacity—Evidence—Negligence of Motorman—Instructions—Direction of Verdict—Assumed Risk.

1. Where a street car on which plaintiff was riding at the time of his injury was so crowded that plaintiff could not secure a safer place than the step on which to ride, whether plaintiff was guilty of contributory negligence in riding on the step was for the jury.

2. In an action for injuries to a passenger on a street car, whether plaintiff could have secured a safer place to ride than on the step, and was therefore guilty of contributory negligence in riding there, was a controverted question of fact, the determination of which by the Appellate Court was conclusive on a further appeal to the Supreme Court.

3. It is the duty of a street railroad company, as a matter of law, to use the highest degree of care and caution consistent with the practical operation of the road, to provide for the safety and security of passengers while being transported.

4. In an action for injuries to a passenger, plaintiff is only bound to prove his case by preponderance of the evidence, and not beyond a reasonable doubt.

5. A passenger who suffered bodily injury as the result of an accident for which the carrier was liable, was entitled to recover for such mental suffering as was the natural and inevitable result of his injuries.

6. Where, in an action for injuries to a passenger, a declaration alleged that plaintiff had been obliged to expend divers large sums of money, amounting, to wit, to the sum of $1,000, and had obligated himself to pay out large sums of money, to wit, $1,000, an instruction authorizing consideration of any necessary expense plaintiff may have been put to "or may have obligated himself to pay," in and about plaintiff's treatment for his injuries, was not objectionable as beyond the issues, in so far as it authorized consideration of expenses plaintiff had obligated himself to pay.

7. Plaintiff's thumb and little finger were torn off and the hand so injured and lacerated as the result of defendant's negligence that it was almost useless. Plaintiff was a machinist, and the year prior to his injury had earned $900 at his trade, but had been unable to work at his trade since the injury, and his capacity to perform any kind of labor had been permanently impaired. Held, that such facts were sufficient to justify a recovery for depreciated capacity to earn money in the future.

8. Where, in an action for injuries to a passenger on a street car, it was a question for the jury whether the motorman was negligent in failing to guard against collision with a wagon, though it was conceded that after the wagon left the track it halted, swerved, or even backed a few inches, an instruction that, if, after the wagon had left the track a sufficient distance to permit the car to pass in safety, and after the forward end of the car had passed the rear of the wagon, without notice to those in charge of the car, the horse suddenly backed the wagon so that it came in contact with the side of the car and plaintiff was thereby injured, the jury should find defendant not guilty, was properly refused.

9. Where an instruction directs a particular verdict if the jury finds certain facts and conditions, the instructions must embrace all the facts and conditions essential to such verdict.

10. The law of assumed risk is inapplicable to an action for injuries to a passenger on a street car caused by a collision between the car and a vehicle.—(Chicago Consolidated Traction Co. vs. Schritter, 78 N. E. Rep., 820.)

INDIANA.—Evidence—Judicial Notice—Functions of Domestic Corporations—Carriers—Injury to Passenger—Action—Complaint—Sufficiency—Trial — Action—Instructions—Assumptions—Damages—Mental Anguish—Personal Injuries.

1. The courts will take judicial notice that a company organized and operating a street railway under the laws of the State is a carrier of passengers.

2. Burns' Ann. St. 1901, Sec. 346, provides that an objection that the complaint does not state a cause of action is not waived by failure to object by demurrer or answer. In an action against a street railroad company for injuries, the complaint alleged that defendant was a corporation engaged in operating various lines of street railroads in a certain city; that plaintiff was riding on "one of the cars of the defendant's road," which was a "passenger car, or one used for the carriage of passengers"; that she desired to leave the car at a certain street, and, before it arrived there, "she sounded the electric bell provided to be sounded by passengers to announce their desire to leave the car"; that the car was known as an open, or summer, car, with seats running from side to side, and with a running board to "assist passengers" in getting on and off; and that plaintiff was a passenger on the car. Held, that after verdict and judgment on the merits, objections to the complaint on the ground that it did not charge that defendant was a carrier of passengers, that there was no allegation that defendant owned the car, that it was not alleged that the car was a passenger car, or one used to carry passengers, that it did not allege that the car was under the control of defendant, and that it did not appear that plainiff paid or offered to pay any fare, were untenable.

3. In an action for injuries, an instruction that plaintiff was entitled to just compensation for being deprived of freedom of action and social meeting and intercourse with her friends, "which you shall believe from the evidence in this cause she would have enjoyed, but for the receipt of such injuries, so far as under the evidence you shall find that she has been and will be deprived of such freedom of action and meeting," was not objectionable on the ground that it assumed that plaintiff had been deprived of her freedom or friends.

4. In an action for personal injuries, plaintiff is not entitled to recover for unhappiness resulting from impaired freedom of action and from being deprived of social intercourse with friends.—(Indianapolis St. Ry. Co. vs. Ray, 78 N. E. Rep., 978.)

IOWA.—Trial—Instructions—Reference to Evidence—Application to Evidence—Street Railroads—Collision with Vehicle—Action—Evidence—Admissibility—Regulations as to Right of Way—Action for Injuries—Instructions—Evidence—Admissibility — Negligence — Imputed Negligence—Appeal—Harmless Error—Trial—Issues.

1. In an action for personal injuries, it was error for the court to suggest in an instruction that the jury should take into consideration certain facts constituting circumstances from which negligence might be inferred, and omit reference to facts favorable to defendant.

2. In an action against a street railroad for the death of a member of the fire department in a collision between a hose wagon and a car, an instruction that the jury must consider whether the motorman was negligent in not stopping or checking the speed of the car, if he could have stopped it, was erroneous; there being no question under the evidence as to the ability of the motorman to stop the car or check its speed in time to have avoided the accident, but the question being whether he was negligent in not doing so.

3. In an action against a street railroad for the death of a member of a municipal fire department in a collision between a hose wagon and a car, while the wagon was crossing the track, it was proper to admit in evidence a section of the city ordinances providing that apparatus of the fire department responding to an alarm should have the right of way.

4. Where a section of a city ordinance provided that the apparatus of the fire department should have the right of way while going to and at any fire, and another section provided that the cars of a street railroad company should be entitled to the track, and that in all cases where any team should meet or be overtaken, the team or vehicle should give way to the car, the former section was controlling as to the right of way as between a street car and fire apparatus responding to an alarm.

5. Where, in an action against a street railroad for the death of a member of a municipal fire department in a collision between a hose wagon and a car, a city ordinance giving fire apparatus the right of way while going to and at any fire was admitted in evidence, it was not error to set out the ordinance in an instruction in which the jury were informed as to the legal effect of it.

6. In an action against a street railroad for the death of a member of a municipal fire department in a collision between a hose wagon and a car, it was proper to refuse to admit in evidence on behalf of plaintiff rules of the fire department intended for the guidance of members thereof and issued only to them.

7. In an action against a street railroad for the death of a member of a municipal fire department, who was riding on a hose wagon, in a collision between the wagon and the car, the negligence of the driver of the wagon was not imputable to decedent.

8. In an action against a street railroad for the death of a fireman in a collision between a hose wagon and a car, a witness was interrogated as to the distance within which a car could be stopped with the use of a different kind of controller than that used, but subsequently, on the request of counsel who introduced the witness, his testimony was stricken, and the jury instructed to disregard it. After the witness had fixed a shorter distance than that fixed by the expert witnesses previously testifying, he changed his testimony so that it substantially accorded with that of the other witnesses. Held, that under the circumstances, there was no error resulting from the admission of the testimony of the witness.

9. In an action against a street railroad for the death of a fireman in a collision between a hose wagon and a car, it was not error to refuse an instruction that, in determining whether plaintiff's intestate was guilty of contributory negligence, the jury should not take into account the instinct of self-preservation, where the attention of the jury was not in any way called to such doctrine.—(McBride vs. Des Moines City Ry. Co.)

KENTUCKY.—Appeal—Verdict—Conflicting Evidence—Review—Carriers—Street Cars—Injuries to Passenger—Time to Alight—Stopping Places—Contributory Negligence—Damages — Personal Injuries — Instructions — Nervous Shock—Erroneous Instructions—Necessity of Request—

Right to Object—Trial—Duty of Court—Witnesses—Evidence—Admissibility—Rebuttal—Conclusions.

1. Where there was a conflict of evidence on practically all the controverted points in a case, a judgment for plaintiff would not be reversed for the reason that the verdict was contrary to the evidence.

2. Where the servants of a street car company in charge of a car, saw plaintiff in the act of alighting when the car had stopped at a switch, it was their duty not to start the car until plaintiff alighted in safety, though a regular stopping place had been established only a short distance further on.

3. Where a passenger, on the stopping of a street car at a switch, left her seat intending to alight, but before she reached the platform or steps for that purpose the car was again in motion, and she persisted in getting off while the car was in motion, and was injured, she was guilty of contributory negligence, precluding a recovery, unless the peril in which she placed herself was known to those in charge of the car, and they might have stopped it in time to have prevented her injuries.

4. In an action for personal injuries, an instruction that, in estimating the damages, the jury may consider plaintiff's physical pain and mental anguish suffered in the past and which will probably be suffered in the future, and any disability, partial or permanent, in plaintiff's right arm, and expenses incurred for medical attendance and nursing, also the nervous shock occasioned by the injury, was erroneous in allowing for pain and mental anguish and also for nervous shock; but the jury should have been instructed to allow such sum as would reasonably compensate her for physical and mental suffering endured, or which she will probably endure, for loss of time, reasonable expenses, and for the permanent impairment of her ability to earn money, that may have been caused by the negligence of defendants, not to exceed the amount claimed in the petition.

5. Where an instruction given on the measure of damages was incorrect, the fact that defendant did not request an instruction on such subject did not deprive it of the right to object to such instruction on appeal.

6. Though a trial judge is required by Civ. Code Prac. Sec. 317, subsec. 5, only to give instructions when asked by the parties, if unasked he undertakes to do so, it is his duty to see that the instructions given are correct.

7. Where an instruction is offered by either party which is defective in form or substance, the court should prepare or direct the preparation of a proper instruction on the point covered by the instruction requested.

8. Plaintiff, after being injured while alighting from a street car, was taken to the store of K., and defendant, in an action for her injuries, proved by certain witnesses that they went into the store while plaintiff was there, and that she made to them or in their presence certain statements that her injuries were caused by her own negligence in stepping from a moving car. Held, that evidence of K. that he did not hear plaintiff make such statements, but that he did hear her say she was attempting to get off the car when it was starting again, was admissible in rebuttal.

9. In an action for injuries, a witness was asked if he heard plaintiff make certain statements attributed to her by witnesses for defendant, in a certain store. He answered that he did not, but did hear her say she was attempting to get off the car when it started again, "that would indicate that the car had stopped." Held, that the part of the answer quoted was objectionable as a conclusion of the witness, and was not responsive.—(South Covington & C. St. Ry. Co. vs. Core, 96 S. W. Rep., 562.)

KENTUCKY.—Appeal—Verdict—Conflicting Evidence—Carriers—Injury to Passenger—Evidence—Character—Contributory Negligence—Injuries to Passengers—Actions—Evidence—Trial—Instructions—Refusal — Carriers—Commencement of Relation—Contributory Negligence—Damages—Personal Injuries.

1. A verdict will not be interfered with on appeal, unless it is palpably against the evidence.

2. Where, in an action for injuries to a street car passenger, defendant claimed that she attempted to get on the car while in motion, evidence that plaintiff had been frequently seen to get off and on street cars while in motion was inadmissible.

3. Where, in an action for injuries to a street car passenger while attempting to board a car at a point other than that marked for the stopping of cars, whether the car in fact stopped to permit plaintiff to get aboard was disputed, evidence that defendant's cars stopped at points on the line other than the place indicated by a sign in question was admissible.

4. Where, in an action for injuries to a street car passenger while attempting to board a car at a point other than that marked as a stopping place by a sign, plaintiff claimed that the car stopped to receive her as a passenger which was denied, evidence concerning the propriety and necessity of stopping defendant's cars at regular stopping places indicated by signs was inadmissible.

5. Where, in an action for injuries to a passenger by the sudden starting of a car as she was attempting to board the same, the instructions given clearly presented the only issue in the case, which was whether the car did or did not stop to receive plaintiff as a passenger, it was not error for the court to refuse to charge that defendant's liability would attach only in the event its employees in charge of the car started the same when they knew that plaintiff was endeavoring to board it.

6. A carrier owes no duty whatever to a person intending to become a passenger, until she has become a passenger by either getting on, or attempting to get on, the car after it has stopped for the purpose of permitting her to board it.

7. It is in general not negligence per se for a passenger to attempt to board or alight from a moving street car.

8. In an action for personal injuries, an instruction that plaintiff, if entitled to recover, should receive such sum as should fairly compensate her for her injury, and that, in estimating the injury done, the jury should allow plaintiff compensation for any pain suffered by her, mental and physical, and any further sum which would fairly compensate her for the loss of her foot, was erroneous; the jury being confined to such a sum as would fairly compensate plaintiff for the value of time lost, for reasonable expenses incurred, for physical and mental suffering caused by the injury, and for any reduction of her power to earn money.—(Lexington Ry. Co. vs. Herring, 96 S. W. Rep., 558.)

KENTUCKY.—Street Railroads—Persons Near Track—Injury Avoidable Notwithstanding Contributory Negligence—Signals.

1. In an action for the death of a boy struck by a street car, plaintiff, as administratrix, can recover, if decedent got on the track or was approaching it far enough ahead of the car for the motorman, in the exercise of ordinary care, to have seen him in time either to stop the car or signal its approach and avoid the injury, and he failed to do so, though the boy was negligent.

2. A street railway company is not liable for death of a boy, where he was standing about 8 ft. from the track and suddenly ran across the track immediately in front of the car, too late for the motorman to avoid striking him, though he did not sound the bell when he saw the boy standing near the track.—(Louisville Ry. Co. vs. Edelen's Adm'x., 96 S. W. Rep., 901.)

KENTUCKY.—Carriers—Injury to Passenger—Question for Jury—Damages—Excessive Damages—Personal Injuries—Action—Instructions.

1. Where a passenger on a street car, a girl 13 years of age, had with her a bundle which was a large one for a girl of her size, and while she was alighting with it and had one foot on the ground and one on the step, the conductor, who was watching her, caused the car to be started, whereby she was injured, it was proper to submit the question of gross negligence to the jury.

2. Where, in an action for injuries to a girl 13 years of age, it appeared that the accident resulted in inflammation of the sciatic nerve and atrophy of adjacent parts, so that she was confined to her bed for some time and suffered intensely, and at the time of the trial walked only with a crutch, and it appeared that she had never been well since the accident, though before that she was a strong, healthy child, a verdict for $6,500 was not excessive.

3. In an action against a street railroad for injuries to a passenger, a girl 13 years of age, it appeared that she had with her a bundle which was a large one for a child of her size, and that, while she was alighting with it and had one foot on the step and one on the ground, the car was suddenly started by the conductor, who was looking at her; and the court instructed that it was the duty of defendant's servants not to start the car until plaintiff had an opportunity to alight therefrom with reasonable safety, and that if, when she was in the act of alighting and exercising ordinary care, defendant's servants suddenly started the car before she had an opportunity to alight with reasonable safety, and by reason thereof she was injured, she

was entitled to recover. Held, that the instruction was not erroneous, on the ground that the court should have told the jury that it was the duty of the conductor not to start the car until plaintiff had a reasonable opportunity to alight therefrom with safety; the evidence not showing any unreasonable delay on the part of plaintiff, and the jury being required to find, as precedent to a recovery by plaintiff, that the car did not start until she had an opportunity to alight by the exercise of ordinary diligence.—(Louisville Ry. Co. vs. Owens, 97 S. W. Rep., 356.)

MASSACHUSETTS.—Carriers—Street Railroads—Injuries to Passengers—Negligence.

Plaintiff was injured as the result of an explosion or burst of flame from the controller on defendant's street car, in which she was a passenger. Defendant claimed that the flash was an ordinary flash from the controller, which could not be prevented by any means yet devised or any care which could be exercised. There was other evidence, however, that the flash was more than an ordinary controller flash, and that it lasted 15 to 20 seconds, lighted the whole front vestibule, and filled the car with dense smoke. Held, that such facts were sufficient to warrant an inference of negligence on defendant's part.—(Gilmore vs. Milford & U. St. Ry. Co., 78 N. E. Rep., 744.)

MASSACHUSETTS.—Death—Action for Causing—Street Railroads—Negligence—Incompetent Servant—Evidence—Negligence of Employees.

1. In an action against a street railway company for the death of a pedestrian struck by a car, the facts that the motorman did not continuously observe decedent while crossing the street, that he failed to give any warning of the approach of the car, and that he did not more promptly apply the brake for the purpose of stopping the car, do not charge the company with negligence in retaining an incompetent servant, without further proof of previous misconduct showing unfitness, within Rev. Laws. c. 111, Sec. 267, authorizing a recovery for the death of a person caused by the negligence of a street railway company.

2. In an action against a street railway company for the death of a pedestrian struck by a car, it was shown that the gong was not rung, that the velocity of the car exceeded the specified rate of speed, and that the motorman did not exercise ordinary care in his general observation of the entire area of the street from curb to curb. Held, not to show gross negligence, within Rev. Laws, c. 111, Sec. 267, authorizing a recovery for the death of a person caused by the gross negligence of the servants of a street railway company.—(Moran vs. Milford & U. St. Ry. Co., 78 N. E. Rep., 736.)

MASSACHUSETTS.—Carriers—Street Railroads—Protection of Passengers.

Nearly all day on July 4, 1905, one O. had been discharging a cannon loaded with blank cartridges from his yard toward the street on which defendant's street railway was operated. When the cannon was fired a jet of flame and smoke extended as far as the sidewalk, but several feet short of defendant's tracks, and defendant had no reason to anticipate any danger to its passengers from such source. About 5:30 p. m. plaintiff, a passenger on defendant's street car, was struck and injured by a wad shot by O. from the cannon. Held, that the street car company was not negligent in failing to anticipate danger to passengers from such source, nor in failing to ascertain whether the cannon was properly loaded or pointed.—(Ormandroyd vs. Fitchburg & L. St. R. Co., 78 N. E. Rep., 740.)

MASSACHUSETTS.—Carriers—Street Railroads—Place to Alight—Streets—Safety—Warning.

1. A public street in a town is not to be regarded as a passenger station for the safety of which a street railway company is responsible, when used by passengers as a place to alight.

2. Plaintiff, a passenger on a street car, alighted at night from the "sidewalk side" of a car and was injured by stepping into a gutter between the car track and the sidewalk, which gutter was similar to those ordinarily maintained in streets in country towns. Held, that the conductor of the car was entitled to assume that plaintiff was familiar with the existence of the gutter, and was therefore not guilty of negligence in failing to warn her of its existence.—(Thompson vs. Gardner, W. & F. St. Ry. Co. (two cases), 7 8N. E. Rep., 853.)

MICHIGAN.—Property—Ownership—Evidence—Sufficiency — Admissions — Estoppel — Pleading—Appeal — Discretion of Trial Court—Rehearing—Surprise.

1. On an issue as to whether certain rails sold by the president of a street railroad in his individual capacity were the property of the president or of the corporation, evidence considered, and held to warrant a finding that the rails belonged to the corporation.

2. Where the president of a street railroad company sold certain rails in his individual capacity, and the company sued to restrain the removal of the rails by the purchaser, the fact that that president had included the rails in a memorandum of assets made by him and furnished to those negotiating to purchase a controlling interest in the road amounted to an admission against him.

3. An equitable estoppel must be pleaded.

4. The Supreme Court will not review the action of the trial court on an application for a rehearing in equity on the ground of surprise by the production of certain evidence and newly discovered evidence relative thereto unless an abuse of discretion clearly appears.—(Saginaw Suburban R. Co. vs. Connelly, 109 N. W. Rep., 677.)

MICHIGAN.—Carriers—Street Railroads—Injury to Passenger — Negligence — Evidence — Damages—Personal Injuries—Excessive Verdict—Witnesses—Credibility—Trial—Instructions—Preponderance of Evidence—View of Premises.

1. Evidence in an action for injury to a passenger on a street car held sufficient to go to the jury on the questions whether he was thrown from the car as it was going round a curve, and whether there was negligence.

2. In an action for personal injury, resulting in a person in perfect physical and mental health becoming a physical and mental wreck, a verdict for $17,000, which testimony tended to show was not in excess of the present worth of his earnings based on his expectancy of life, is not excessive.

3. Witnesses for plaintiff having testified that plaintiff offered them a suit of clothes if they would testify in his behalf, plaintiff may show by his testimony and that of such witnesses that he did not attempt to influence them to tell anything but the truth, and that such promises had not affected their testimony.

4. To instruct that the number of witnesses has nothing to do with the case in the determination of the question of preponderance of the evidence is error.

5. The refusal of the court, in an action for injury to a passenger claimed to have been thrown from a street car as it was rounding a curve, to direct a view of the premises, and to accept an offer "to take the court and the jury on that curve and arrange to make, with the court and jury, the turn of the curve on that car," is in the discretion of the court.—(Dupuis vs. Saginaw Valley Traction Co., 109 N. W. Rep., 413.)

MISSISSIPPI.—Nuisance—Action for Damages—Question for Jury—Exercise of Legal Rights—Eminent Domain—Injury to Property not Taken—Damages—Invasion by Smoke—Defenses.

1. In an action for damages to plaintiff's property, resulting from noise, smoke and cinders, where the evidence showed that the property of plaintiff was damaged in the manner alleged by the plants of defendant and by a railroad company, it should have been left to the jury to determine defendant's liability.

2. Where a corporation, in operating a plant, maintains a nuisance, damaging private property, it cannot claim exemption from liability because it is operating under public authority conferring the right to conduct its business.

3. Const. Sec. 17, providing for compensation to be first made in a manner to be provided by law, while intended for formal condemnation proceedings, is equally protective of the owner of private property, when no condemnation is had and his property is damaged by public use.

4. Due compensation is what will make the owner whole pecuniarily for appropriating or injuring his property by any invasion of it cognizable by the senses, or by interference with some right in relation to the property, whereby its market value is lessened as the direct result of the public use.

5. Though people live in cities, they are entitled to enjoy their homes free from damaging results by smoke, soot, and cinders, sufficient to depreciate the value of their property, in addition to rendering their occupancy uncomfortable.

6. If the damage to plaintiff's property from the nuisance complained of was not caused by the plant of defendant since it acquired it, but before, and there has been no continuing cause of damage, whereby depreciation of value has been maintained, there is no liability; but if damage was done during former ownership, and the cause is continued, whereby the restoration of value has been prevented, the fact of the former damage is no defense.—(King vs. Vicksburg Ry. & Light Co., 42 S. Rep., 204.)

MISSOURI.—Street Railroads—Operation—Negligence—Contributory Negligence—Question for Jury.

1. The running of a street car at a speed of 20 miles an hour without warning signals as it neared a street crossing was negligence.

2. Plaintiff approaching a street railroad track at a crossing saw a car approaching the crossing at a distance of 450 ft., and, though his wagon could not cross and pass beyond danger of collision in less than from 40 to 45 ft., drove on the track without giving further attention to the car. Held, in an action for injuries sustained in a collision, that he was guilty of contributory negligence.

3. In an action for injuries sustained in a collision between plaintiff's vehicle and a car, held a question for the jury whether defendant was negligent under the "humanitarian" doctrine.—(Cole vs. Metropolitan St. Ry. Co., 97 S. W. Rep., 555.)

MISSOURI.—Street Railways—Control and Operation—Collision with Animals—Negligence—Evidence—Sufficiency—Question for Jury.

1. In an action for the killing of horses by being struck by a street car, positive testimony of several witnesses that there was no signal light burning on the car is not to be set aside merely because the motorman swore to the contrary.

2. In an action for the killing of horses through being struck by a street car, evidence examined, and held sufficient to take to the jury the question as to whether the car could have been stopped after the motorman could have discovered the wagon on the track.—(Cross vs. St. Louis Transit Co., 97 S. W. Rep., 183.)

MISSOURI. — Carriers — Street Railways — Contracts — Breach—Regulation Routeing Cars—Ordinances.

1. At an intersecting street, plaintiff, a passenger, was offered a transfer to another car, which was at hand, ready to carry him to his destination, four blocks north, but plaintiff refused the transfer, stating that if he had known the car was not going to his place of destination, as indicated thereon, before he boarded it, he would have taken another car; the car being traneferred en route to another track in order to make up lost time. Held, that there was no actionable breach of the carrier's contract to transport plaintiff to destination.

2. St. Louis city ordinance No. 21,113, Sec. 1760 D. legalized the routeing of cars on defendant's street car line, in existence Aug. 28, 1902, and provided that no change of the routeing should be thereafter made without the written consent of the Mayor, president of the Council, and supervisor of street railways. It also provided that a car should not be turned from its established route except in cases of unavoidable accident or when according to schedule, it was about to be turned into a car house. Held, that such ordinance did not prohibit the diversion of a car from its regular route for the purpose of making up time that had been unavoidably lost, to restore it to schedule, and get the usual space ahead of the car that was following, though it necessitated a transfer of passengers.—(Dryden vs. St. Louis Transit Co., 96 S. W. Rep., 1044.)

MISSOURI. — Carriers — Passengers — Injuries — Negligence—Evidence—Presumption—Question for Jury—Admissibility.

1. In an action against a street railway by a passenger for injuries received through being struck by a missile thrown by a bystander, no presumption of negligence on the part of the defendant arises from the mere fact of the injury.

2. In an action against a street railway by a passenger for injuries received by being struck by a missile thrown by a bystander, plaintiff testified that he was seated near the front of the car, and that as the car approached the corner, where by ordinance it was required to stop, he saw a man standing between the tracks, making violent motions with something in his hands. His next recollection was of transactions after the injury. Another witness testified to seeing some one throw a missile through the front vestibule of the car. Held insufficient to take to the jury the question of the company's negligence.

3. In an action against a street railway by a passenger for injuries received through being struck by a missile thrown by a bystander near a street corner, where the car was by ordinance required to stop, plaintiff's evidence, offered to show prior assaults on the car for failure to stop at such corner, was not so framed as to exclude sporadic assaults occurring during a period of years, or as to show a frequent occurrence thereof, indicating future repetition. Held properly rejected as too indefinite and not bringing home to the company facts indicating danger to its passengers.—(Woas vs. St. Louis Transit Co., 96 S. W. Rep., 1017.)

MONTANA.—Appeal—Harmless Error—Exclusion of Evidence—Subsequent Admission—Judgment—Conformity to Verdict—Amount—Interest.

1. In a proceeding for the condemnation of a right of way across a mining claim, plaintiff offered in evidence a written offer made by it to construct a tramway across the right of way for the better working of the claim. Subsequently the manager of plaintiff testified, without objection, to the same offer, in substance, as well as to an offer to do other work, preventing damage to the right of way. Held, that any error in excluding the written offer was harmless.

2. Code Civ. Proc., Sec. 1102, provides that, when a verdict is found in an action for the recovery of money, "the jury must also find the amount of the recovery." In a proceeding for the condemnation of land the jury were instructed to find damages as of the date of the summons, and to allow interest thereon from the time of the actual occupation of the property by the railway. The verdict found specific sums for specific items of damage, and concluded, "the total amount awarded to the answering defendants being $1,200." Held, that the court was not justified in rendering judgment for such sum, with interest from the date of the occupation.—(Butte Electric Ry. Co. vs. Matthews et al., 87 Pac. Rep., 460.

NEBRASKA.—Carriers—Injury to Passenger—Negligence—Burden of Proof—Shifting of Burden—Instructions.

1. In an action for damages against a street railway company for a personal injury caused by the alleged negligent starting of one of its cars when the plaintiff, a passenger, was in the act of alighting, the defense being a general or special denial, the burden of proof never shifts, but remains with the plaintiff to prove that the injury was received substantially as alleged.

2. When, in an action for damages for a personal injury inflicted while the plaintiff, a passenger, was in the act of alighting from a street railway car, the evidence is conflicting as to where the plaintiff alighted, an instruction that "plaintiff became a passenger of the company, and continued to be its passenger up to and including the act of alighting at his proper stopping place" is erroneous.—(Lincoln Traction Co. vs. Brookover, 109 N. W. Rep., 168.)

NEW YORK.—Master and Servant—Injuries to Servant—Negligence—Safe Place to Work—Evidence.

1. Deceased was killed by being thrown from a hanging scaffold under an elevated railroad structure, by a collision between a truck and the scaffold. The scaffold was suspended from the elevated structure only a short distance above the tops of the surface cars, and it was impossible for men to work thereon and keep watch for approaching vehicles. Held, that the elevated railroad company was guilty of negligence in failing to provide a watchman to warn approaching vehicles of the scaffold.

2. Where intestate was thrown from a suspended scaffold underneath an elevated railroad by a collision between a truck and the scaffold, evidence of the truck driver that he had no notice of the scaffold either before or after the accident, that he had no warning not to proceed, that no person signaled to him, and that he did not see any watchman there on that day, was sufficient to justify a finding that no watchman had been provided.—(Sheridan vs. Interborough Rapid Transit Co. et al., 190 N. Y. Sup., 821.)

OHIO.—Carriers—Injury to Passengers—Contributory Negligence—Instructions.

1. A carrier of passengers is bound to exercise the utmost practicable care and diligence to secure the safety of the passenger, but a duty of reasonable care for his own safety as well rests upon the passenger himself.

2. It is negligence, as matter of law, for a passenger traveling on a rapidly moving railroad car to intentionally and needlessly project his arm, or a part thereof, out of the window of the car.

3. In a suit against an interurban electric railway company for injury to a passenger by reason of his arm being struck by a car passing upon an adjoining track, it is not error for the court to instruct the jury that if they find that there were four iron bars extending horizontally across the window of the car, equally distant from each other, the top one approximately 12 ins. from the window sill, and that plaintiff while sitting in the car permitted his arm, or any part thereof, to extend or project out beyond or over the rods, and that said act directly contributed to the accident, the plaintiff would be guilty of contributory negligence and cannot recover.—(Interurban Ry. & Terminal Co. et al. vs. Hancock, 78 N. E. Rep., 963.)

TEXAS.—Street Railroads—Injuries to Travelers—Care Required—Action—Instruction.

In an action for injuries to a traveler caused by a street car striking his wagon from the rear, an instruction that it was the motorman's duty to use care to look on each side of his car to see that no persons were about to get on the track, and that no conditions or circumstances presented themselves which would evidently compel persons then in his view passing along the street to go on the track in front of the car, was erroneous, as imposing on defendant a greater burden than the law required.—(Metropolitan St. Ry. Co. vs. Kirkpatrick, 94 S. W. Rep., 1092.)

TEXAS.—Carriers—Injury to Passenger—Evidence—Admissibility—Instructions—Contributory Negligence.

1. In an action against a street railway for injuries to a passenger who jumped from a car while riding on the front platform, it was error to permit the conductor and motorman to testify that they had no idea that, if a horse fell down in front of the car, the passenger would bcome frightened and jump off, and that no one had ever told them or said anything to them to make them believe she would do so.

2. In an action against a street railway for injuries to a passenger, evidence that the car was going "very fast" and "mighty fast" was sufficient to render it error to exclude an ordinance limiting the rate of speed of a street car to 7 miles an hour.

3. In an action against a street railway for injuries to a passenger, an instruction that defendant owed the duty "to exercise that high degree of care for the reasonable personal safety of passengers which a prudent person would use," etc., was improper by reason of the use of the word "reasonable."

4. In an action against a street railway for injuries to a passenger who was riding on the front platform, and, becoming frightened, jumped from the car, it was proper to submit to the jury the question of the passenger's contributory negligence in taking a position on the front platform.

5. In an action against a street railway for injuries to a passenger who jumped from a car while riding on the front platform, the court instructed for plaintiff, if the motorman ought reasonably to have anticipated that as a result of his negligence, if any, there was danger of the passengers bcoming so frightened as to jump from the car. In another paragraph the jury were authorized to find for plaintiff, if they found defendant guilty of negligence in maintaining its track in the condition alleged, and if they believed that it ought reasonably to have been anticipated by the defendant that such an injury to some passenger on some of its cars might probably result as a consequence. Another paragraph stated that, if a very prudent and competent person, exercising the degree of care owed by the defendant, could not reasonably have anticipated that an injury to a passenger on a car, occasioned as plaintiff's injury was occasioned, might result as a consequence of such negligence, they should find for defendant. After receiving the charge the jury asked the court whether "reasonable anticipation" referred only to the particular accident or generally to all accidents that might occur to those riding on the front of a car, and whether it referred to both the motorman and management, or to only one and which, to which the court replied that, even though the jury should find that the agents of defendant charged with maintaining the track were negligent, yet, if they further believed that if a very prudent and competent person charged with the same duty and exercising the degree of care owed by defendant could not reasonably have anticipated that, as a result of the negligence, a horse might fall in the street, etc., and a passenger jump from the car, a verdict could not be returned for plaintiff. Held, that the instructions were erroneous as on the weight of the evidence, as giving undue prominence to the fact that defendant must have been able to anticipate the accident before it would be liable, and in that the jury were probably led to believe that, before defendant would be liable, the motorman must have anticipated the precise injury and person to whom it would have happened.—(Moore vs. Northern Texas Traction Co., 95 S. W. Rep., 652.)

VIRGINIA.—Street Railroads—Injuries to Person on Track—Contributory Negligence—Evidence—Sufficiency—Trial—Reopening Case After Close of Evidence.

1. In an action for injuries to one struck by a car while walking on the track, the court instructed that, if persons generally walked on the track at that point it was the duty of defendant to exercise reasonable care to discover persons so using the track, and that if defendant's servants, in the exercise of a proper lookout, failed to observe plaintiff's persistence in remaining on the track, and did not then exercise all reasonable care to avoid an accident, defendant was liable. Held that the instruction was erroneous, because if defendant's servants exercised proper care they had discharged defendant's duty, and it was not liable, though plaintiff's presence was not observed.

2. The court instructed that if the injury was caused by the negligence of defendant's servants and without any greater want of ordinary care and caution on the part of the plaintiff than was reasonably to be expected of him under the circumstances, plaintiff was entitled to recover. Held, that the instruction was erroneous, since if plaintiff failed to exercise that ordinary care and caution to be expected of him under the circumstances, and such want of care contributed to the injury he was not entitled to recover.

3. In an action against a street railway for injuries to one struck by a car while walking on the track in the nighttime, evidence considered, and held insufficient to warrant a finding of a failure of proper care to furnish necessary lights on the car.

4. The evidence for both parties having been closed there was no error in refusing to permit plaintiff to offer witnesses to prove facts concerning his case in chief, where it did not appear that the witnesses had been absent or ill, or that there was any surprise, accident or mistake.—(Wilkie vs. Richmond Traction Co., 54 S. E. Rep., 43.)

WASHINGTON.—Carriers—Injuries to Passenger—Negligence.

Where a person reached the rear platform of a street car, and attempted to board it after the signal to start had been given, and, failing to board, received the injuries complained of, the company was not guilty of negligence, where the conductor was at his proper station, and did not see before the car was started that the person intended to board it.—(Woodman et al. vs. Seattle Electric Co., 85 Pac. Rep., 23.)

WASHINGTON. — Appeal — Instructions — Argumentative Language—Harmless Error—Trial—Weight of Evidence—Damages—Personal Injuries—Future Medical Treatment—Impairment of Mental Faculties.

1. Where, in an action for injuries to a passenger, the jury saw plaintiff, knew his exact condition, heard him testify, etc., defendant was not prejudiced by an argumentative instruction that if a corporation injures a person so as to make him an object of pity to his fellow men and an object of ridicule to the thoughtless and unfeeling, and deprives him of the comfort and companionship of his fellows, defendant should respond in damages, etc.

2. Where a complaint for injuries to a passenger alleged damages for medical services incurred in the sum of $100 and for loss of earnings in the sum of $450, instructions that the jury, if warranted by the evidence, might allow damages to plaintiff for medical services for which he had become liable, or had obligated himself in an amount not exceeding $100, and, if warranted by the evidence, might allow damages for loss of time not exceeding $450, merely limited the recovery to the amount alleged, and were not erroneous as an intimation that there was evidence sufficient to warrant a finding for the amount stated for medical services and loss of earnings.

3. Where a number if not all the physicians testified that it might be, or probably would be, necessary for plaintiff to have further medical treatment, the court was justified in permitting the jury to make an allowance to plaintiff for probable future expenses for necessary medical treatment.

4. Where there was evidence both of a permanent impairment of plaintiff's health and also of an impairment of his mind, evidencing a lack of mental vigor and inability to give intelligent, successful, and conservative attention to his business, which he had never experienced prior to the accident, and evidence that plaintiff might not ever fully recover, it was not error for the court to permit the jury to award damages as for the permanent impairment of plaintiff's mind.—(Cole vs. Seattle R. & S. Ry. Co., 85 Pac. Rep., 3.)

As an inducement to its employees to save money, the Columbus Railway & Light Company this year presented them with pass books on the Ohio Trust Company and the Citizens' Savings Bank, in the way of Christmas presents, $1 being credited upon those of the single and $2 on those of the married men. Accompanying the books was a letter in which it was stated that the company has no desire to impose an obligation upon the men to keep these accounts up, and if they prefer they may present the books and get the money. It is hoped, however, that all will keep them and keep up a savings account.

LONDON LETTER

Two important electric traction events took place in the metropolis last month, one being the opening of the newest underground electric railway and the other the opening of the London County Council tramways across Westminister Bridge and along the embankment to Blackfriars Bridge. The underground line, which has been recently opened, is another of the Yerkes group and is known as the Great Northern, Piccadilly & Brompton Railway. Probably it will soon receive a contracted name in the same way as the Baker Street & Waterloo Railway has been contracted into the "Bakerloo." The route of the new line and its equipment are described elsewhere in this issue.

While on the subject of tunnel railways, it may be of interest to note that there appears to be a strong effort at present to revive interest in the construction of a tunnel between England and France, from Dover to Calais. It is interesting that the scheme is backed on the one hand by the London, Chatham & Dover Railway, so far as the English portion of it is concerned, and by the Chemin de Fer du Nord, and a powerful body of French financiers, on the other. A great deal is at present appearing in the daily press regarding the scheme, which would entail an expenditure of about £16,000,000. There is nothing new in the idea, as it has been promulgated in previous years, but although a good deal of money was spent and some boring done, the plan was ultimately abandoned. Now that the entente cordiale between England and France is so assured, more determined efforts are being made to place the scheme in such a position that Parliamentary powers will be asked for it in an early session. The military fears are ridiculed by the backers of the proposition. Some of the greatest engineers in Great Britain and France are perfectly satisfied that the construction of such a tunnel is quite possible, and with the greatly enhanced experience of boring tunnels during the last twenty years, no insuperable difficulties are expected to occur. Such a tunnel would undoubtedly be extremely useful and would shorten the journey between London and Paris considerably. Baron Emile d'Erlanger, the chairman of the company, is quite confident that not only is the scheme practicable, but that it will be a paying one, and, in fact, figures out a handsome dividend even on the common stock.

It has been decided to make a strong effort to increase the importance and influence of the Tramway and Light Railways Association. Although an attempt at the consolidation of this association with the other two existing associations has proved futile, it is hoped that individual members of the other two associations will join this association. It is proposed to enlarge the membership considerably, and increase the annual subscription to two guineas. New offices have been taken at 35 Parliament Street, Westminster, and Mr. Benedict, who has for several years been the secretary of the association, has now retired in favor of a younger man. The Duke of Argyll has consented to be president of the association in future, and vice-presidents for the ensuing year will be as follows: Lord Vaux, of Harrowden; Lord Armstrong, Sir Joseph Baxter Ellis, Sir J. Clifton-Robinson, Sir Charles Petrie, Sir Charles Rivers-Wilson (past president), L. A. Atherley-Jones, Esq., K. C., M. P. (past president). The association has done considerable useful work in the past, and with the broadening out of its lines and the introduction of these influential men as officers it will undoubtedly enter on a much more useful career.

As stated at the beginning of this letter, the opening of the tramways on the Victoria Embankment has formed another important item in the progress of the London County Council in equipping London with a convenient service of electric tramways. As hinted from time to time in these columns, the battle for permission to run tramways on the Embankment has extended over a period of many years. It was only a few months ago that the Royal consent was given to the scheme which had been passed by the House of Lords and the House of Commons. The first electric car across Westminster Bridge, continuing along the Embankment, performed its triumphant career only a few days ago, or rather a few nights ago, as it was just on the hour of 11 o'clock at night that the special trip was made. John Burns was specially prominent, and he was accompanied by Sir J. W. Benn, Dr. Macnamara, J. Allen Baker, J. Gilbert, Mr. Fell, the tramway manager, and a large party of friends. The trip from the south side of Westminster Bridge to the end of the route on the Embankment and back was successfully performed amidst many congratulations by all present. The system has now been inspected by Colonel Yorke, of the Board of Trade, and the route thrown open to the public.

Already much patronage has been accorded to the new line, though it would appear that without the connecting link of Blackfriars Bridge, which will not be opened for about three years, there are almost too many cars on the Embankment. Without giving the matter very serious consideration one would think that it would not be necessary for the cars which go to the eastern portions of London, such as the Tower Bridge, Woolwich, etc., to come across Westminster Bridge or along the Embankment. No doubt this correction will be made in due time, as undoubtedly the eastern portion of the Embankment does not afford sufficient traffic for all these cars, and a quicker way of getting home can be secured than traveling by this circuitous route. The cars are undoubtedly, however, filling a long-felt want, and when the whole scheme is completed, will prove a huge success so far as convenience for the public is concerned. In the meantime, it is interesting to note that the City Corporation has just granted the contract to Sir Wm. Arrol & Company for the widening of Blackfriars Bridge at the cost of about £200,000. Wm. Arrol & Company are well known as the contractors for the Forth Bridge, the Tay Bridge and the Tower Bridge, as well as many other important engineering structures, so that the work could not be in better hands. The opening of Westminster Bridge and the Embankment will afford tremendous relief at the southern end of Westminster Bridge, where, since the opening of the electric tramways a few years ago, a state of severe congestion has existed. Instead of having to shunt at the end of the bridge, the cars will continue on their way across Westminster Bridge and up the Embankment, so that the dead end of Westminster Bridge will be entirely eliminated. The shunting will, of course, have to be done elsewhere, but on the Embankment, near Blackfriars Bridge, there is ample room for this work. When Blackfriars Bridge is opened, the formation of the circular route will make the work considerably easier. Other work in connection with the London County Council tramways is proceeding apace, and on the northern side the tramways from Clerkenwell to Poplar are almost finished, and many new cars have already been ordered for use on this service when completed. The work in the St. Pancras district will also be commenced before long, although the borough of St. Pancras is putting much trouble in the way of the London County Council by insisting upon the underground conduit instead of the overhead system as proposed by the London County Council.

With regard to the large power scheme of the London County Council, referred to frequently in these columns, there does not appear to be much to add to what has been said already, except the fact that the electric supply bill, which has been prepared by the Parliamentary Committee for introduction to the House of Lords in the next session, has now received the formal approval of the London County Council. One new feature has, however, become apparent, that the bill has been so drafted as to leave it open to the London County Council to decide what to do with these powers when secured, so that the discussion as to whether the Council, should it obtain these powers, should work this tremendous scheme as a whole, or endeavor to augment the facilities, which at present exist, does not now come up. In a few words, the object of the bill is to supply electrical energy in the County of London, in certain parts of Essex, Kent, Surrey and Middlesex; an outlay of four and a half million pounds spread over seven years will be necessary, and the acquisition of the electrical undertakings of the metropolitan borough councils within five years from the passing of the bill, and of the undertakings of the private companies in the year 1931.

This bill, of course, will not go unopposed, as the various private electric supply companies in London have joined issue in the matter, and will promulgate a bill in Parliament themselves to try and secure practically the same rights as asked for by the London County Council bill. The Administrative County Company, whose bill was defeated last year in Parliament, also intends to offer a new bill, but has altered its condition. It is now seeking to secure powers to produce electricity in bulk and to sell to the existing borough councils. The whole subject, therefore, is an extremely interesting one, and it remains to be seen what Parliament will do with it. The solution is undoubtedly difficult, and with the London County Council elections, which take place next year, it seems

almost impossible to know what will be the ultimate result.

Arthur Ellis, electrical engineer and tramways manager of the Cardiff City Council, recently prepared a report on the applications made by private companies for the privilege of running motor omnibuses in Cardiff. Naturally, Mr. Ellis brings strong arguments to bear on the vital importance of preventing outside motor omnibus companies from being granted any privileges for running in the streets of the city, where there are already good tramway facilities. He would not object, however, so much to private companies being permitted to operate on the outside suburbs, provided that they would work in conjunction with the tramway department, and act as feeders to the tramway system. Should the Council not approve of that plan, he suggests that the corporation should buy a limited number of buses to put on certain approved routes in the outlying districts. The Council has the report under consideration, and it is not at all likely that privileges will be granted to outside omnibus companies for the present, except in a very limited degree on the outskirts. As the scheme of providing twelve or fifteen motor omnibuses to be operated by the Council itself involves a considerable sum, it is doubtful whether this plan will be adopted either. The whole thing is interesting, however, as showing the determined attack of motor omnibus companies, and also the opposition of corporation officials to interference with their existing rights.

The Manchester tramways committee has not yet satisfied its men by the revised system of carrying parcels, and objections have been placed before the committee by the general secretary of the tramway men's union. This official writes that it is not fair to cast responsibility for the parcels upon conductors of ordinary tram cars, who certainly have already enough to do. The cars are not made for parcels and at busy hours of the day there is hardly sufficient room for passengers without providing room for parcels. If the parcel delivery business was maintained, punctuality could not be ensured, and it is easy to imagine that parcels left on the platform could easily be lost, damaged or stolen while the conductor was collecting fares on the top of the car. He maintained that the proper method of handling a parcels carrying system would be by having special cars for the purpose managed by special men. The subject is still under consideration by the committee.

The Birmingham Corporation has now opened another of its electric tramway routes, which has been constructed for some time. This route commences in Albert Square and proceeds to Bordesley Green. It is about 2½ miles long. The contractors for the new line were Sir John Aird & Company, and for the overhead equipment, Dick, Kerr & Company.

At the last half-yearly meeting of the London & North-Western Railway brief details were given of the new electric line, which this company proposes to construct from Euston to Watford. A Parliamentary notice is now published of a bill for next session to enable the company to carry out this and other works. Starting from beneath the present terminus at Euston, the new railway will run below the existing main line until open country is reached at Kilburn, and for the remainder of the distance will be formed partly by widening the existing way and partly by the construction of an independent route alongside. The total distance will be about 16 miles. The trains on the new railway are doubtless expected to yield a return sufficient to pay interest on the capital expended, but quite as important is the fact that the main line will be freed from suburban and local traffic, and can be wholly devoted to long-distance trains, whether passenger, goods, or mineral.

A scheme for the electrification of the Central Railway has been suggested to the Isle of Wight County Council. In a report to the Council the Parliamentary and railway committee, which had under consideration the proposal that the Council should acquire and work the railways, urged that any plan which would be calculated to improve the existing state of affairs as regarded the railways should receive every support.

At a recent meeting of the tramways committee of the Newcastle Corporation, a discussion took place regarding the system adopted since the inauguration of the tramways of dividing amongst the tramway employees the proceeds of the annual sale of articles left in tramcars. It was ultimately decided to put a stop to the practice, and further discussion will take place to decide what shall be done with the money realized.

The possibilities of a through service of tramcars between Leeds and Bradford have, it is thought, been brought nearer realization by an invention of Mr. Spencer, the manager of the Bradford Tramways, and Dr. Dawson, assistant engineer. The invention is an extensible axle truck, and it is claimed for it that it overcomes the difficulty caused by the different gages of the rails of the Leeds and Bradford systems. A trial truck has been fitted at the Thornbury Tramway works, where a special track has been laid down for trial runs. Here the 4-ft. rails of the Bradford tramways are gradually extended until each rail is moved outward 4¼ ins. and the track thus becomes the 4-ft. 8½-in. gage of the Leeds tramways. This changing from 4 ft. to 4 ft. 8½ ins. is effected in a distance of about three yards in the trial track in the sheds, and the truck runs over it in an extremely easy and smooth fashion.

Leyton recently inaugurated an important system of municipal electric tramways, the total amount expended on which is £300,000, of which nearly one-third went towards purchasing the rights of the two tramway companies in the district. Arrangements have been made for inter-communication with the West Ham tramway, and the effect of this will be that people will be able to board a train at Bow Bridge, which is the eastern extremity of the metropolis, and ride direct to Clapton and the fringe of Epping Forest. When linked up with the Waltham-Finsbury Park and new Southgate.

Sir Francis Cory-Wright, chairman of the light railways committee of the Middlesex County Council, recently opened the new electric tramway from Wood-Green to New Southgate by driving the first car over a portion of the route. Representatives of the county and local authorities were present. Wood-Green has now direct tramway communication with Tottenham, Finsbury Park and new Southgate; and the Enfield line is being laid.

It is rumored that the Liverpool overhead railway will probably be absorbed before long by the Lancashire & Yorkshire Railway Company. The company dates from 1888, when it was incorporated to construct the overhead railway authorized by the Mersey Docks and Harbor Board Acts, and further extensions were authorized four years later, the railway now being worked by electricity. Never a very great financial success, the severe competition of the Liverpool Corporation Tramways has gradually reduced its earning powers till for the past two years no dividend has been paid on the common stock.

A. C. S.

WAGE INCREASE ON P. S. C.

Announcement was made last week of the general increase in the wages of the motormen and conductors in the employ of the Public Service Corporation of New Jersey, the increase to date from Jan. 1. A general circular, issued over the signatures of President McCarter and General Superintendent Stanley, announced the change. This circular follows:

North Jersey Street Railway Company; Jersey City, Hoboken & Paterson Street Railway Company; Public Service Corporation of New Jersey (lessee).

Office of the General Superintendent.

Bulletin Order No. 1358.

December 27, 1906.

To Motormen and Conductors:

The board of directors has this date authorized the following rates of wages for motormen and conductors, to take effect Jan. 1, 1907:

Grade 1. Motormen and conductors who have been continuously in the service over ten (10) years will receive twenty-three (23) cents per hour.

Grade 2. Motormen and conductors who have been continuously in the service five (5) years and up to ten (10) years will receive twenty-two (22) cents per hour.

Grade 3. Motormen and conductors who have been continuously in the service one (1) year and up to five (5) years will receive twenty-one (21) cents per hour.

Grade 4. Motormen and conductors in service up to one (1) year will receive twenty (20) cents per hour.

This increase is made with the belief that this substantial way of recognizing meritorious service will result in motormen and conductors using their best endeavors to perform their duties toward the public and the company courteously, honestly and efficiently, and that the best possible class of labor will be encouraged to enter and remain in the service.

Approved:

(Signed) Thos. N. McCarter, President.

(Signed) Albert H. Stanley, General Superintendent.

SOUTHERN PACIFIC ELECTRICAL PLANS

General Manager Calvin, of the Southern Pacific Company, has given out the following statement concerning the proposed electrical work on the east side of San Francisco Bay: "The contracts have been let for the electrification of the local roads to the Fourteenth Street terminal in Oakland from the end of the Alameda Mole, and also to the High Street terminal in Alameda and the present terminal at Melrose, and for the construction of an electric power house in the triangle formed by the parting of the Alameda and the Oakland and Melrose tracks at Alameda Point, where the round-house and turntable are now standing. It is our intention to change the Seventh Street local and the other local lines from the Oakland pier, so as to also be operated by electric power, as soon as we get through with the electrization of the local system starting from the Alameda Mole. The contracts which we have given out for the latter purpose involve an expenditure of $1,881,600. The cars are being constructed in the East. Everything is being rushed to a finish, and as soon as the equipment is ready for service these lines will be operated exclusively by electric power.

"We expect that the new lines will be in operation in July or at the latest in August next. The tracks now used by steam traction will be used by trains propelled by electric motive power. The report that the Webster Street track in this city would be abandoned from Second to Fourteenth Street and diverted on Franklin Street, is incorrect. All that needs to be changed on the present Webster Street track is the bonding of the rails to fit them for electric operation, and a large part of that has already been done for the operation of the block signal system now in use. Our plans regarding the future use of the terminal property at Fourteenth Street and Franklin have not yet been completed, and it would be premature to say anything about them, for we do not desire in any of the changes anticipated to be made to misinform and mislead the public. As to the reports that we intend to extend the electric railway system along Franklin to Twentieth Street, I may say that it is premature. Nothing has been yet decided about the extension of the system from Franklin and Fourteenth."

The Southern Pacific Company has filed an application with the War Department for permission to widen the Oakland Mole from its present area of 50 acres, by making a fill, which will increase the surface area by 27 additional acres. This application has been sent by the authorities at Washington to the United States Harbor Line Board, at San Francisco, for a report on its advisability. Maj. William Hart, of the engineer corps, has called a meeting, to be held Jan. 8, at the rooms of the California Promotion Committee, for the public consideration of this application. Some time ago the Key Route people made a request to the War Department for permission to build a mole and fill in a large tract on the water front for the construction of an extensive mole and basin for foreign ships. This application was denied on the ground that the proposed fill would interfere with the tidal currents, but permission was granted to the Key Route people to build a mole and ship basin on concrete piers, and that company will proceed with the construction on these lines.

OHIO QUESTIONS SETTLED BY RAILROAD COMMISSION AND COURTS

Two rulings by the Ohio Railroad Commission and a decision by the Ohio Supreme Court have set at rest questions that have frequently bothered traffic and operating officials of the electric railway systems of the State. The rulings of the Railway Commission are the outgrowth of the recent informal conference held by the Commission with the executive heads of the Ohio traction lines.

At this meeting the Commission was asked if the law relative to the issuance of special rates and free transportation was applicable to interurban roads as well as steam roads, and the Commission replied that it was. The commission was then requested to make a ruling on this subject that would serve to relieve the traction officials of embarrassment, when they are called upon to refuse free transportation. One of the rulings just announced is in response to this request.

It states specifically that the law relating to the issuance of special rates and free transportation, governs all classes of railroads, electric as well as steam, and fines for the violation of these provisions can reach as high as $10,000 for each case. The ruling also requires the traction lines of the State to file a report with the Commission by the first Monday in February of each year, showing all passes, mileage books and transportation issued at other than regular rates.

This ruling will assist many of the electric lines of the State to drop a large free list. These lists include many passes that were issued incident to the promotion and construction of the various roads, and the officials have been unable to annul them. In the future the traction lines will not be able to furnish transportation legally to any but those designated in the law as follows: Employees and their dependents, officials of the companies and their families, officials of other railroad companies in exchange for like favors, ministers of the gospel, agents of incorporated colleges and charitable societies, when traveling on the business of such colleges or societies, destitute and homeless persons and for an attendant in the case of live stock shipments.

The other ruling of the commission was on a question, also discussed at the conference with the traction officials, relating to the proper caution to be taken by traction companies at steam road crossings. The order requires that all cars must be stopped at least 10 ft., and not more than 50 ft., from the crossings, while the conductor or some other trainman goes ahead and makes sure the track is clear. The conductor or trainman is ordered to make certain that all is right before he signals the car to go ahead. The managements of the traction companies are directed to see that this order is rigidly obeyed, and to have printed copies of it conspicuously displayed in every car.

During the discussion of this question at the conference it was discovered that widely divergent rules on this subject were in effect on the various roads of the State, and it was deemed advisable to have a uniform rule governing this vital feature of operation. The rules of some roads required the stops to be made 100 ft. from the crossing, others designated 50 ft., while still others designated no distance at all, leaving that to the judgment of the men in operation of the cars. The Commission holds that 100 ft. is too far away to stop, as a clear track could easily be obstructed while the car was making the distance. On the other hand, it holds that the car should stop at least 10 ft. from the crossing. Before issuing the above order the members of the Commission personally investigated the working of the rules in effect by watching various crossings at Dayton and other points. They all said they found the rules, if any existed, obeyed in a very lax manner.

The decision of the Supreme Court of Ohio was that interurban roads, whose franchises provide for the sale of round-trip tickets, must sell round-trip tickets on the cars as well as at the stations. The decision was in the case brought by the prosecuting attorney of Stark County against the Canton-Akron Traction Company, which decided some time ago to withdraw from sale on cars all round-trip tickets, and confine such sales to the ticket offices of the company.

NEW ENGLAND STREET RAILWAY CLUB MEETING

Railway signaling was the subject of a paper by Jacob B. Struble, of the Union Switch & Signal Company, at the regular meeting of the New England Street Railway Club on Dec. 27. The larger part of the paper was given to a comprehensive discussion of various systems of manual and block signals as used on steam railroads. President Paul Winsor presided. Mr. Struble described the types of signal mechanism now in use in a broad way, and summarized the important features of semaphors, disc, telegraph block, controlled manual, home, distant and automatic signal practice. The upward inclination of the semaphore arm is being favored by some engineers instead of the downward slant for the safety indication. The track circuit automatic block system is probably the best, all things considered, and with alternating-current differential coils in the track circuit, the two rails can both be used to carry return currents back to the power house. The staff system has a valuable field of usefulness on single tracks where the traffic is not too heavy.

Mr. Struble stated that although many able minds are at work on the problem of signaling for electric interurban railways, an entirely satisfactory system has, in his judgment, not yet been developed. The conditions are so varied with respect to intervals and movements in each direction that it is hard to meet all the requirements and to be sure of positive indications in counting cars in and out of a block. A short discussion favorable to the general use of signals was held at the conclusion of the paper.

CONVENTION OF THE INDIANA ENGINEERING SOCIETY

The final plans are being made for the convention of the Indiana Engineering Society, to be held on Thursday, Friday and Saturday, Jan. 17, 18 and 19, in Indianapolis. The full program of the meeting, however, has not been arranged. The part of it that is now available includes among its papers the following of interest to street railway companies: "Paving Between Street Car Tracks and Rails," by B. T. Jeup, civil engineer, Indianapolis; "Interurban Railway Engineering," by R. P. Woods, chief engineer of the Indianapolis & Western Railway; "Advantages of Electrical Inspection," by R. F. Daniel, chief city inspector for the insurance organizations; "Electric Car Braking," by Prof. R. T. Plumb, Perdue University. Prof. W. F. M. Goss, of Perdue University, also has promised a paper, but the subject of it has not been given out. The social features of the convention include a banquet, smoker and entertainment tendered to the out-of-town members by those resident in Indianapolis, also an excursion to points of interest if time can be found for it on the program. The banquet will be given the first evening of the convention. The society includes among its members civil, mechanical, electrical, mining and chemical engineers in all their various sub-divisions. Charles Carroll Brown, 408 Commercial Club Building, Indianapolis, Ind., is secretary of the society.

TRANSIT AFFAIRS IN NEW YORK

John B. McDonald, the contractor for the New York subway, has submitted to the Rapid Transit Commission a plan for a loop to connect the Brooklyn, Williamsburg and Manhattan bridges and land passengers from Brooklyn in the financial district by running a two-track subway down Nassau Street to Water Street. In submitting the plan Mr. McDonald said he would guarantee that it would prove to be a thoroughly practical operating system. He said that it would cost about $10,000,000, and would obviate the necessity of building one of the longer routes. He said that it would take the place of one of the routes the building of which would cost about $25,000,000. It is understood that the Belmont interests are backing Mr. McDonald. Controller Metz objected to the route because in going from Bedford and Flushing Avenues, it crosses in a straight line to the Williamsburg Bridge Plaza, cutting diagonally through residence streets in old Williamsburg. He has asked that the route be changed so as to take it down Bedford Avenue to Division Street, following streets instead of cutting through private property. Mr. McDonald said that the new subway to Brooklyn would carry not more than 20,000 passengers an hour. That, he said, was about the capacity of any two-track system, and that was about what his proposed new two-track loop system would do. Chief Engineer Rice said that probably 85 per cent of the Brooklynites who came to Manhattan did not go above Fourteenth Street, and he thought that the new loop plan would carry a very large traffic.

The important announcement was made last week that the city authorities and the officials of the Pennsylvania Railroad have come to an agreement as to the terms for the franchise to be granted to the Connecting Railroad, this after three and one-half years of discussion. When the company found its progress blocked by the refusal of the Board of Aldermen to grant the franchise except on impossible conditions, the Pennsylvania publicly announced its desire to obtain a fair hearing by legislation taking the franchise-granting power from the Aldermen and placing it in the hands of the Board of Estimate. On Nov. 16 of last year, after the new legislation had become effective, the company renewed its application before the Rapid Transit Commission, accompanying it, as usual, with voluminous accounts of its plans, together with maps, drawings, etc. On March 1 of this year the plans and contract committee made a report of a form of franchise, under which a flat payment of $100,000 was to be made to the city, together with annual payments of $25,000 for ten years and $50,000 for the next fifteen years. At the end of the twenty-five years the rate of the compensation to the city was to be readjusted. Under other clauses of this proposal the company agreed to assume every charge of any nature arising from the carrying out of its plans, thus relieving the city of all expense. The company felt then, and publicly stated, that the annual rates were too high in view of the great benefit the building of the road would indirectly confer upon the city, and the risk to the company in its undertaking.

The preparatory work, including the permit from the United States Government to build a bridge to span both the Harlem and East River, and the legislative permit to cross Ward's and Randall's Islands, and the purchase of $2,000,000 of private property for right of way, have all been completed, and plans and specifications are soon to be ready for bidders. The completion of the work will bring Brooklyn and Queens, by way of Greenville and Bay Ridge, and the car ferry between those points, and by means of the bridge over Ward's and Randall's Islands, in direct communication with all parts of the West and South.

Joseph H. Hoadley, former president of the Manhattan Transit Company, has taken title to the property on the northwest corner of Beekman and Water Streets, New York, and announced his intention of turning it over to the Manhattan Transit Company. This gave rise to a report that the company would bid for the right to build and operate the Fourth Avenue (Brooklyn) subway to Fort Hamilton, part of one of the seven routes approved by the Rapid Transit Commissioners and the Board of Estimate. This report Mr. Sheehan later confirmed. In addition to planning the construction of the Fourth Avenue subway the Manhattan Company, according to Mr. Sheehan, is in the field to construct a tunnel under the East River.

IMPORTANT ELECTRIC PROJECTS IN JAPAN OFFER OPPORTUNITIES TO AMERICANS

The early construction of three electric tramways in the northern portion of the Japanese island of Kyushu is under contemplation. The first, to be built from Moji to Kokura, a distance of 8 miles, estimated cost $350,000; the second, from Moji to Yawata, 12 miles in length, at a cost of $500,000, and the third, one of 23 miles, between the important towns of Fukuoka and Kokura, at an estimated cost of $1,250,000 gold. Consul C. B. Harris, of Nagasaki, suggests that American electric and railway supply houses send their catalogues, in the English language, to the Mayor and Chamber of Commerce of the cities of Nagasaki, Moji, Fukuoka, Kokura and Kumamoto, with the request that the catalogues be handed to the projectors of the lines under contemplation.

THE QUESTION OF T-RAILS AT COLUMBUS, OHIO

The question of whether the interurban railway systems entering Columbus, Ohio, shall be allowed to lay T-rails in the city, or be compelled to put up with the grooved rails, will probably be settled in the courts. This is a result of a controversy caused by an attempt on the part of the city engineer to compel the Indiana, Columbus & Eastern Traction Company to replace its T-rails on McDowell Street, an unimproved street, with grooved rails so that the city can proceed with a paving contract.

The matter was threshed out in two open meetings before the Board of Public Service, in which the railway interests were represented by several business and improvement associations of the city and J. L. Adams, general manager of the Western division of the Indiana, Columbus & Eastern, and the advocates of the grooved rail by City Civil Engineer Maetzel and Frederick L. Ford, city engineer of Hartford, Conn., in which city the subject of T-rails was considered in connection with a request for rights from the Consolidated Railway Company. At the close of the second meeting, Mr. Adams handed a written statement to the secretary of the Board of Public Service, which announced that his company refused absolutely to replace the T-rails on McDowell Street with grooved rails.

Fast limited passenger service from Zanesville to Indianapolis has been planned by the Indiana, Columbus & Eastern Company, and to make such a service safe the company will have to put on heavier cars with the standard depth of flange on the wheels, and these flanges cannot be operated over grooved rails. Thus the T-rail controversy is not only an important one to the city of Columbus, but effects improvements and the character of passenger and freight service all over the Schoepf system in Indiana and Ohio.

The company not only agrees to do its part in improving and paving the streets and putting in the special paving blocks next to the T-rail, but is willing to put up a terminal passenger station and make other improvements in Columbus, if its plans are not blocked by the city insisting on the grooved rail.

THE BOSTON TERMINUS OF THE CAMBRIDGE SUBWAY

One of the most important problems at present before the Boston Transit Commission is the determination of the Boston terminus of the new subway to be built soon in Cambridge. It is no easy matter to locate rapid transit routes in any large city, for, however well present needs may be determined, the requirements of the future are always more or less hidden by the uncertainties of urban development. Even larger interests must be taken into account than the immediate desires of operating railway companies and the supposed interests of the populations served. Problems of real estate valuation and depreciation, the concentration of business in the vicinity of important stations, and, above all, the relation of projected to both present and remote future routes must all be considered with great care. Points already favored by an overwhelming traffic are the very ones which every new line or transit desires to reach.

At a hearing recently held by the Boston Transit Commission a strong sentiment was shown in favor of terminating the Boston route of the Cambridge subway at the present Park Street station of the Tremont Street subway, instead of at Scolloy Square as previously suggested. Both the public and the Boston Elevated Railway Company favored the Park Street terminus. The precise route to be followed from the new West Boston Bridge to the present subway depends considerably upon the terminus selected, but the end of the route is the vital point at issue just now. All indications point to the continued use of the Park Street station as one of the principal traffic centers of the city. Traffic at Scolloy Square is now almost as dense as at Park Street during certain hours of the day; this station is nearest the financial district, and is the western terminus of the East Boston tunnel, but there is little evidence that the great majority of Cambridge passengers prefer to enter and leave their trains at any other point than Park Street. The original idea of operating through cars between East Boston and Cambridge via the East Boston tunnel, Scolloy Square and the Cambridge subway, seems to have been set aside as failing to meet any large public desire for transit. The termination of the Cambridge subway at Park Street, presumably in a sub-subway or parallel subway station, with a deep tunnel connection under Beacon Hill with the West Boston Bridge, appears to meet the situation, present and future, better than the old plans. It should be a much less expensive terminus beneath the Common at Park Street than beneath the business blocks and narrow streets adjoining Scolloy Square. The two proposed terminals are but 5 minutes' walk apart, but if the pressure of public need and desires is duly regarded in the light of possible future routes, the Transit Commission will probably decide most wisely if it settles upon Park Street as the terminus of the new Cambridge service.

EXECUTIVE COMMITTEE MEETING OF MANUFACTURERS' ASSOCIATION

A meeting of the executive committee of the American Street and Interurban Railway Manufacturers' Association was held Dec. 28, at 114 Liberty Street, New York City. Those present were Messrs. McGraw, Wharton, Hequembourg, Williams, Wilson, Martin, Garland (representing Mr. King), Evans, Heulings (representing Mr. Brill), Randall, Knickerbocker, Ellicott and Treasurer Baker. The treasurer rendered his report, which showed a balance in the treasury of $4,049. Upon motion, Mr. Baker was tendered a vote of thanks for his administration of the affairs of the association, and the secretary was instructed to draw a letter to be sent to Mr. Baker, expressing the appreciation of the association for his valuable services. The president then announced that a formal release had been received from all liability in connection with the buildings at the State Fair Grounds at Columbus.

In the election of officers a nominating committee of three, consisting of Messrs. Randall, Knickerbocker and Martin, chairman, was appointed. This committee reported that it had taken a canvass of the members present and reported: James H. McGraw for president, F. C. Randall for vice-president, J. R. Ellicott for treasurer. These gentlemen were unanimously elected to these offices. C. C. Pierce, of Boston, was then unanimously elected chairman of the entertainment committee, and George Keegan was re-elected secretary. An auditing committee of three, consisting of Messrs. Evans, Chairman; Randall and McGraw, was appointed to audit the accounts for 1907.

NEW PUBLICATIONS

Was Sind und Wie Entstehen Entfindungen? (What are Inventions and How do they Originate?) A study in evolution, by Josef Löwy, engineer. Published by A. Hartleben, Vienna and Leipzig. 18 pages. Price, 1 mark ($.25).

In these days when the once revolutionary theories of Darwin and Spencer have become almost commonplace, it is not surprising that the touchstone of evolution should be applied to so many arts and sciences. While the field of invention is one which at first sight does not seem to lend itself to such analysis, the author demonstrates that the art of invention is no exception to the rule. As an official of the Austrian patent office Mr. Löwy writes with authority on the subject. Despite the briefness of his booklet, he cites so many authorities and instances to prove his point that one leaves convinced that there is something more to invention than happy accidents. It cannot be claimed that a perusal of this work will help the reader to become an inventor, but it should do much good in deterring the ignorant experimenter from spending time and money before knowing the technical and commercial state of his field.

THE ANNUAL MEETING OF THE CENTRAL ELECTRIC RAILWAY ASSOCIATION

As previously announced in the STREET RAILWAY JOURNAL the annual meeting and election of officers, together with the first annual dinner of the Central Electric Railway Association, will be held Thursday, Jan. 24, at the Claypool Hotel, Indianapolis. According to the detail program just announced, the business meeting and election of officers of the association will take place at the morning session at 10:30 o'clock. The following subjects will be discussed at the afternoon session: "Cost of Power for Rental Purposes." "Developing a Demand for Renting Power. Does it Pay?" "The Model Car for Long Travel." "Car Lighting." "Handling of Accidents and Claims."

A special feature will be made of the after-dinner program, many gentlemen high in the electrical world have been invited to attend together with gentlemen prominent in public life, and under the efficient direction of the toastmaster, Charles L. Henry, this portion of the meeting will be very elaborate.

The tickets for the dinner will be $2.50 a piece, and each member of the association is at liberty to bring as many friends as he desires. It has been decided not to admit ladies to the dinner this year; also evening dress is not compulsory. The dinner will be served at 6:30 p. m., and that the committee may not be handicapped in any way and also that satisfactory arrangements may be made with the hotel people, it is requested that those planning to attend communicate with the secretary, at Indianapolis, on or before Jan. 15, regarding the number of tickets desired.

STREET RAILWAY PATENTS

[This department is conducted by Rosenbaum & Stockbridge, patent attorneys, 140 Nassau Street, New York.]

UNITED STATES PATENTS ISSUED DEC. 25, 1906

839,184. Railway Track Construction; Henry B. Nichols and George B. Taylor, Philadelphia, Pa. App. filed March 2, 1906. A rail support comprising a pair of cross-bonded channel irons, having a concrete filling, and short ties resting upon the concrete but secured to the channels.

839,216. Circuit-Closing Mechanism; Thomas W. Small, Cleveland, Ohio. App. filed May 17, 1905. A circuit-closing device, mounted adjacent the trolley wire, closes the circuit to signal mechanism within the car through insulated knobs on the arms of the harp, from which insulated wires lead through the trolley pole to said signals.

839,238. Extension Car Step; Edwin T. Wade, Magee, Miss. App. filed Aug. 17, 1906. A folding supplemental car step.

839,282. Curtain for Vestibule Cars; William H. Forsyth, Chicago, Ill. App. filed Oct. 15, 1906. A spring-actuated vesti-

bule curtain having a handle and catch and anti-friction means therebetween.

839,365. Protective Device for Signal Systems; Fred B. Corey, Schenectady, N. Y. App, filed Aug. 1, 1904. A cut-out magnet is operated by an excessive flow of current due to potential fluctuations in the track relays to prevent injury to said relays.

839,366. Air-Brake System; Fred B. Corey, Schenectady, N. Y. App. filed June 5, 1905. Consists in the combination with a straight air-brake system of a second train-line normally carrying air at reservoir-pressure, reservoirs on the several cars connected to this train line, pilot valves connected to and supplied with reservoir-pressure and arranged to operate when the reservoir-pressure falls below a predetermined amount, and a valve controlled by the pilot valve and arranged to disconnect brake cylinder from one train line and reservoir from the other and to connect reservoir and brake cylinder to each other.

839,505. Engineer's Alarm; Edward McClintock, Merriam Park, Minn. App. filed Sept, 20, 1905. Special trolleys are arranged adjacent to the usual track rails and circuits for various signal purposes are established in the locomotive cab.

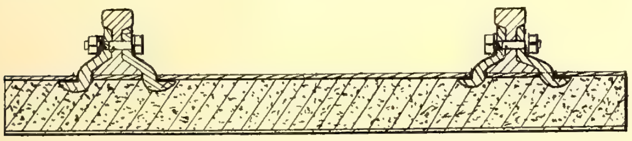
839,525. Railway Signaling System; Louis H. Thullen, Edgewood Park, Pa. App. filed Jan. 4, 1904. A signal system in which the track rails are energized by transformers which are interconnected in a special way so as to secure overlap signal features.

839,526. Trolley-Pole Head; William J. Wagner, East Bradford, Pa. App. filed Oct. 28, 1905. Opposing clamping members adapted to engage yieldably each other to embrace the trolley wire both in front and behind the trolley wheel, said clamping members having flaring ends whereby brackets and circuit breakers may be readily passed.

839,549. Railway Signal; Aricola L. Carpenter, Mount Vernon, N. Y. App. filed Sept. 19, 1905. An electro-pneumatic railroad signaling apparatus in which a piston is normally prevented from movement to close a circuit by the pressure of air in a chamber and a valve adjacent to the track rails is depressed by the car wheels to release the air from the chamber and close an alarm circuit.

839,601. Car Truck; Peter M. Kling, Allegheny, Pa. App. filed March 20, 1906. A car truck having an elliptic spring support consisting in part of four double elliptic springs diagonally arranged, so as to provide for the lateral and longitudinal swinging motion existing in six-wheel trucks.

839,630. Fare Register and Recorder; Wilfred I. Ohmer, Dayton, Ohio; John W. Hill, Providence, R. I.; David B. Whistler and John E. McAllister, Dayton, Ohio. App. filed May 24, 1906. Relates to improvements in a prior patent providing means whereby a complete record of each trip, including six different classes of fares is made, and a complete record of the total trips.



PATENT NO. 839,731

839,730. Frame or Reinforcement for Concrete Railroad Sleepers; Pierre Chaudy, Paris, France. App. filed Sept. 8, 1905. A metal framework designed to reinforce concrete.

839,731. Railroad Construction; John M. Collins, South Pittsburg, Tenn. App. filed April 27, 1906. Relates to means for securing the rails to a concrete-filled metallic tie.

PERSONAL MENTION

MR. N. P. YEATMAN, for fifteen years secretary of the Nashville Railway & Light Company, is dead.

MR. J. S. PAUL, of Sharon, Pa., has been appointed general superintendent of all the lines of the Mahoning & Shenango Traction Company, with headquarters at Youngstown, Ohio.

MR. WINTHROP B. NYE, general superintendent of the Ray system of street railways, which has been purchased by the New York, New Haven & Hartford Railroad, severed his connection with the system on Dec. 31 to enter the employ of Mr. Joseph Gordon Ray, former general manager of the Ray system, as private secretary.

MR. J. T. HARMER has been appointed controller of the Worcester & Blackstone Valley Street Railway Company, Worcester & Southbridge Street Railway Company, Western Massachusetts Street Railway Company, Hartford & Worcester Street Railway Company, Berkshire Street Railway Company, Woronoco Street Railway Company, with office in Boston, Mass.

MR. J. D. COLEMAN, secretary of the H. G. Vogel Company, was the guest of honor at a dinner given by the employees of the company Thursday evening, Dec. 20, in New York. During the evening Mr. Coleman was presented with a gold watch fob, which is an exact reproduction in minature of an automatic fire sprinkler. The fob was a gift from the employees as a slight token of their appreciation.

MR. J. E. SEWELL has been appointed general manager of the properties operated by the Connecticut Railway & Lighting Company, which were taken over by the New York, New Haven & Hartford Railroad on Dec. 20. Mr. Sewell was in charge of the properties under the former owners. These properties will hereafter be operated under the title, "Lessees, Connecticut Railway & Lighting Company," and Mr. Sewell's headquarters will be in Waterbury.

MR. A. GABOURY has been appointed superintendent of the Montreal Street Railway and operating lines. Mr. Gaboury has been practically in charge of the department since last May, owing to the serious illness of the late Mr. Trudeau. Mr. Gaboury entered the service of the company as a conductor. In 1901 he was appointed assistant inspector, which was the occasion of the visit of the Duke of York to Montreal. In the same year he was put in charge of the Cote Street sheds and later he was named chief clerk of the St. Denis Street shops. On the return of Manager McDonald from Paris, in 1903, Mr. Gaboury was appointed claim agent. When last May the late Superintendent Trudeau had to retire, Mr. Gadboury was appointed assistant.

MR. S. L. RHOADES has resigned as general claim agent of the Philadelphia Rapid Transit Company, of Philadelphia, Pa., to become general supervisor of claims of the Casualty Company of America, with offices in New York. Mr. Rhoades is a native of Philadelphia and has been associated with railway claim departments since 1888. His first railway experience was in the claim departments of the West Chicago Street Railway Company and the West End Company, of Boston. Later he became connected with the claim department of the Philadelphia Rapid Transit Company, first as an investigator, later as an adjuster, then as assistant claim agent, and finally as claim agent. Mr. Rhoades is especially well known as the president of the American Association of Street Railway Claim Agents. He will be succeeded in the Philadelphia Rapid Transit Company by Mr. Harry G. Goshorn, now assistant general claim agent of the company.

MR. EDWARD G. BUCKLAND has been elected vice-president of the New York, New Haven & Hartford Railroad, and vice-president of the Rhode Island Company, and will make his headquarters in Providence. In his new position he will have direct charge of all of the Consolidated's interests in this section, including the newly acquired electric railway systems as well as the steam road. Mr. Buckland was born near Buffalo, N. Y., and graduated at Washburn College in 1887. He came from the West in 1889, and was with the law firm of Townsend & Watrous, of New Haven. When Mr. Townsend was appointed United States circuit judge for the District of Connecticut the firm name was changed to Watrous & Buckland. During this time Mr. Buckland was professor of law in the Yale Law School. President Clark, of the New York, New Haven & Hartford, appointed Mr. Buckland Rhode Island representative of the company in 1898. After Mr. Clark's retirement from the presidency Mr. Buckland held the position during the administration of Mr. John Hall, and when Mr. Charles S. Mellen was elected president Mr. Buckland's record for energy, capacity and tact led to his transfer to a wider field in New Haven.

TABLE OF OPERATING STATISTICS

Notice.—These statistics will be carefully revised from month to month, upon information received from the companies direct, or from official sources. The table should be used in connection with our Financial Supplement "American Street Railway Investments," which contains the annual operating reports to the ends of the various financial years. Similar statistics in regard to roads not reporting are solicited by the editors. * Including taxes. † Deficit.

Company.	Period.	Total Gross Earnings.	Operating Expenses.	Net Earnings.	Deductions From Income.	Net Income, Amount Available for Dividends.
AKRON, O.	1 m., Oct., '06	134,890	80,054	54,836	39,548	15,288
Northern Ohio Tr. &	1 " " '05	130,081	82,327	47,753	39,197	8,557
Light Co.	10 " " '06	905,286	489,306	415,979	243,918	172,061
	10 " " '05	846,595	463,336	383,258	246,500	136,759
BINGHAMTON, N. Y.	1 m., Oct., '06	21,969	13,878	8,091	7,707	384
Binghamton Railway	1 " " '05	22,728	12,262	10,467	7,282	3,185
Co.	4 " " '06	116,844	57,584	59,260	30,845	28,415
	4 " " '05	110,583	51,978	58,605	28,847	29,758
CHARLESTON, S. C.	1 m., Nov., '06	56,774	34,722	22,053	13,017	9,036
Charleston Consolidated	1 " " '05	53,549	30,489	23,060	13,167	9,893
Ry., Gas & Elec.	9 " " '06	488,933	303,725	185,209	117,000	68,209
Co.	9 " " '05	456,061	271,519	184,542	118,050	66,492
CHICAGO, ILL.	1 m., Oct., '06	109,738	59,154	50,584	26,158	24,425
Aurora Elgin & Chi-	1 " " '05	100,948	53,907	47,041	24,450	22,591
cago Ry. Co.	4 " " '06	502,821	250,070	252,750	100,809	151,941
	4 " " '05	451,656	222,086	229,570	97,743	131,827
Chicago & Milwaukee	1 m., Nov., '06	81,143	39,905	41,238	......	......
Elec. R.R. Co.	1 " " '05	54,400	24,480	29,920	......	......
	11 " " '06	803,591	333,285	470,306	......	......
	11 " " '05	528,291	220,353	307,938	......	......
CLEVELAND, O.	1 m., Oct., '06	22,916	*12,848	10,068	......	......
Cleveland, Painesville	1 " " '05	21,872	*12,183	9,688	......	......
& Eastern R.R. Co.	10 " " '06	230,553	*123,203	107,350	......	......
	10 " " '05	207,190	*119,196	87,995	......	......
Cleveland & South-	1 m., Nov., '06	54,286	30,532	23,754	......	......
western Traction Co	1 " " '05	46,254	25,900	20,354	......	......
	11 " " '06	593,419	334,962	258,458	......	......
	11 " " '05	495,687	287,706	207,981	......	......
Lake Shore Electric	1 m., Oct., '06	69,730	*39,174	30,556	20,450	10,106
	1 " " '05	71,141	*41,118	30,022	20,404	9,618
	10 " " '06	734,536	*400,903	333,633	204,203	129,429
	10 " " '05	660,209	*359,838	300,372	204,042	96,330
DALLAS, TEX.	1 m., Oct., '06	118,324	*75,070	43,254	15,858	27,396
Dallas Elec. Corp'n.	1 " " '05	88,601	*51,463	37,138	15,378	21,760
	12 " " '06	1,040,463	*662,385	378,078	183,406	194,673
	12 " " '05	881,115	*553,556	327,559	182,781	144,778
DAVENPORT, IA.	1 m., Oct., '06	143,434	85,182	58,252	28,087	30,165
Tri-City Railway &	1 " " '05	120,179	80,954	39,225	......	......
Lt. Co.	7 " " '06	946,900	574,389	372,511	173,511	198,999
	7 " " '05	829,465	532,655	296,810	......	......
DETROIT, MICH.	1 m., Nov., '06	458,582	*315,693	142,889	95,721	47,168
Detroit United Ry.	1 " " '05	419,299	*247,426	171,873	93,023	78,850
	11 " " '06	5,322,235	*3,222,278	2,099,957	1,045,021	1054936
	11 " " '05	4,725,292	*2,798,901	1,926,391	1,014,597	911,794
DULUTH, MINN.	1 m., Oct., '06	66,422	38,003	28,420	17,849	10,571
Duluth St. Ry. Co.	1 " " '05	57,506	27,906	29,600	17,388	12,212
	10 " " '06	636,892	335,929	300,963	176,494	124,469
	10 " " '05	547,180	281,309	265,871	170,178	95,693
EL PASO, TEX.	1 m., Oct., '06	34,630	*27,126	7,504	3,932	3,572
El Paso Electric Co.	1 " " '05	26,765	*18,324	8,442	3,816	4,625
	12 " " '06	367,993	*255,554	112,439	46,588	65,851
	12 " " '05	284,941	*187,004	97,937	42,402	55,534
FT. WAYNE, IND.	1 m., Oct., '06	93,492	55,787	37,705	......	......
Ft. Wayne & Wabash	1 " " '05	80,993	48,625	32,367	......	......
Valley Tr. Co.	10 " " '06	914,671	564,793	349,878	......	......
	10 " " '05	781,697	483,577	298,120	......	......
FT. WORTH, TEX.	1 m., Oct., '06	93,458	*63,202	30,256	9,942	20,314
Northern Texas Tr. Co	1 " " '05	57,797	*37,237	20,560	9,938	10,623
	11 " " '06	831,467	*528,191	303,276	119,292	183,984
	11 " " '05	640,269	*381,451	258,819	116,534	142,285
GALVESTON, TEX.	1 m., Oct., '06	24,761	*16,481	8,280	4,167	4,113
Galveston Elec. Co.	1 " " '05	23,927	*15,037	8,890	4,167	4,723
	2 " " '06	307,201	*186,578	120,624	50,000	70,624
	12 " " '05	263,046	*187,269	75,777	40,000	35,777
GREENSBURG, PA.	1 m., Nov., '06	13,440	6,779	6,661	......	......
Pittsburg, McKeesport	1 " " '05	12,564	7,057	5,508	......	......
& Greensburg Ry. Co	11 " " '06	168,751	87,745	81,006	......	......
	11 " " '05	198,131	90,474	107,657	......	......
HANCOCK, MICH.	1 m., Oct., '06	19,353	*12,058	7,295	3,916	3,379
Houghton County St.	1 " " '05	16,540	*11,422	5,118	3,753	1,365
Ry. Co.	12 " " '06	222,794	*145,142	77,653	46,649	31,004
	12 " " '05	168,770	*169,712	†942	42,780	†43,722
HOUSTON, TEX.	1 m., Oct., '06	51,251	*33,652	17,600	7,792	9,808
Houston Electric Co.	1 " " '05	46,324	*27,166	19,158	9,015	10,143
	12 " " '06	578,779	*375,041	203,737	95,533	108,204
	12 " " '05	499,754	*299,885	199,870	104,260	95,610
KANSAS CITY, MO.	1 m., Oct., '06	531,672	250,023	281,649	150,244	131,404
Kansas City Ry. & Lt.	1 " " '05	466,860	210,114	256,746	139,456	117,290
Co.	5 " " '06	2,406,770	1,184,232	1,222,538	724,194	498,343
	5 " " '05	2,164,755	1,054,883	1,109,871	683,160	426,711
LEECHBURG, PA.						
Pittsburg & Allegheny	1 m., Nov., '06	4,167	2,103	2,064	1,500	564
Valley Ry. Co.	8 " " '06	37,306	18,821	18,485	15,614	2,871
LEXINGTON, KY.						
Lexington & Interur-	1 m., Oct., '06	46,482	27,895	18,587	......	......
ban Rys. Co.	10 " " '06	443,551	283,930	159,621	......	......
MANILA, P. I.						
Manila Elec. R.R. &	1 m., Nov., '06	40,250	23,350	16,900	......	......
Ltg. Corp., Ry. Dept.	11 " " '06	467,301	244,424	222,877	......	......
	1 " " '06	77,575	40,548	37,027	......	......
All Depts.	11 " " '06	823,780	422,390	401,390	......	......
MILWAUKEE, WIS.	1 m., Nov., '06	308,753	144,065	164,687	92,272	72,416
Milwaukee Elec. Ry.	1 " " '05	278,458	127,494	150,964	78,712	72,252
& Lt. Co.	11 " " '06	3,244,223	1,576,645	1,667,578	976,641	690,937
	11 " " '05	2,947,791	1,412,899	1,534,892	847,930	686,962
Milwaukee Lt., Ht. &	1 m., Nov., '06	54,330	23,352	30,978	28,797	2,181
Tr. Co.	1 " " '05	45,962	18,856	27,106	22,409	4,697
	11 " " '06	646,602	252,381	394,220	296,298	97,922
	11 " " '05	560,664	232,996	327,668	232,506	95,162
MINNEAPOLIS, MINN.	1 m., Oct., '06	473,821	226,436	247,386	114,758	132,627
Twin City R. T. Co.	1 " " '05	420,981	192,938	228,043	103,208	124,835
	10 " " '06	4,691,259	2,177,485	2,513,773	1,118,911	1394862
	10 " " '05	3,903,669	1,771,088	2,132,581	1,000,217	1132364
MONTREAL, CAN.	1 m., Oct., '06	281,822	157,689	124,133	40,610	83,523
Montreal St. Ry. Co.	1 " " '05	249,788	141,681	108,107	21,063	87,044
NORFOLK, VA.	1 m., Oct., '06	124,657	74,923	49,734	......	......
Norfolk & Portsmouth	1 " " '05	117,681	64,072	53,608	......	......
Tr. Co.	10 " " '06	1,229,092	763,311	465,781	......	......
	10 " " '05	1,121,150	678,267	442,884	......	......
PHILADELPHIA, PA.	1 m., Nov., '06	216,621	......	......	......	......
American Rys. Co.	1 " " '05	198,243	......	......	......	......
	5 " " '06	1,255,349	......	......	......	......
	5 " " '05	1,143,655	......	......	......	......
PLYMOUTH, MASS.	1 m., Oct., '06	8,708	*5,892	2,816	1,796	1,020
Brockton & Plymouth	1 " " '05	7,995	*5,403	2,592	1,730	862
St. Ry. Co.	12 " " '06	110,490	*70,244	40,246	21,859	18,388
	12 " " '05	101,199	*71,927	29,272	21,357	7,915
ST. LOUIS, MO.	1 m. Nov '06	755,549	*448,126	307,423	198,026	109,397
United Railways Co.	1 " " '05	714,771	*417,608	297,163	198,609	98,554
of St. Louis	11 " " '06	8,363,834	*5,103,821	3,260,013	2,179,451	1080562
	11 " " '05	7,729,554	*4,889,847	2,839,707	2,189,306	650,401
SAVANNAH, GA.	1 m., Oct., '06	43,835	*31,911	11,924	11,300	624
Savannah Electric Co.	1 " " '05	49,907	*31,752	18,155	10,642	7,513
	12 " " '06	622,077	*379,554	242,523	133,920	108,603
	12 " " '05	575,758	*341,322	234,436	126,739	107,697
TAMPA, FLA.	1 m., Oct., '06	39,385	*24,334	15,050	182	14,868
Tampa Elec. Co.	1 " " '05	34,586	*18,731	15,855	1,885	13,970
	12 " " '06	461,731	*267,675	194,056	3,138	190,918
	12 " " '05	398,526	*234,004	164,522	22,705	141,817
TERRE HAUTE, IND.	1 m., Oct., '06	75,968	*41,646	34,322	13,502	20,820
Terre Haute Tr. & Lt.	1 " " '05	57,336	*37,813	19,523	10,430	9,093
Co.	12 " " '06	780,976	*454,680	326,296	153,991	172,304
	12 " " '05	614,617	*402,638	211,980	119,445	92,535
TOLEDO, O.	1 m., Oct., '06	176,960	*100,870	76,090	42,507	33,
Toledo Rys. & Lt. Co.	1 " " '05	165,511	*82,256	83,255	42,826	40
	10 " " '06	1,688,034	*882,687	805,347	423,961	381,3
	10 " " '05	1,573,293	*801,906	771,387	425,020	346,367

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NOTICE TO ADVERTISERS

Changes of advertising copy should reach this office by 10 a. m. Monday preceding the date of publication, except the first issue of the month, for which changes of copy should be received two weeks prior to publication date. New advertisements for any issue will be accepted up to noon of Tuesday for the paper dated the following Saturday.

During 1906 *the Street Railway Journal printed and circulated* 426,950 *copies, an average of* 8210 *copies per week. Of this issue* 8000 *copies are printed.*

The Tendency Toward Steel Cars

A remarkable feature of electric railway practice at the present time is the diversity of car designs found, not only in different parts of the country, but in different parts of the same system. No one can tell how long it will be before more uniform standards become common. It is surprising that the comparatively straightforward proposition of carrying people from point to point in city, suburban or interurban service should exhibit such wide variations in rolling stock. The peculiar tastes of the public in different cities and the dissimilarity of the climate in one place as compared with another doubtless account for a considerable part of the difference in detailed design. Another reason is the fact that the development of the car is undoubtedly not yet complete and that during this evolution a variety of types is being produced from which the best forms for different kinds of service will result. This condition is particularly true with cars for city "rapid transit" or elevated and subway service, but holds broadly true for all classes of cars.

There is one particular in which practice in car building is becoming more and more uniform, and that is with respect to fire risk prevention. No progressive electric railway manager would now consider buying other than fireproof cars for operation in a subway or tunnel system, and the tendency to install wiring in armored conduit is spreading even to surface cars. Steel underframe cars have been improved upon to the extent of building cars almost entirely of steel, with absolutely no inflammable contents except the cushions or rattan seats, the grab handles and straps. These all-steel cars have so far been operated mainly in tunnel or subway service, though a few have found their way into heavy suburban traffic. Of greater importance in interurban service on single track than their incombustibility will be the collision-proof qualities of the steel car. We may find that the steel car is to conquer the field of high-grade interurban service sooner or later, just as it is about to take possession of the urban subway and tunnel line. The steam railroads are fast awakening to the value of the steel car, and electric roads will not be behind in appreciation of it.

Routeing Cars for Night Service

The operation of cars during the small hours of the night is a necessity upon every street railway system occupying urban territory, costly though such service is in comparison with the expense of handling day traffic. The demand for night service grows more insistent with the increasing complexity of modern civilization, and as cities become larger the class of night workers constantly broadens in occupations and numbers. Transportation between home and place of business is quite as essential in the case of this class of patrons as with the larger number of day riders.

The conditions which determine the routeing of night cars are, however, decidedly different from those which bear upon the running of cars in the daytime.

Although the local conditions in every large city vary as to the character of night service needed, it is generally the case that travel is in the main between down-town and residence districts during the night hours. In the daytime there is a large volume of traffic between different points in the business district, or between different suburbs, quite apart from the great ebb and flow of the rush hours between home and office. It is safe to say that the bulk of the night travel is for purely business reasons, though in the very largest cities belated pleasure seekers are frequently found on the cars without definite homeward or office-bound aims. In laying out a night service, therefore, it is safe to count on the fundamental fact that the great majority of night travelers, say between 1 and 5 a. m., are en route between their homes and their places of business. Newspaper men, actors, police officers, telegraph operators, writers, janitors, employees of hotels, markets, restaurants and power plant operators, railroad men and teamsters—in short, all those employees who are concerned with the production of twenty-four-hour public service of one kind or another, have to be considered in establishing night car routes. To lay out such service properly a company should have a pretty definite idea as to the number and location of business establishments which are open all night, and the character of the residence districts with respect to nocturnal labor.

The fitting of car routes to the needs of night traffic generally results in longer and less direct runs in cities where routeing is not held to hard and fast lines of geographical limitations. Desirable as it is for the night patron to be able to make quick and direct journeys between points, it is such a costly service to operate that a company may well run its cars somewhat circuitously if a broader territory can thereby be served with a given number of cars and crews. Usually a suburban resident is so glad to be given night service between the city and his home that the routeing is far less important to him than it is in the daytime. There are plenty of instances, of course, where direct runs can be made to advantage over the regular lines operated in the daytime, but there need not be much hesitation in diverting the cars when necessary.

It is doubtless a fact that the existence of night service tends to build up residential districts and increase their day travel. The cost of operating night cars should be compensated for in this way, even though it probably will not pay to run them on the basis of night receipts except in very large systems. In some cases it is an advantage to terminate all the night car routes at a common point in the business district. Transfers can then be easily made between all the important points on the system, and even on hourly intervals the waits for cars will frequently be short.

Liability for Overcrowded Stations

A singular decision was handed down by the Supreme Court of Massachusetts a few days ago in connection with a damage suit against the Boston & Northern Street Railway Company. The plaintiff was a woman who was injured in attempting to board a car in one of the subway stations in Boston by being thrown down by a pushing and jostling crowd. The Court held the company responsible to the extent of $2,000, and charged it with the duty of protecting passengers at stations from injury in consequence of jostling and struggling of other passengers attempting to board cars or trains.

It is certainly going to be a difficult proposition to operate a modern city system of trolley cars successfully if companies are to be held financially responsible for the behavior of both actual and prospective passengers under conditions like the above. The vagaries of human nature cannot thus be capitalized in fairness to the company which is straining every nerve to handle the traffic which pours in upon it during the rush hours of the morning and afternoon. Every practical street railway man knows that it is a physical impossibility to move the business offered in the rush hours fast enough to avoid congestion, unless every condition upon the streets is favorable. The desire of everybody to go home or down town practically at once is the old trouble at the bottom of congested conditions, and a street railway company can control this no more than it can alter the temperature of the polar regions.

The efforts which are made in the principal stations on both the New York and Boston subways to handle the traffic in safety are evident upon the most casual inspection at the Grand Central or Brooklyn Bridge stations of the former or the Park Street station of the latter. Platform men are at work all through the rush hours to prevent persons from being injured in boarding and leaving cars; conductors and motormen are careful not to open vestibule doors until the cars have come to a full stop, and trains do not start until a signal announces the closing of all doors. In Boston a further device is used which the New York conditions render unnecessary. At the Park Street station two illuminated bulletin boards above the platform of maximum traffic are operated to give about a minute's warning of the arrival of cars for specific destinations at numbered berths, so that congestion may be decreased as much as possible.

Overcrowding at stations is, of course, aggravated by anything which interrupts the regular movement of cars. The rush hour stream must be continuously carried away. Accidents to equipment will occur on the best managed roads at times, and blockades due to teams and other causes of street congestion beyond a company's control are certain to increase the discomfort of the traveling public on station platforms as well as among passengers on board the cars. The remedy for overcrowding lies with the public itself in the vast majority of cases. The practice of the ordinary decencies of personal restraint, patience and courtesy on the part of the patrons of the modern urban system will do more to ameliorate the dangers of overcrowding than fines enough upon the operating street railways to swell the surplus of the Bank of England. By and by street railways will be mulcted damages in proportion to the microbes brought into their cars by the great unwashed! The public itself should have been forced to compensate the accidental victim of its own act in the case cited.

Hydraulic Progress in Transmission Plants

The improvement of the mechanical equipment of engineering has been one of the most interesting results of electrical development. Progress in steam and gas engine building during the past few years has been largely stimulated by the exacting requirements of the electric power situation, and with the development of hydraulic transmission plants has come a remarkable improvement in the design of water wheels, pipe lines and penstocks, which would scarcely have been attained without the incentive of electric power utilization in lighting, railway and motor service.

Significant hydraulic progress is outlined in a paper of Messrs. F. S. Pearson and F. O. Blackwell upon the Necaxa plant of the Mexican Light & Power Company, presented before the American Society of Civil Engineers on Jan. 2. The increase of drainage area by the diversion of neighboring streams into the general power basin which serves the plant marks a bold adaptation of means to ends which is typical of modern engineering projects, and the utilization of the entire run-off of the streams during any year will doubtless go a long way toward insuring absolutely continuous service. The use of pipes with flanges forged from a single piece of sheet steel and their connection by clamping rings results in a stronger and more reliable form of pipe than one built up of plates riveted together, and the smooth interior will materially reduce the loss of head due to friction, especially at the higher velocities occurring at times of overload.

In the Necaxa plant there are six impulse wheels, each rated at 7000 hp, with a maximum capacity of 9000 hp, operating under an effective head of about 1300 ft. Large impulse wheels have been previously built with horizontal shafts and single deflecting nozzles, but in this installation each wheel has two 4½-in. square regulating nozzles fixed on opposite sides of the wheel but joined together so that they are opened and closed simultaneously; and a vertical shaft 14 ins. in diameter and flanged at the bottom to take the water-wheel disc, carries the revolving parts of both the generator and water wheel. The weight is supported by a thrust bearing under which oil is forced at a pressure of 150 lbs. per sq. in. This construction has many advantages. The double nozzle reduces the size of both the jet and the bucket and permits the use of a water wheel of smaller diameter and higher speed of rotation without loss in efficiency. The mechanism is more easily operated than a deflecting nozzle, and as the two nozzles are set in opposition to each other there is no thrust on the steady bearings, and all the parts can be made smaller than would be the case for a horizontal shaft unit for this head and capacity. The authors state that under actual running conditions the speed regulation is very close, practically no water being wasted except when the circuit breakers throw the full load off the plant instantly. These improvements in the prime movers were also supplemented by the use of exciter sets taking power from the main units, for the reason that with small wheels the nozzles give trouble by getting obstructed by materials floating in the water. Each year that passes brings a closer control and wider knowledge of high-pressure hydraulics in relation to electric transmissions, and every step in advance is a cause for congratulation by all users of hydro-electric power.

Trestle Preservation

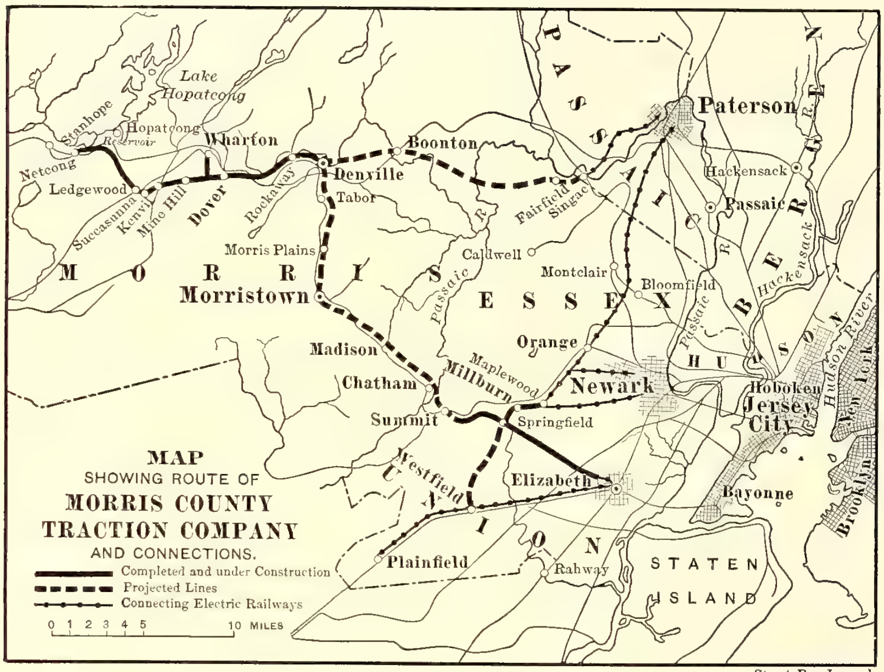
The importance of preserving the life of timber when used in large quantities in railway structures is coming to be widely recognized by transportation companies, and although the average electric road uses a comparatively small amount of this material as contrasted with the larger steam systems, the subject is worth bearing in mind in these times of close operating economy. At the recent convention in Boston of the Association of Railway Bridge and Building Superintendents the subject of trestle preservation was discussed at some length, and the application of the points brought out to electric railway trestles is certainly worth making.

Trestles on electric roads are fortunately not exposed to anything like the serious fire hazard which obtains on steam railways, thanks to the difference in motive power. At the same time we believe it is the part of wisdom to equip every long trestle with at least one water barrel or its equivalent, for the reason that a serious fire on a car, or possibly a broken trolley or high-tension wire might cause the destruction of the trestle in addition to the other damage done, even though there is no cinder problem to deal with. The cost of doing this is nominal, and if the barrel is kept filled with a saline solution in the winter season, with a pail handy, the protection will certainly be adequate in the majority of cases. Where a special hazard exists, as in the case of a wooden trestle located near enough to a steam railroad line to be in danger of being struck by locomotive sparks, it may pay to cover the tops and sides of the ties and stringers with sheet iron on the exposed surfaces nearest the railroad. The gist of the whole matter is that this kind of protection costs so little that the serious expense of interrupted service should never be incurred through the lack of a little foresight. In these extra hazardous locations it is a good plan for the track department to keep weeds and all inflammable rubbish at least five or six feet away from the trestle bents, and to remove all bark, dry shavings and slivers once or twice a month on inspection trips, if any such refuse be found. Red cedar trestles are particularly liable to ignite under favorable conditions, and should be watched with extra care.

As for the application of chemical preservatives, it is too early to determine the best method of procedure in any general way. Creosoted ties and stringers are finding much favor in some localities, while the use of special paints is practiced in other quarters with success. As far as we are aware electric railways have done little as yet in the preservation of timber, but the increasing scarcity of this material and the steady tendency of its price to advance will certainly lead to protective measures in time. The cost of creosoting may be perhaps 50 per cent or 75 per cent in addition to the cost of the timber, but the indications are that the life is greatly extended, especially where the timber comes in contact with earth or other timber in such a way as to be liable to cause decay. Doubtless it does not pay at present to attempt specially to preserve or protect a trestle only a few feet in length, but the matter is worth looking into in the case of trestles, say from 50 ft. upward. It costs little to experiment with timber preservatives, and experience in this direction would be of general interest if made public.

THE MORRIS COUNTY TRACTION COMPANY'S INTER-SUBURBAN SYSTEM IN NEW JERSEY

There is now under construction in the northern and eastern portions of New Jersey contiguous to New York City an electric railway system rather novel in scope but nevertheless well adapted for the proper development of the territory it will serve. It is natural that at first the railways of a metropolitan district should be of distinctly radial character with the business center forming the origin of all the lines running to the suburban towns; but as the latter grow in importance the demand for satisfactory inter-suburban transportation can only be satisfied by cross-connecting lines which make it possible to reach the outlying towns without going to a common terminal.



MAP SHOWING ROUTES OF THE MORRIS COUNTY TRACTION COMPANY'S LINES AND CONNECTIONS

An examination of the accompanying map will show how common the radial type of railway construction is in the district under consideration. While such large towns adjacent to New York, like Hoboken, Jersey City, Newark, the Oranges, Elizabeth, Plainfield, have excellent means of inter-communication via the lines of the Public Service Corporation, most of the towns and villages to the north and west have no service aside from the infrequent headway and roundabout routes of the steam railroads. For this reason the present population of these more distant localities is not as dense as the suburbs of a large city should be, but with the opening of the several Hudson River tunnels nearing completion, this most attractive territory will be within easy access from the metropolis. Hence the possibilities of a railway system in this district, bright as they are now with reference to present conditions, are not to be compared to the great development due within the next five years.

The electric railway system which is now being built to bring these outlying places within closer touch to each other and to the numerous lines of the Public Service Corporation is known as the Morris County Traction Company, with headquarters at Morristown, N. J., located about the center of the line. As shown on the map, the towns to be served directly lie wholly within the counties of Morris, Essex and Union. There are to be four eastern terminal connections with the lines of the Public Service Corporation at the following points: Singac, for Paterson; Maplewood, for the lines to Newark, the Oranges, Bloomfield and Montclair; Elizabeth, where trackage rights to operate into the heart of the city have been secured; and Westfield, for connection with the line between Elizabeth and Plainfield. The western terminal will be at Stanhope, N. J., where connection will be made with the Washington & Easton Railway, now under construction, running via Washington, N. J., and Easton, Pa., to Reading, Pa. The values of the eastern connections can be realized when it is stated that they tap a district containing over half a million people. The western connection will also prove of value, as will appear in the later paragraphs discussing the traffic possibilities of the different parts of the system.

A CURVE ON THE ROUTE TO SUCCASUNNA

DOUBLE-TRACK PART OF THE LINE IN DOVER

The principal communities to be served directly by the Morris County Traction Company may be classified as residential and industrial. Those of the first type are on the

northwest to southeast and southern divisions, while those of the other are on the line running from the west to the east. This condition is shown in detail by the following table giving the names of the towns and the population:

Residential	Population	Industrial	Population
Morristown	11,267	Rockaway	1,483
Morris Plains	445	Little Falls	1,500
Madison	3,754	Dover	5,938
Chatham	1,361	Netcong	941
Summit	5,302	Stanhope	682
Springfield	1,073	Boonton	3,901
Milburn	2,837		
Westfield	4,328		14,445
	30,367		

In addition to the foregoing it is estimated that with the inclusion of the minor villages the total population is 65,000, or over 1000 persons per mile for the 64.5 miles of route. These figures by no means give a proper insight into the probable amount of travel, as they leave out of account the greater riding tendencies in a prosperous territory and the extra income from pleasure traffic in the summer months Indeed, the latter factor will be a very important one on this system, as the new line will offer a splendid route to Lake Hopatcong. This lake is one of the most popular summer resorts in the East, particularly with residents of the metropolitan district, to whom it will soon be made more accessible by the lines of the Morris County Traction Company. The upper route connecting at Singac with the Public Service System will also have a good all-the-year business in transporting the large numbers of workers employed at the mines, iron furnaces and mills in this territory.

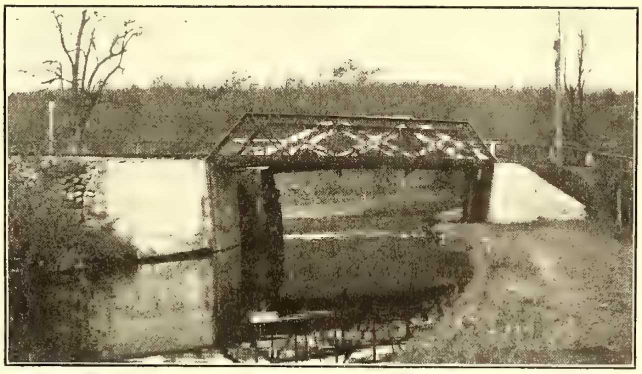
At present only 11 miles of single track are in operation, but an excellent traffic has already been developed on this still isolated part of the system which serves Rockaway, Wharton, Dover, Mine Hill and Kenvil. Four cars are operated on these lines at intervals of thirty minutes.

The 2½-mile extension from Kenvil through Succasunna toward Ledgewood which was opened about Dec. 15, was marked by comparatively heavy travel, especially so when the comparatively small population is considered. On this division cars are run every hour, so that there is no competition between the steam (High Bridge Branch of Central Railroad of New Jersey) and electric cars, as the former go north at 10:21 a. m. and 7:23 p. m., returning from Dover at 6:29 a. m., 4:10 p. m. and 5:30 p. m., making the run in from eighteen to twenty-three minutes, or about the same as the electric cars. Succasunna and Kenvil had the advantage of six trains on the Chester Branch of the Delaware, Lackawanna & Western Railroad, also, but as they were run only at wide intervals, and neither very early nor very late, there was but little additional inducement for travel.

The next section of the system to be placed in operation is at the other end of the line, comprising about 8 miles of single track between Summit and Elizabeth, with a branch from Springfield on the main road to Milburn (for Newark) to connect with the Public Service tracks at that point. Two cars have been running on this division, but the service will be increased in the early spring when connections are made at Newark and Elizabeth.

In all, the system will be 64½ miles long between the terminals, with a total of 78½ miles of track, of which 8½ are double. All of the franchises granted are perpetual except in Morristown, where the franchise is limited to forty years. This town is composed largely of wealthy people who for a long time were opposed to the introduction of electric traction, but who are now enthusiastic for it.

The rolling stock now consists of twelve 35-ft. single-truck motor cars, each carrying two 68-C Westinghouse motors and six 48-ft. double-truck cars with four No. 101-B

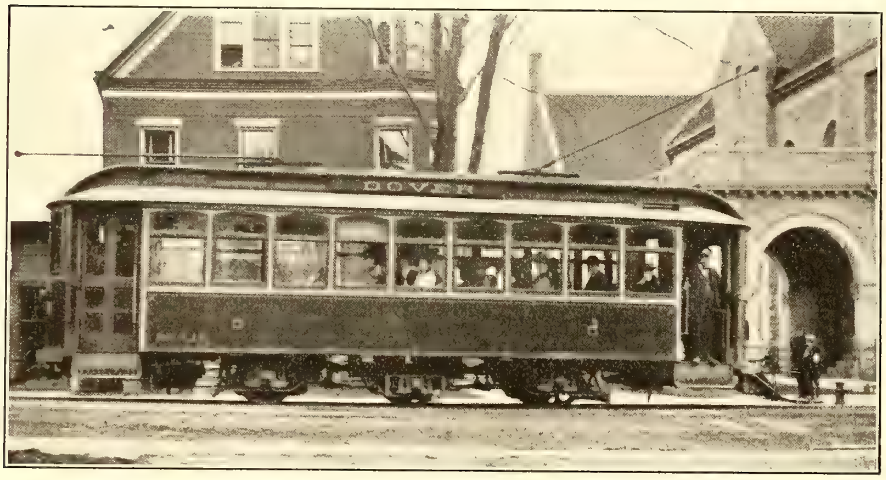


BRIDGE ACROSS THE MORRIS CANAL

A VIEW ALONG THE ROUTE FROM SUCCASSUNNA TO KENVIL

THE ROCK BALLASTED LINE ON RIGHT OF WAY FROM DOVER TO ROCKAWAY

Westinghouse motors each. The air brakes are also of the same manufacture. The cars, which were built by the American Car & Foundry Company, are furnished with rattan cross seats and short longitudinal seats at the ends. There are also six old passenger cars equipped as motor work cars, in addition to a number of regular construction cars. The company owns a frame car house on the outskirts of Dover to provide for the cars on the Dover-



ONE OF THE SMALLER CARS LEAVING DOVER FOR WHARTON

Wharton section, and another at Millburn for the cars on the Elizabeth division. These quarters are only temporary, however, as concrete car houses are to be built in connection with the sub-stations when the locations of the latter have been determined.

Although a large part of the mileage is on the public highway, the company has not hesitated to locate portions on purchased right of way where such action would avoid severe grades and curves, and in one instance onerous franchise conditions. The system, therefore, will be capable of giving high-speed service, even in the vicinity of the larger towns, without interference from the authorities or running the risk of accident to travel on narrow and crooked roads.

The character of the territory, like that of the towns, may also be divided in two classes, the northern section being rather hilly and the southern rather level. In following the highway from Dover to Stanhope it was necessary entirely to reconstruct portions of the road to minimize the grades. At Stanhope the public highway runs over a hill with a 7 per cent grade. To avoid this the line will be built along the edge of the lake on the company's right of way.

In purchasing land at various points along the railway, the Morris County Traction Company had in mind not only leaving room for double tracking in the future, but also to develop the property along real estate lines. Thus the water front property at Stanhope is wide enough between the public highway and the edge of the lake to permit the construction of a row of cottages along the right of way. The private route to Elizabeth will also offer the means of opening up a new line of settlements within a very short distance of that city.

The track and overhead construction of this system is not elaborate, but is the best suited to the conditions. In the cities an 80-lb. girder rail is used, and in the country a 70-lb. T-rail laid on wooden ties. All joints are bonded with two No. 0000 bonds. The northern portions of the line are being splendidly ballasted with the heavy ore-bearing rock common in the district, and the same ballast will replace the sand and gravel used on the southern portions of the line when the through connections are made. The company crushes its own rock at a cost of 50 cents per cubic yard.

The overhead system is generally of the span type in cities and villages and bracket construction in the city. The northern portion of the line is carrying one 500,000-circ.-mil feeder and one No. 00 trolley wire. Power is purchased on very reasonable terms from neighboring lighting companies, but it is proposed ultimately to install a central power station at Morristown with the usual a. c. transmission to d. c. sub-stations. The northern end of the line is now operated by power from the Dover Electric Light Company's station, where the traction company has a generator and switchboard equipment. In this station a Harrisburg "Ideal" engine with 300-kw Westinghouse generator will soon be installed to meet the increasing power demands on the Stanhope and Lake Hopatcong extensions to be operated the coming summer. The southern end of the line receives power from the Milburn Electric Light Company, where the traction company also owns the generating apparatus.

Herbert Barnum Seeley, formerly of Bridgeport, Conn., a brother of Clinton Barnum Seeley, is organizing two circuses, which will be transported by trolley, and exhibit in the parks maintained by the trolley companies throughout New England, New Jersey and Pennsylvania. The rolling stock of the enterprise will consist exclusively of trolley chariots, trolley baggage wagons, trolley stock cars, trolley sleeping cars and trolley cages. According to the New York "Herald," Mr. Seeley's outfit will consist of less than twenty cars, but he is ready to compete in merit with his larger competitors. Side shows by the dozen will accompany the circus proper.

ONE OF THE LARGER CARS NOW OPERATED ON THE DOVER-ROCKAWAY LINE

THERMIT RAIL-WELDING—EXPERIENCES OF THE UTICA & MOHAWK VALLEY RAILWAY COMPANY

BY M. J. FRENCH
Engineer Maintenance of Way, Utica & Mohawk Valley Railway Co.

In all branches of electric railway work there are knotty problems to be solved, and in the track construction department surely no subject has called for more careful study and received more serious consideration than that of the maintenance of rail joints. Manufacturers and track engineers alike have put forth their best efforts in the endeavor to solve this problem.

The hardest proposition with which manufacturers of improved rail joint fastenings have to contend is to secure fair play for their devices. Many fastenings have features that mark a material advance over the old-style of joint plates, but their application requires such care that its neglect would make the joints appear less desirable than those of older date, especially when the extra cost and consequent additional loss through failure is given due weight. All track engineers and superintendents concede the great advantage of a continuous rail, but the attempts to secure it have in some cases been so expensive and unsatisfactory that others have hesitated to recommend to their superiors the use of the latest and most scientific appliances.

Thermit, electric and cast-welded joints all have their partisans among track engineers, who have given study and especial care in the application of one particular type of weld. No one disputes the statement that all three methods have been successfully employed, but it likewise must be admitted that there have been some failures, and in some instances that money loss has resulted in the abandonment rather than in a more careful mechanical application of the process.

On the Utica & Mohawk Valley Railway Company's system we have used only the thermit process of welding, but know that others have had such marked success with electric and cast welding that we cannot take exception to their practice. Granted that we have had failures, we must also admit that, save in one particular, the fault is attributable either to carelessness in application or to lack of knowledge of requirements. This is proven by results obtained this year in applying the knowledge gained through failure last year.

Although the details of the thermit welding process are familiar to track engineers generally, a brief description may help others to appreciate its advantages more fully. The process consists in pouring molten iron, or more correctly mild steel, from a crucible into sand and flour molds placed around the rails at the joint. The rails having first been lined and surfaced, the joint is thoroughly cleaned with a sand blash or wire brush. Then the rails are heated by gasoline or oil blow torch to expel all moisture, and by heating the rails to a dull red better results are insured, as the temperature of the molten steel is not reduced as much when coming into contact with the rails.

A pair of molds made of an equal mixture of common clay and sand, or more preferably of sand and 10 per cent of cheap rye flour, is then clamped firmly to the rails. The material of the molds is held by wrought-iron framework provided with handles to facilitate carrying. The rail head is then painted with a watery solution of common red clay which the heated rail immediately dries up to a thin coating. This is to prevent the molten slag or steel from uniting with or burning the rail-head. After thoroughly luting all joints of the molds with clay of the consistency of putty, common earth is packed around the outside of the molds. The molds and rails are then given a final warming with the blow torch, the flame being directed inside the molds to expel any remaining moisture. The crucible on its tripod is placed with pouring hole directly over and about 2 ins. above the gate in the mold. After placing the tapping pin, iron disc, asbestos disc and refractory sand in the bottom of the crucible to act as a plug for the opening, the thermit compound is poured in and in the center of the top is placed about one-third of a teaspoon of ignition powder. A storm match starts the chemical process.

The chemical reaction is a great mystery to the curious bystanders, and a foreman might spend all of his time answering questions. The thermit compound is composed of aluminum and iron oxide, both in granular or flake form; the ignition powder is composed of aluminum and barium peroxide in much finer form. When the match is applied the barium peroxide ignites and releases its oxygen to the aluminum very quickly. The heat produced is so intense that it causes the iron oxide to release its oxygen, which in turn is seized by the aluminum and

TRACK GANG TAPPING THE CUPOLA

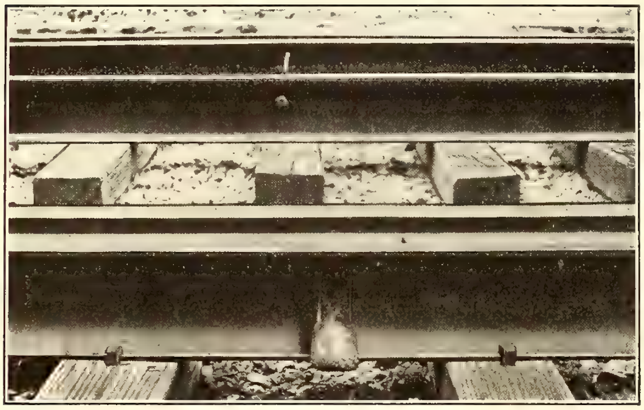
almost instantly the entire contents of the crucible is a boiling and seething mass. By this reaction the pure steel is liberated and settles immediately to the bottom of the crucible. This wonderful chemical action is concluded within thirty seconds, the crucible is tapped by striking the tapping pin with a special iron spade, and the incandescent steel runs smoothly into the mold, the aluminum oxide or corundum slag following. In five minutes the mold can be removed for the passage of cars.

To go back to the beginning of operations, our attempts to make molds of half proportions of clay and sand resulted unsatisfactorily in that they shrunk and checked badly in baking and required a great amount of careful luting to fill all irregularities at the joints. Also the clay was baked like a brick from the great heat of the welded joint and was quite hard to remove, adding somewhat to the expense.

An old foundryman suggested to our foreman that he should try a mixture of clean, sharp sand with 10 per cent of coarse rye flour, moistening the mixture sufficiently to retain its form when pressed in the hand. This mixture came away from the model without adhering, baked without shrinking a particle, and was hard enough to stand ordinary handling. I believe we were the first users of thermit to employ this

mixture that has now become general. For baking the molds we have found that a moderate heat of about the temperature required in baking bread proved most satisfactory, as a higher temperature burned the rye flour and destroyed its cementing property.

By adding a teaspoon of turpentine for each pair of molds the material was made as hard as concrete—unnecessarily hard for ordinary use but most desirable for special molds for broken or combination joints. These special molds we make solid and then with cold chisel and file hollow out the space to form a welt of iron.



COMPLETED JOINT

We first tried baking the molds in a furnace with banked fire under a boiler, but the heat could not be regulated sufficiently and we lost many molds through burning. Our foreman then built an oven out at our Utica Park storeyard, using old bricks and building in a flat plate of iron above the firebox to baffle the heat. Above that two racks were placed to hold the molds. This oven has a capacity of twelve sets of molds, one man receiving 15 cents an hour making and baking twelve sets in five hours. Thus we have a capacity of twenty-four sets per day at a cost of 6¼ cents a set for labor. Our molds actually cost about 10 cents a set, as the workman was not constantly employed and we did not require the full output each day.

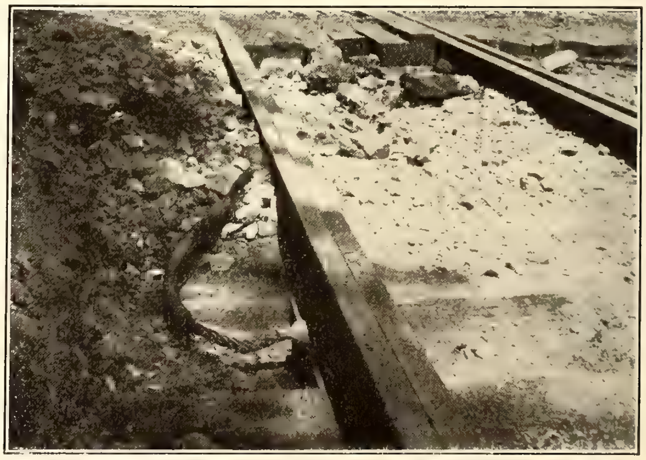
Our oven is constructed with but one door for the molds and fuel, but it is more desirable to have a separate door on the side of the baking chamber, as the oven is not then cooled off when fuel is placed in the firebox. We use old ties for fuel.

We have made our crucibles since using up the first six furnished by the Goldschmidt Thermit Company. We buy the magnesia tar and mix with it 25 per cent of old crucible material finely powdered. These crucibles are very durable and last on an average for about thirty joints. We bake these in our oven with a higher temperature than that required for the molds.

We have welded about 900 joints during the years 1905 and 1906. Of these 600 were made in 1905 on Lorain 95-lb.-297 9-in. tram-head rail. This work was subsequently paved in with vitrified blocks on concrete extending from the bottom of ties. The ties were 6-in. x 8-in. hewed Southern pine, 8 ft. long, spaced 24 ins. center to center on 8 ins. of crushed stone. Ten of these joints proved faulty during the year, the break being generally elliptical in shape and extending from the end of the rail just underneath the head and above the weld, to the upper bolt hole; thence to the lower bolt hole and back to the base of rail near its end. This break is supposed to follow closely the line defining the extreme limit of re-crystallization of the rail that is produced as a result of the heat radiated from the weld itself. These rails had been drilled with 1¼-in. holes, spaced 2½ ins.—6 ins.—6 ins. in upper row and 3½ ins.—6 ins.—6 ins. in lower row, for regular ribbed girder joint-plates, and the line of re-crystallization passed through the first holes in most instances. I understand that this re-crystallization is the cause of most of the breaks in both cast and electrically-welded rails. Nearly all of these joints that failed broke through contraction of the rails due to failure to protect them properly after welding continuously 500 ft. to 600 ft. of rail. Later we omitted the weld at every sixth joint until after the paving was finished on all joints but those left for contraction, when the latter were welded and the concreting and paving around them was finished. Thin sections sawed from the upper half of a rail were placed in the openings before welding.

Another kind of joint failure developed in the form of a slip joint, due to the iron of the weld failing to unite properly with the rail itself. We had about four of these slip joints during 1905. Later on we tested all welds immediately after cooling by striking them on both sides of the rail with a heavy spike maul, the laborer being instructed to break off the weld if possible. These defective joints were all repaired by making a special mold to enclose the old weld and by running another weld close against and at one side of the old one, over the break in the rail. This year we have had seven breaks in this total of 600 joints, all of them breaking through the bolt holes.

During 1906 we welded 200 joints on the same section of rail laid in 1902, where the twelve-bolt, ribbed plates had begun to show failure through working loose or the rail head had mashed down at the receiving end. In the latter case the receiving rail was shimmed up and after welding the head was ground true to a straight edge by means of a hand-power emery wheel grinder. Thus far but one of these joints has proven defective, as there was no expansion or contraction noticeable, the pavement being removed only at the joints.



JOINT WELD WITH CABLE BOND

We have also welded during 1906 about one hundred joints on Pennsylvania Steel Company's section 95-272, a T-rail 7 ins. high with 6-in. base and head 3 ins. wide. We ordered this rail with the first bolt hole omitted. Thus the distance from end of rail to nearest bolt hole is 6 ins., and as the line change of crystallization fell several inches short of the holes we have experienced no trouble from the brakes except in two instances where long sections were left uncovered along the outside rail, awaiting paving. After this

we banked earth against the rail on long sections without expansion joints.

When we began welding this 7-in. rail we found that we could sledge off the welds and that the iron from the thermit compound had not united with the rail; also that the iron came up to the top of the rail head. We subsequently found that the mold models had become mixed, and we had used one of too small horizontal cross section, and consequently the rail chilled the small volume of molten iron coming in contact with it. Upon enlarging the mold model so that the thermit portion furnished only enough iron to come up under the rail head, we obtained welds that resisted the most vigorous sledging that could be given with a 10-lb. hammer. We were able to batter the weld out of shape, but could not separate it from the rail. This sledging test is now applied to all welds.

We found when welding in the morning with rising temperature that tightly-closed joints often humped up when welded. This proved to be due to the latent compression in the rails that did not manifest itself until the rail ends became soft. These humped joints were ground down with an emery wheel grinder. We had only a few of these joints when we realized the cause, and readily prevented such action by welding on cooler days or when the temperature was falling. We obtained the best results with joints open about 1-16 in. to 1-32 in., the expansion in welding closing tightly such an opening. We have made excellent combination welds between 80-lb. T-rail, 7-in. 70-lb. and 95-lb. T-rails and 9-in. girder rails. In making combination welds we found that it was essential to get a good body of metal between the upper side of the base of the deeper rail and the under side of the shallower section in order to secure the strongest type of weld. This form is shown clearly in one of the accompanying illustrations.

Thus far there has been no appreciable excess wear in the head of the rails at the welds and the heated portion seems to take the original temper, as it cools down slowly in about the same way as when coming from the rolls.

A few portions of thermit, not over six, have been lost through failure of the workman to tap the crucible properly, or lack of luting around the joints of the molds. We have had but one explosion during our entire experience. That occurred after using the process eighteen months, and was caused through carelessness in welding on a rainy day and in not thoroughly luting the molds near the top. The slag came in contact with the wet earth around the mold, but aside from the scare occasioned by the report and a slight burn on the foreman's arm from flying slag no harm was done, and the weld turned out to be a good one.

The total cost per joint to weld the 9-in. girder rail on the 1905 construction, including all labor, materials, tools and patterns incident to the work, experimenting with mold materials and cost of oven, was $5.86. The total cost of welding old 9-in. girder work, including the removal of brick pavement and concrete at the joints and replacing the same, was $7.44 per joint. The total cost of welding the 7-in. T-rail during 1906 was $5.81 per joint.

Our track construction work has not been of such magnitude as to require continuous welding day after day, and we have used three men from a regular track gang for this work. In consequence the cost has not been so low as would have been the case under continuous operation. We have never exceeded twenty welds in any on day.

We tried welding at night for a short time, but on account of increased expense and liability of accident gave it up, as there was no real necessity for doing it at night so far as the operation of cars was concerned. The comparative simplicity and small cost of the outfit required, the facility of manipulation and the flexibleness of the process in its application to various sections of rails and to other welding purposes serves in our opinion to make it altogether desirable.

Besides the regular rail welding we have successfully welded a broken side frame of a Brill 27-F truck at a cost of $6.85. This new part would have cost $30, and the master mechanic considers the frame as serviceable as a new one. As the truck was not taken apart to do the welding, the advantages and economy of the thermit for this kind of work must appeal strongly to the economical mechanical engineer.

COMBINATION WELD

We have made a practice of welding in 500,000-circ. mil copper cable cross-bonds spaced about 1000 ft. apart, and have met with signal success. As a matter of economy we have used a joint weld at one end of the cross-bond by boring a hole through the mold and inserting the cable opened to receive the projection of the rail base. The other end of the cable was welded opposite the joint by using a regular mold and one-fifth of a portion of thermit at a cost of about $1.25. A joint weld with cable bond is shown in one of the accompanying engravings.

We feel that our experience and the signal improvement of 1906 over the welding done in 1905 warrants us in continuing the use of the process. If our breakage does not exceed 2 per cent a year, assuming the life of the rail to be fifteen years, we shall have expended about $2.25 per joint in paved streets in maintaining perfect stability and practically full electrical conductivity of the rails. Moreover we have every reason to expect that the failures will materially decrease, as the weak joints should show themselves within the first year of service. We are also confident of reducing the breakage and loss of welding portions at the time of welding because of the experience gained by our men.

SUGGESTIONS ON RAPID TRANSIT WITH PARTICULAR REFERENCE TO ROLLING STOCK—II

BY JOHN P. FOX

In his previous article the writer compared the carrying capacity and length of station stops under New York subway conditions for a variety of different types of cars. As several of these were side-door cars, it might be well to consider the objections which have been raised in the past to side-entrance cars and see if they are valid in view of the latest evidence on the subject.

(1) Can side-door cars be used with curved platforms? The idea that they cannot is very widespread, but really erroneous, as shown by the writer in his previous article. The remedy for the difficulty is simply a matter of car construction, as constantly seen in Europe, where the gap between car and platform is filled up either by continuous running boards or by projecting the whole car body beyond the underframe over the platform. Precedents in electric railway practice may be found in the projecting car platforms of the Mersey Railway, the running boards of the Metropolitan Railway of London, and the overhanging car bodies of the Lancashire & Yorkshire and Paris Metropolitan cars. The writer has the designs of some French railroad cars which project 19 ins. each side over the steel underframe. A further answer will be given next week, in connection with Fig. 20.

(2) Can a low car be framed strong enough to admit doors in the side? The 47-ft. motor car of the Waterloo & City Railway illustrated in Fig. 13 is only 9 ft. 8 ins. from rail to roof, and has two doors each side, while the floor is only 22 ins. above the rail. The Budapest subway cars, also with two doors each side, are only 8 ft. 4 ins. from rail to roof, and 15¾ ins. from rail to floor. The Central London underframes are as low as those of the Waterloo & City cars, or about 20 ins. lower than a New York underframe would have to be, so that this quesion seems easily answered.

(3) Can a continuous stream of people entering a train be cut off easily and safely with so many doors? Open street cars have had to be started without any way to check the stream, so that the presence of doors would improve this present practice. The Manhattan Elevated open cars have been operated for several years now with side gates, but are said to cause more accidents than all the other cars put together, and to be a constant source of delay. But is not the delay due partly to their popularity and partly to their lack of longitudinal aisle? And as to the accidents, the openings are narrow, the gates low, and the guards have two cars to look after instead of one, and from their position between two cars they cannot look along the platform as well as with a side-door type. Of course the ideal way to deal with a stream of people is to shut them off from a train entirely by gates when the train is ready to start, as is common at steam railroad terminals, and on some European electric lines, but this would hardly be feasible with such crowds as at the Brooklyn Bridge, where the slightest checking of the unbroken throngs on the stairways is dangerous, though sliding gates, simply diverting the stream from one platform to another, would appear perfectly feasible. But as people must be shut off from a starting train in one way or another, the real question is, which is easiest, to shut off at two, three, or ten points? With many side doors, obviously there is time for more deliberate and careful closing, giving the same length of stop, five times as long as in the case of the New York subway. This might often make any shutting off of persons wishing to board wholly unnecessary when required by other types of cars. Suppose, for example, ten people wish to get on a present subway car at the last minute, and that there are already 110 passengers on board. With such a degree of congestion, judging by the data gathered, it might take 15 seconds or more to allow five on at each door; and if this time could not be allowed, and the persons were insistent about getting on, the closing of the doors in their faces might have to be slow to avoid hurting any one. With a side-door car, the ten persons could all get on in one second, if they were scattered along the platforms, so that side-door cars offer more leeway in dealing with crowds than other types. The utilization possible of more floor space than in other types gives a total holding capacity that would not easily be swamped. A capacity per car of 188 or 217 seems ample for the New York subway, and it might be well to point out here how easy it would be to get out of a side door even when crowded, for the average distance to the nearest door is only about 4 ft., and the greatest distance 8 ft.; while for any one getting in, a door is never more than 2 ft. 6 ins. away.

It must be remembered that side-door cars in Europe have to handle even larger crowds than ever found in this country. The Great Eastern Railway in England has to carry as many as 1500 passengers on one of its fifteen-car suburban trains, with seventy-five doors each side, and swinging doors at that. The Berlin Stadt and Ringbahn, which carried 124,000,000 passengers last year, runs ten-car local trains with forty-seven doors each side, and its rush hour stops, as timed by the writer last year, appear to be about 20 seconds, which is not bad for such a heavy service with steam. But the continued success of the Illinois Central car is the best argument for the side-door type. A recent letter from Mr. Renshaw says: "I wish to state that the cars first built have given entire satisfaction both from a transportation standpoint and cost of maintenance. We have received absolutely no reports of failures in connection with the operation of the cars or door mechanism. The decrease in personal injuries in the use of the new car with side doors as compared with the old car with end doors is most gratifying. The time consumed in delivering and receiving passengers at stations has not been materially decreased since the report made on this by Mr. Sullivan; if my memory serves me correctly, the average standing time at stations is 7.65 seconds. You must take into consideration that this is about as quick as a steam locomotive will stop and start, regardless of all passengers having been received and delivered at the platform."

(4) Can side-door cars be kept warm in winter? This question was so fully answered in the article of April 1, 1905, that it is only necessary to recall that the Illinois Central found the type better heated than end-door cars, because there were no drafts sweeping down the cars, and all entering air currents were quickly broken up by the seats and warmed by the effective position of the heating coils.

(5) Can side doors be used throughout cars with very low floor and roof, as on the London tube railways? The Waterloo & City car, as shown in Fig. 13, and the Budapest subway cars have side doors only at two points between the trucks. But with the possible exception of the City & South London Railway, the writer knows of no cars too low for side doors at any point except over some of the motor trucks. Doors are possible even between the wheels of the trailer trucks of the London tube cars. A Central London or a Baker Street & Waterloo train, for example, could have side doors the whole length of every car, except over

the first and last trucks of the train, where the motors are, and where there is no need for doors, as the space is occupied by the motorman's cab and apparatus. To get the desired headroom at the top of the doors, it would be necessary to slant in the top of the car, and to make a bend also in the door, but this is already done with the side doors of the Waterloo & City cars as seen in Fig. 13, and the Great Northern & City cars. The writer hopes soon to make a drawing of a London tube car showing just how this surprising result can be obtained. While side-door cars and their large increase of seats may not be needed in London to reduce the length of stops, they would be valuable in economizing rolling stock. Thus on one tube line, while the saving in time would only be about 12½ per cent, and the same saving for the number of trains, the number of cars on a train could be cut down from six to four with a gain of 6 per cent in the seats, while there would be a total saving of 41 per cent in the number of cars needed, 12½ per cent less motor cars, and 56 per cent less trailers. The latter would each seat 90 passengers instead of 52, and the motor cars 70 instead of 46.

(6) Would the multiplication of doors multiply accidents or at least the number of claims? As we have seen, the Illinois Central Company has found less accidents with the side-door type than with the Manhattan type, while the open elevated cars in New York have more accidents than the Manhattan type. of car. The Illinois Central doors would then seem highly satisfactory, but it would hardly be safe to predict exactly what would happen with New York crowds. The multiplication of doors might cause people to hurry less, as entrances would always be near, and this might lead to more deliberate and careful movement. The filling up of all gaps at curved platforms ought to reduce accidents, also the seating of all the passengers, and addition of more firm posts and handles. As to accident claims, the improved service possible with side door cars, with their shorter stops, and especially their abundance of seats possible at all hours ought to please the public and reduce their inclination to get even with a company for poor service or congestion. The chief thing that irritates the public is certainly the lack of seats; and the superiority of the side-door type for overcoming this serious and expensive cause for complaint seems worthy of careful consideration. Side-door cars would also mean shorter stops, curved platform difficulties done away with, far less power needed, easier braking with less injurious iron dust in the air, less oil thrown about, less noise, and less wear of moving parts in trying to keep up to the schedule speed. In the future far more trains could be run than now, and the final capacity of the New York subway could be put at a figure which the writer hardly dares to mention until the possibilities of side-door cars are fully appreciated.

THE SIDE-DOOR CAR IN ENGLAND

While in England the American end-door car has been usually adopted for electric service, there is growing dissatisfaction with it, and there is a tendency to return to side doors. The electrification of the old rolling stock of the Metropolitan Railway of London has recently been described in the Journal, and in commenting on this action one of the London electrical papers makes some statements which are worth quoting: "It is stated that some of the [Metropolitan] officials are inclined to think that an error was made in adopting the American saloon car, as the cost of the extra train staff is higher than was realized at the time. To cut down expenses, the directors of the District Railway have been experimenting with a train having only two men, one in front and one behind, these two to have control over the whole of the doors on the train. Among the most popular trains on the Underground are the luxurious compartment trains provided by the London & North Railway for their Broad Street-Mansion House traffic." The Manhattan type of car has given great satisfaction on the Central London Railway, but has been subjected to much criticism on the District Railway. The Englishman for one thing did not like to see nearly a quarter of his seats done away with, and straps furnished instead. Then the pneumatic operation of the end and center doors gave much trouble at first, and the use of the center doors was finally abandoned. The better class of English suburban compartment cars, with their luxurious seats and electric lights over one's shoulder, are certainly more comfortable and pleasant in many ways than some of the hard-riding and hard-seated end-door cars. So it is not surprising to find Mr. Philip Dawson, in the Street Railway Journal for April 7, 1906, advocating as the most satisfactory type of rapid-transit car a compartment type with side aisle and side doors as used in Germany. Mr. Dawson prefers swinging doors to sliding ones, because he thinks the latter are more difficult to keep air tight and require an expensive use of air to operate them. But the experience of the Illinois Central appears

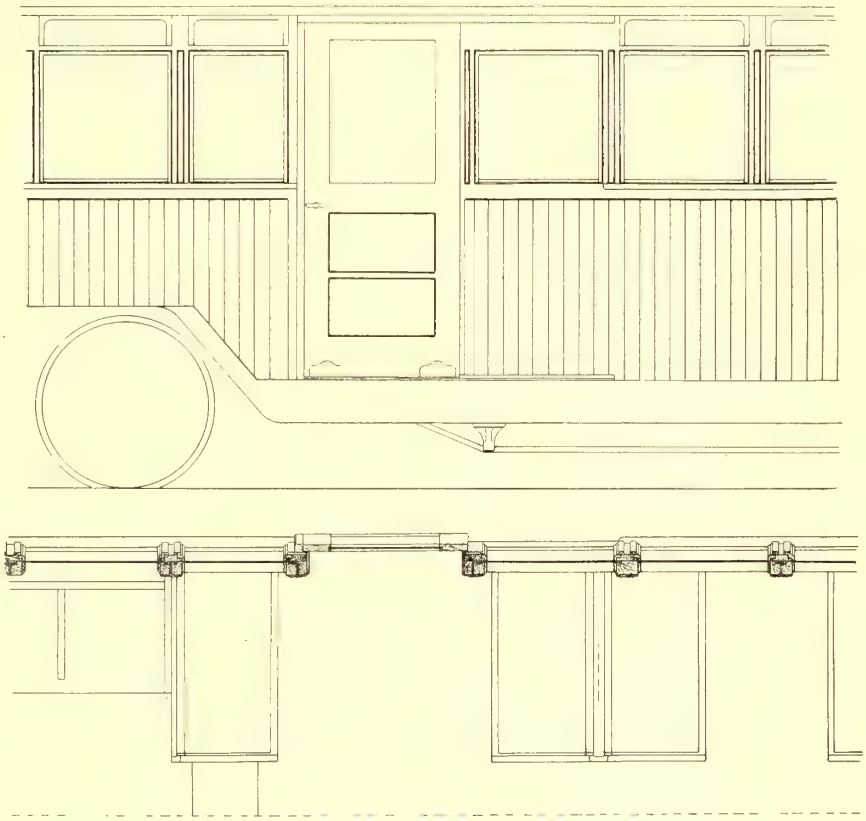


FIG. 13.—MOTOR CAR WITH SIDE DOORS, WATERLOO & CITY RAILWAY

to answer both these objections, as the cars are warm enough in a Northwest winter, and are operated easily by hand. Swinging doors, of course, have their advantages in Europe, where passengers are already used to them, and where their details have been worked out to make them very safe, especially in Germany. They can have a connecting mechanism for opening and closing as with sliding doors,

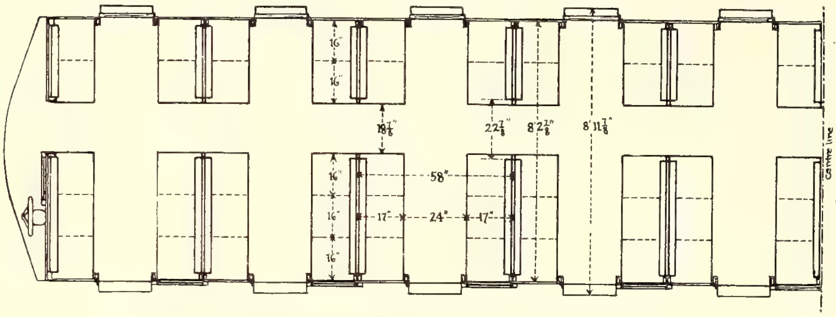


FIG. 14.—TYPE 4000. TRAILER WITH 100 SEATS

but there is always a chance of some one's being struck or caught by the open door of a starting or passing train, and the possible widths of cars are reduced by the need of allowing clearance space everywhere for open doors.

PROPOSED DESIGN OF RAPID TRANSIT CAR

In submitting designs for New York subway cars, the writer hopes that the results will meet the severest demands of the technical critic of side-door cars as well as the most rigid requirements of the public in the way of convenience, comfort, good lighting, ventilation, and other matters. The first point was to get the largest number of seats and side doors in a car with the present dimensions, viz: 51 ft. 2 ins. over the buffers, 8 ft. 8 ins. wide over the eaves, and 9 ft. ½ in. wide over all. The final side-door type submitted in

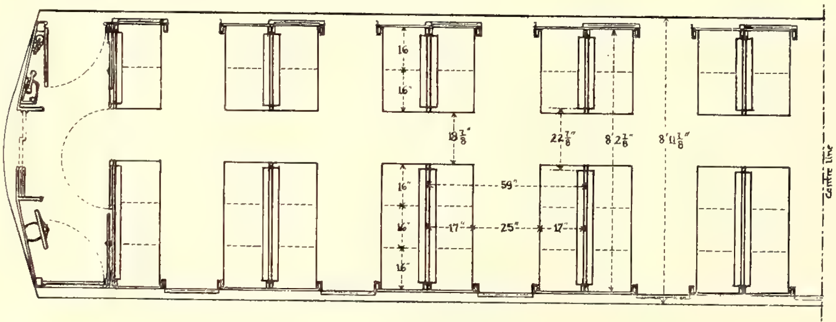


FIG. 16.—TYPE 5000, 90 SEATS

the JOURNAL for April 1, 1905, was a shorter car with 80 seats, but at the eaves it was about 12 ins. too wide for the desired clearances. While it will be seen later that a wider car than the present could be run in the subway without even changing the station platforms, it is interesting to see just how many seats could be got without exceeding present limits. The reduction in width was obtained, first, by allowing 16 ins. of seat room to each passenger, which is a common allowance both in this country and in England in narrow city cars. The open cars in Boston furnish, for example, about 15½ ins. While a 32-in seat for two passengers is very uncomfortable if made of rattan, the writer proposes a flat cushion on springs after the best European practice, which would avoid any sliding off the end of the seat. With 100 or more seats in a car, if there were not more than 60 persons to occupy them, as in the slack hours, then each passenger could have 24 ins. or 32 ins. apiece, and it would only be in the rush hours that the minimum space would be found.

A second way of reducing the car width is to omit any wall outside of the sliding doors. This was suggested by the practice found on the Waterloo & City cars as seen in Fig. 13. The hangers and operating mechanism of the doors are of course carefully closed at the top.

Thirdly, the car walls are reduced in thickness to a minimum between the posts, somewhat as in semi-convertible car construction and recent English wide suburban car practice. The posts are angles and tees, with outside panels and finish of sheet steel, and inside panels fastened to the inside of the flanges, with an insulating material between the two panels. This allows a wall only one-half inch thick at the seat level. The glass of the lower windows can be set in rubber and brass, or brass and wood.

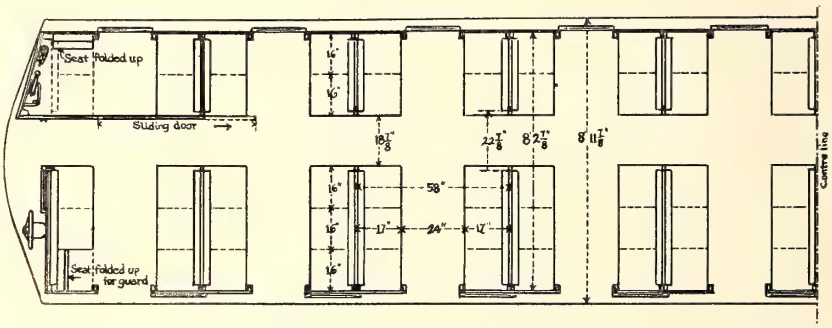
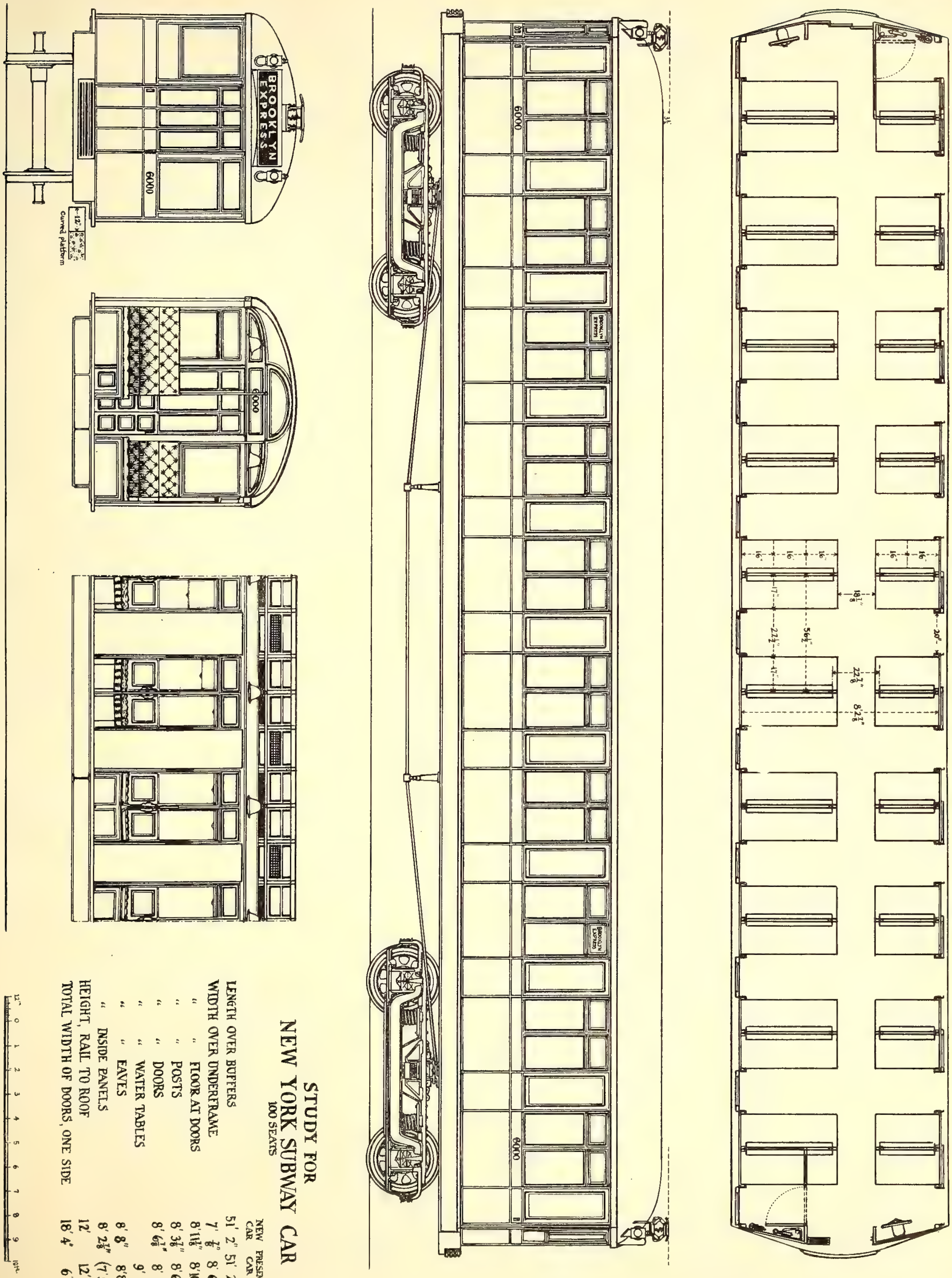


FIG. 15.—TYPE 4500. MOTOR CAR, 100 SEATS

Having reduced the car width to within the limits, car plans may be considered. Fig. 14, Type 4000, illustrates a 100-seat trailer, but with features that need improving. The guard operates the doors from a narrow end platform, which is the worst place to see from, but would have the economical advantage of allowing one man to look after two cars if sufficient time were given. The projecting step at each door ought preferably to be level with the car floor; and, as shown, would not fill up all the space between edge and car at a curved platform. Fig. 15, Type 4500, is a 100-seat motor car of better design. Here the guard stands inside the car on either side, in the space made by folding up one or two seats The cab by preference should extend across the whole front of the car, but that would shut off six more seats, of course, at the head of train. The brake wheel would be handier inside the car, but the end seats hinder this location. The position of the cab door when open can be seen in Fig. 12, in the issue for last week. The car floor merges at the doors into a continuous running board as on the London Metropolitan cars.

Fig. 16, Type 5000, has vestibules more like the present subway cars, for use by the motorman and guard. The latter can drop a window in the swinging outside door, and so easily look out along the platform as a train starts. This arrangement is the most satisfactory, but it only allows 90 seats to a car. In this type the doors can be operated by



STUDY FOR NEW YORK SUBWAY CAR

100 SEATS

	NEW CAR	PRESENT CAR
LENGTH OVER BUFFERS	51' 2"	51' 2"
WIDTH OVER UNDERFRAME	7' $\frac{7}{8}$"	8' $6\frac{3}{4}$"
" " FLOOR AT DOORS	8' $11\frac{1}{8}$"	8' 10"
" " POSTS	8' $3\frac{7}{8}$"	8' $6\frac{3}{4}$"
" " DOORS	8' $6\frac{7}{8}$"	8' $\frac{1}{2}$"
" " WATER TABLES		9' $\frac{1}{2}$"
" " EAVES	8' 8"	8' 8"
" INSIDE PANELS	8' $2\frac{1}{8}$" (7' $9\frac{1}{2}$")	
HEIGHT, RAIL TO ROOF	12'	12'
TOTAL WIDTH OF DOORS, ONE SIDE	18' 4"	6'

FIG. 17.—CAR TYPE 6000 WITH 100 SEATS

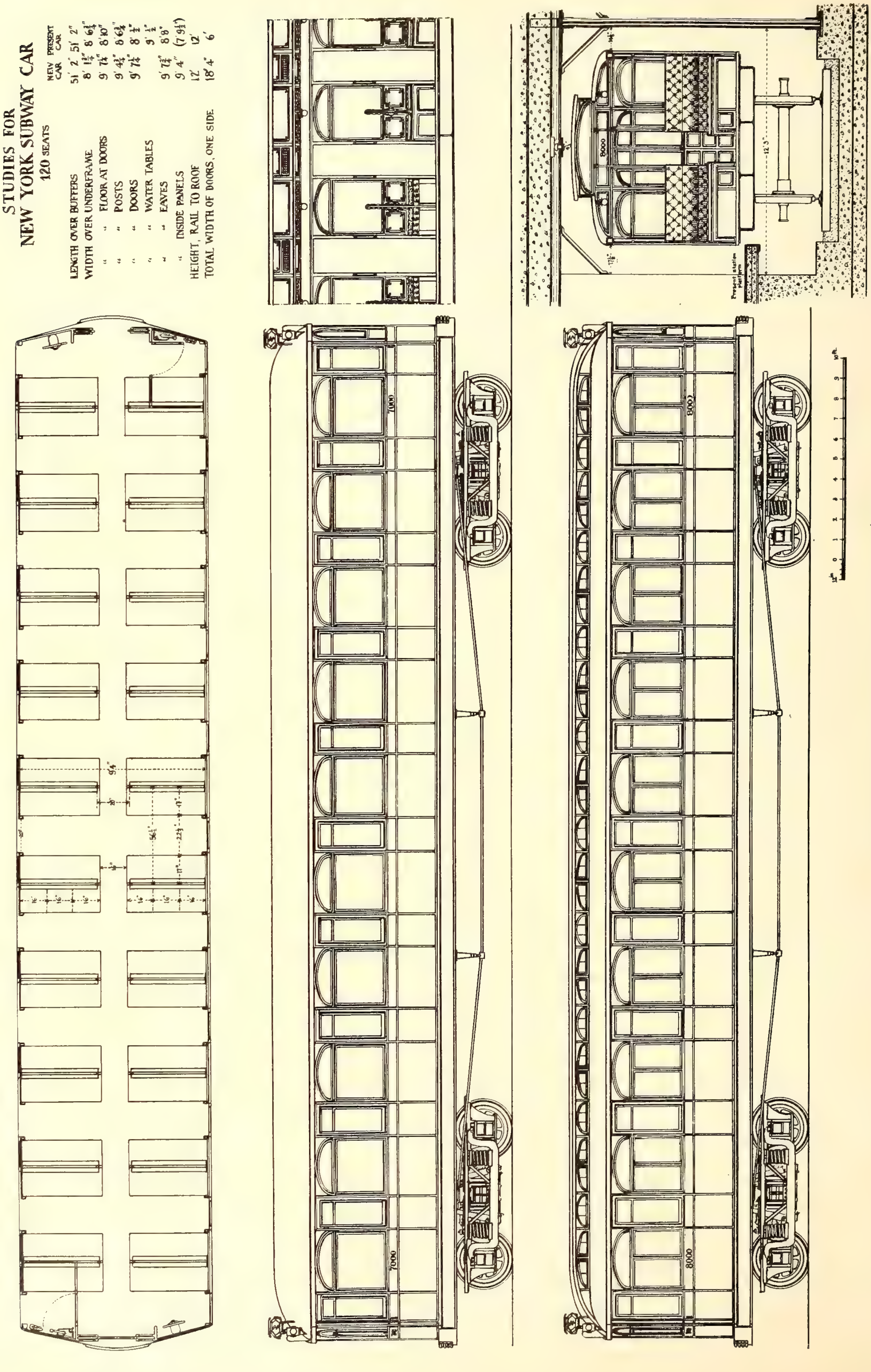


FIG. 18.—CAR TYPES 7000 AND 8000, WITH 120 SEATS

simple hand levers, as the levers are on the outside of each end partition. Of course all partitions inside any of these cars must be glazed so as to allow the guard to see through to operate the doors from either end and either side of the car.

The plan in Fig. 17, Type 6000, provides for eleven doors, instead of the previous ten, but makes the space between seats slightly less. Ten of the doors would be fastened to one operating rod, the other being opened by hand when needed, as it must move opposite to the others. The guard can stand at the end where this eleventh door is and open it or lower the window to see better along the station platform.

Fig. 18 follows the same general plan as Fig. 17, but widens the car out so as to get six seats and an aisle. The construction is lightened by omitting posts between the seats so as to give larger windows. This size of car seems the best for any new lines. An attempt has been made in Types 7000 and 8000 to give a more attractive appearance than with Type 6000, which follows the somewhat severe lines of the Midland cars of England. While it is customary to round the upper corners of doors on the most ornate cars now, it does not seem to look well with this side-door type, so square-topped doors are shown.

In the next and concluding installment of this article the author will take up the constructional features of this car, together with other facts to be considered in rapid transit work.

(To be continued.)

RECTIFIER FOR ELECTRIC LOCOMOTIVES

On page 1052 of the STREET RAILWAY JOURNAL for Dec. 1 a brief account was given of a system of electric traction proposed by MM. Auvert and Ferrand, engineers of the Paris-Lyons-Mediterranean Railway, in which the current supplied is alternating, while direct-current motors are used

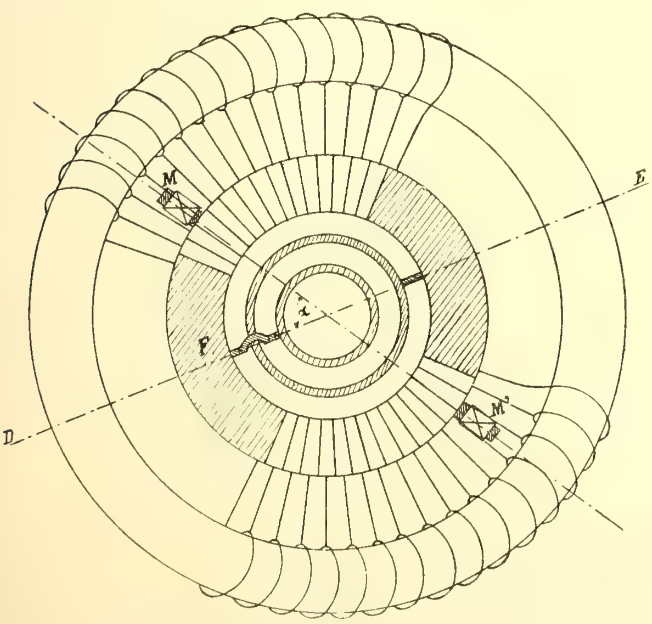


FIG. 1.—SCHEMATIC DIAGRAM OF AUVERT-FERRAND RECTIFIER

for driving the locomotive. The locomotive is equipped with a special form of "regulating rectifier," which receives alternating current at constant voltage and delivers direct current at a voltage which can be varied at will according to the demands of the driving motors. The novel feature of the system resides in the "regulating rectifier," the mechanical construction and electrical characteristics of which are discussed below.

Fig. 1 gives a schematic representation of the circuits of the "rectifier" reduced to a two-pole model. The commutator is made up of two large conducting segments which are connected directly to the alternating-current slip rings and between which are joined the two parts of the rectifier

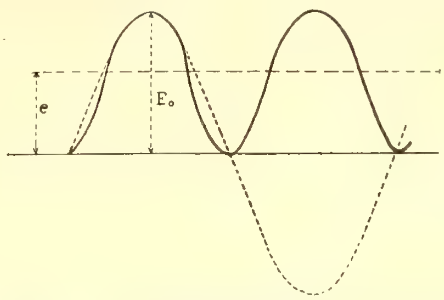


FIG. 2.—RELATION OF IMPRESSED AND DELIVERED ELECTROMOTIVE FORCES

winding, in addition to numerous small conducting segments tapped to the rectifier windings at regular intervals. The two pairs of the rectifier winding surround a continuous magnetic circuit, shown in the illustrations as being similar to a Gramme ring, but the parts are so arranged that current which passes from one large commutator segment to the other flows in such a way as to produce two magnetomotive forces in series in the magnetic ring. Thus when an alternating e. m. f. is impressed between the two slip rings, the windings and the magnetic circuit act in every respect like the primary winding and core of an alternating-current transformer, or, as the equipment is used, as the single winding of an auto-transformer. The small commutator segments serve as the contact devices for taps from the auto-transformer. Two brushes are arranged to bear continuously upon the commutator, which as noted above is formed of the two terminal pieces and the intermediate contacts of the auto-transformer. The addition of means for driving the commutator and auto-transformer in synchronism with the alternations of the supply current completes the essential details of the rectifier.

It will be apparent from a study of Fig. 1 that with the two brushes placed diametrically opposite each other the instantaneous value of the e. m. f between them will depend upon their mechanical position with reference to the terminal pieces of the auto-transformer, and upon the value of the e. m. f. impressed between them. If when the alternating e. m. f. has its maximum value the synchronously rotating element is in the position to cause each brush to be in the center of a terminal piece, then the time-value of the e. m. f. between the brushes will be similar to the heavy curve of Fig. 2, provided the alternating e. m. f. has a time-value similar to the dotted curve. Thus the delivered e. m. f. is unidirectional but fluctuates in value from a certain maximum to zero twice during each cycle of the alternating e. m. f. A little further consideration will show that the delivered e. m. f. can be given any value desired from the maximum to zero, by decreasing the arc of separation between the brushes from 180 degs. to zero. In practical operation the voltage impressed upon the direct-current motors is varied throughout the required range by shifting the brushes on the rectifier; on account of this characteristic of the machine it has been given the name "regulating rectifier."

As intended for railway use the machine differs in minor

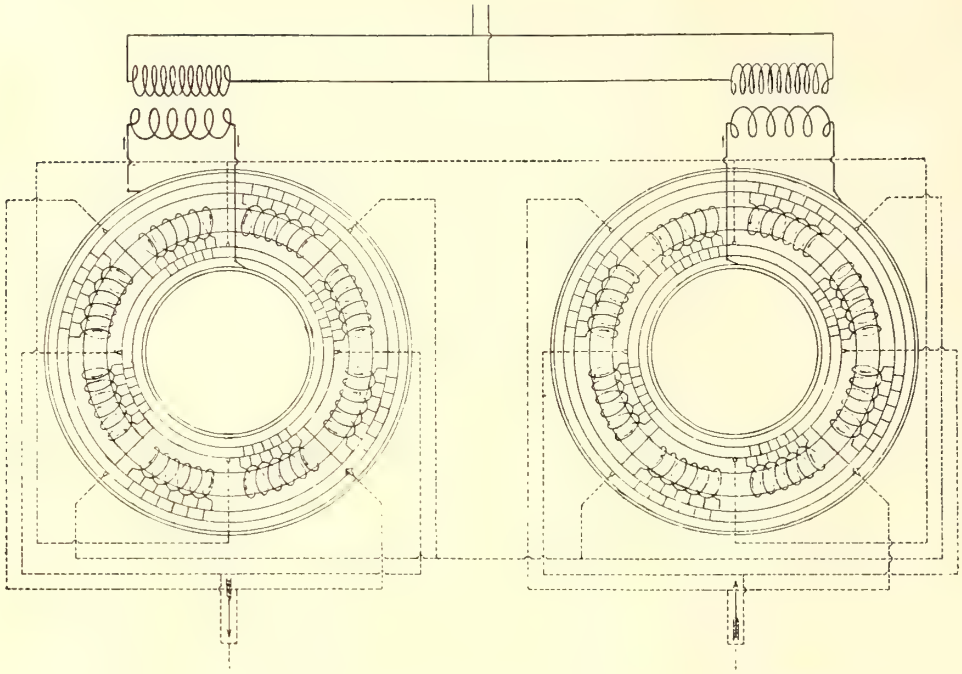


FIG. 3.—DIAGRAM OF CONNECTIONS OF A GROUP OF TWO RECTIFIERS

details from the simple bipolar model described above. Fig. 3, which is a diagram of the electric circuits of a rectifier equipment designed for railway work, shows that the high potential alternating current is fed in parallel to two step-down transformers whose secondaries are connected to the slip rings of two distinct rectifiers, the delivery circuits of which are joined in series. The series connection of the delivery sides of the rectifiers is desirable on account of the fact that each machine operates better at a lower than at a higher e. m. f., and the e. m. f. necessary for traction is greater than the value that can conveniently be obtained from one rectifier. It will be seen from Fig. 3 that each rectifier is provided with two commutators and two distinct sets of auto-transformer windings. This construction has been adopted for mechanical symmetry, and in order that the core material may be economically utilized. The two auto-transformer windings can be arranged for series connection, although the arrangement is somewhat simpler when they are connected in parallel, as shown in Fig. 3.

A plan view of two "regulating rectifiers" directly geared to a synchronous motor is given in Fig. 4, while a longitudinal sectional elevation of one of the rectifiers is shown in Fig. 5. It will be noted that the revolving element of each rectifier resembles somewhat the armature of a rotary converter except that it is provided with two commutators. A striking difference in mechanical details is found, however, in the fact that there is no part to correspond to the field structure of the rotary, and the machines are essentially different electrically in that there is no transformation of electrical into mechanical power and the rectifier proper is incapable of maintaining itself in motion. The synchronous motor serves merely to revolve the rectifier at synchronous speed, and it is relatively small in size.

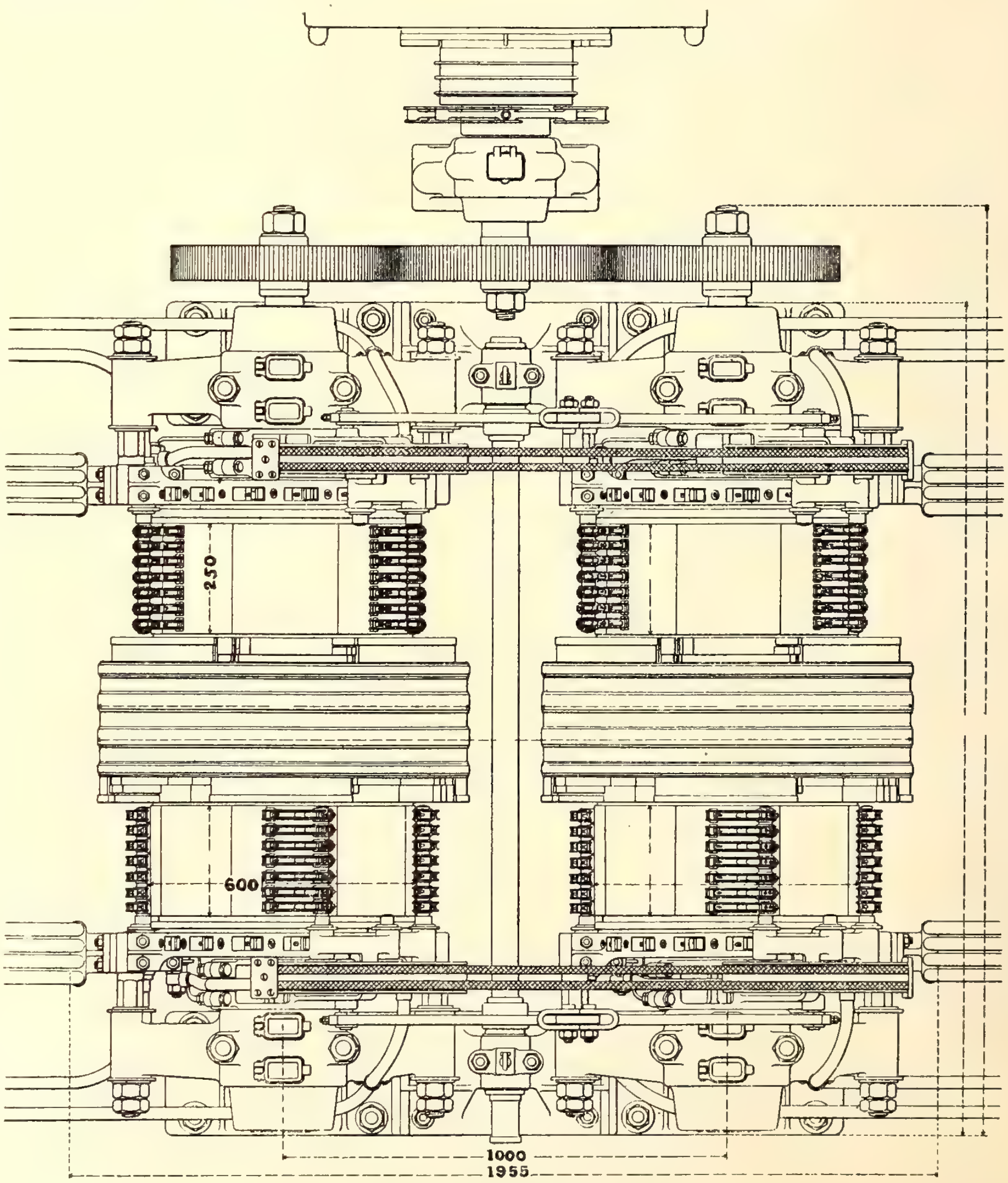


FIG. 4.—PLAN OF RECTIFIER

The rectifiers shown in Fig. 4 have a combined direct-current capacity of 400 kw at 235 volts, the alternating e. m. f. impressed upon each rectifier being 155 volts, the efficiency at full load being 91 per rcent. By shifting the brushes the e. m. f. can be varied from 20 to 280 volts with a constant supply pressure of 165 volts. It is stated that the commutation is excellent at 1500 amps., and that loads of 2100 amps. have been carried without difficulty. The locomotive to utilize this rectifier is now being built for the Paris-Lyons-Mediterranean Railway by the Alioth Electric Company, of Paris.

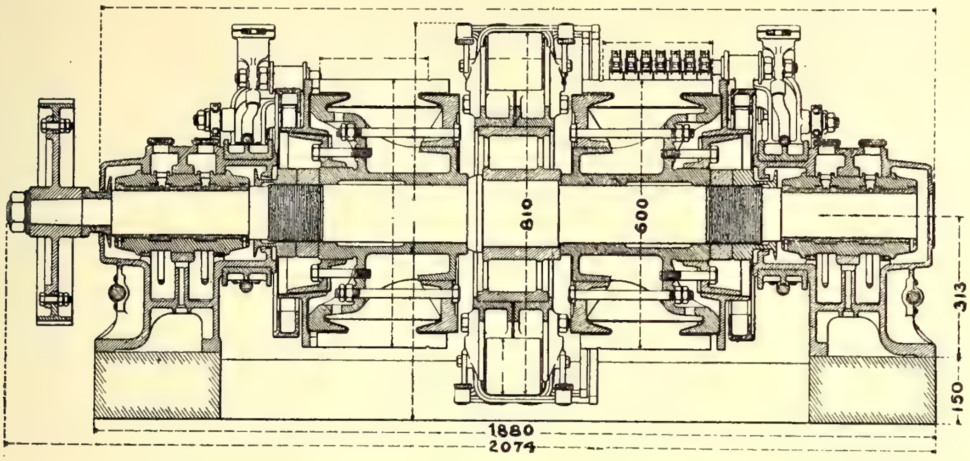


FIG. 5.—LONGITUDINAL SECTION OF RECTIFIER

IMPROVED TRACK CONSTRUCTION IN WASHINGTON STREET, BOSTON

In connection with a paper upon "Wood Block Pavements," recently presented by F. A. Kummer before the Boston Society of Civil Engineers, a brief discussion of the new track construction of the surface lines on Washington Street was given by Arthur L. Plimpton, civil engineer of the Boston Elevated Railway Company. The rails are supported on the usual 6-in. x 7-ft. tie construction, the ties being 30 ins. on centers. These in turn are supported in and on a continuous concrete beam extending 6 ins. below the bottom of the ties, and about 5.5 ins. above them, giving a total thickness of about 17.5 ins. These beams are connected by an arch of concrete, which gives about 5.5 ins. of concrete base in the middle of the wooden blcck pavement.

The wooden blocks recently laid on Washington Street are black gum of the South, which is a very tough, hard wood, with an irregular grain. If used in the shape of planks it is badly subject to warping, but if used in the shape of blocks it seems to have many advantages even over pine in some respects. It is a swamp wood and if untreated decays rapidly, but when thoroughly treated with a creosote oil mixture it resists decay and wears excellently. On account of its close and irregular grain it does not split as readily as pine, and the waste in handling on the street is less. It exists in large quantities in the South, and as it is not very useful for general lumber purposes the chances are good for getting it in large quantities and at reasonable prices for a considerable period. The foregoing points in this paragraph were brought out by Mr. Kummer. Mr. Plimpton stated also that previous experience on Beacon Street, where there were laid wooden blocks in 1901, showed the importance of doing the work in such a manner as to prevent water from working down at the side of the rail, so that when done there were no voids left in which the water could accumulate. In the work recently done of relaying the tracks on Beacon Street with wooden block pavement, the blocks themselves were laid on a layer of cement mortar and the joints filled with cement grout. Cement mortar was also filled in around the girder rails in the Washington Street track.

Cars were not run on the tracks on either Washington Street or Beacon Street until the concrete had been in place for ten days. The whole aim in this form of track construction is to eliminate all movement of the rail under passing cars as far as possible, and in some recent work in connection with brick pavement a form of screw has been used instead of the usual track spike, which, with its vastly greater holding power, will certainly help a great deal to prevent movement of the rails, and if the results justify the added cost it will probably be adopted instead of the spike in future work in connection with expensive forms of pavement.

PROGRESS ON THE WASHINGTON, BALTIMORE & ANNAPOLIS LINE

President George T. Bishop, of the Washington, Baltimore & Annapolis Electric Railway Company, says that there is little doubt that the road will be completed and in operation by the date originally set, July 1, 1907. Mr. Bishop is quoted as follows:

"Much of the track has been laid east and west of Odenton, about half way between Baltimore and Washington, and the bridge work is well under way. There will be no grade crossings on the line. We will not erect a power house at this time, deeming it best to wait a few years until we see what the electrical plants being erected along the Susquehanna River will mean in the electric power field. We have closed a contract with the Potomac Power Company, of Washington, and this company will furnish us all our current. There will be sub-stations erected along the line, contracts for their equipment having already been let.

"Our cars will be capable of a speed of 65 miles an hour, but we figure now that it will take 75 minutes to make the trip from the center of Baltimore to the treasury in Washington. We will give both express and local service and will also arrange for the handling of freight."

Arrangements have been made for an entrance into Baltimore over the tracks of the United Railways & Electric Company of that city. The Washington, Baltimore & Annapolis Electric Railway Company will lay a third rail in Baltimore on account of the difference in gage between its tracks and the city tracks in Baltimore.

The Indiana Union Traction Company has established limited service between Anderson and Wabash, Ind.

STANDARD CAR CONNECTIONS

BY H. SCHLEGEL

By standard car connections are meant connections such that a glance at any wire on a car will identify that wire whether it be tagged or not—in fact with recognized standard connections no tags or other identification marks are needed because a wire becomes identified by its position.

On small roads with uniform equipment the adoption of standard connections is a simple matter not likely to cause any confusion; on large systems representing absorbed roads of various equipments and methods, many obstacles are to be overcome. In any case if all devices—heaters, compressors, governors, headlights, car lights, switches, breakers, starting coils, arc light resistances, air tanks, sand riggings, brake riggings, car cables, etc., are located according to drawing, the task of running wires in stranded paths is much simplified. Where such standard location of devices is not observed, the task is more difficult, but satisfactory results can still be obtained, as far as the wires themselves are concerned, by running the wires in certain fixed relations to each other. To illustrate the advantages of being able to identify active wires, wheresoever they may be exposed, consider the proposition of standard motor circuit connections.

The first step toward standardization is an agreement as to the No. 1 end of the car. On a single-end car this is naturally the operating end and no further fixing condition is needed. Ordinarily, on double-end cars the No. 1 end is arbitrarily taken as the fuse box, register, resistance or wall-wire end; but on modern cars where these devices are or are likely to be duplicated such a rule is useless, for the "fuse box end" means nothing if there is one on both ends. Probably as good a plan as any is to take the cash register end, as it covers the possibility of two registers. If the registers are installed first, the electrical equipment must be installed accordingly and vice versa. In general, change the one that costs the least to change. An incidental advantage of having a fixed, recognized No. 1 end is that a motorman can readily tell the number of a faulty motor and avoid the hit-and-miss method of cutting it out.

Motors of different makes and even types of motor of the same make may rotate in opposite directions for apparently the same connections owing to the relations in which their field coils are connected. For example, the GE-57 and 67 rotate in opposite directions, so do the Westinghouse 68 and 101. The motor internal connections should be such that when the terminals are brought out of the frame according to a standard rule, the same polarity of field and armature terminals will produce on all motors the same direction of rotation; otherwise the wiremen cannot tell how to connect the motors of the car wires so as to move the car as indicated by the controller reverse handle. When no rule is observed in bringing out the terminals, the final results are a loss of time in connecting the motors, especially on a four-motor car, delay in locating the affected part in times of trouble and confusion in reconnecting after replacing a controller, motor or equipped truck.

Where the kinds of motor in use are too numerous to make the changes necessary to have all rotate in the same direction for given connections, the motor leads can be brought out according to rule; then the motors will be recognized as divided into two classes—those that rotate clockwise and those that rotate counter-clockwise for given connections, facing the commutator end. Suppose that experiment shows the rotation of an armature to be clockwise for certain connections; for example, the long B. H. lead being made T or $+$, the short B. H. lead being connected to the top field terminal and the bottom field terminal being grounded. Having thus determined the field and armature polarity that produce clockwise rotation, the wiremen know how to connect the motor to turn, hence move the car, in a certain direction, because: (1) All No. 1 controller A wires and F wires are $+$ and all AA and E wires are —. Then to make the armature rotate clockwise it is only necessary to make the left-hand B.H. or long lead A, the right hand B.H. AA, the top field terminal F and the bottom field terminal E or G. With a standard observed rule for bringing the terminals out of the motor it is unnecessary for the wiremen to look into the motor to identify the wires, for he knows that the long B.H. lead, say the one to be made A to secure clockwise rotation, comes out of the top bushing, the short one out of the next, the F field terminal out of the next and the bottom or E field terminal out of the bottom bushing.

Having the leads of both motors brought out in absolutely the same manner, the next step is to select an invariable order for bringing them through the spreader that separates and supports the terminals where they issue from the bushings. This order is arbitrary to a certain extent, but should be suited to that observed in connecting the controller car wires to the junction boxes. Assuming the junction boxes to be in place on the car, suppose that the rule adopted for connecting the No. 1 controller wires to them be as follows: facing the junction box the order of connecting controller car wires to it, counting from the right is A, AA, F, E, G. Irrespective of the position or angle in which the junction box is supported, the wireman then knows that when facing it single A lies to the right and G to the left, the other wires lying in regular order between them. If the order of bringing the motor terminals through the spreader, facing the spreader, be made just the reverse of this, the spreader wires can be brought to the junction box in the same order as they leave the spreader and car wires and motor wires of the same name thereby connected together, because since the spreader and junction box face each other what is to the right when facing one will be to the left when facing the other. When a wireman is ready to connect the motors after the trucks are run under the car, he knows that facing the junction box the single A is to the right, and that facing the spreader, the single A is to the left, G being at the opposite end in both cases. Furthermore, he knows when facing the commutator end which armature terminal and which field terminal must be made $+$ to have the armature rotate clockwise. As the top of the armature moves in the direction opposite to that in which the car moves, owing to the gearing between the armature and axle, it is an easy matter to tell in which direction the armature should rotate.

If the car is to move to the right, then, facing the commutator end, with the motor occupying relatively the same position that it will hang on the car, the top of the armature must move to the left, which means that the armature must turn counter-clockwise. If the car is to move to the left, then the top of the armature must move to the right and the armature must turn clockwise. Knowing the rotation for given connections, and knowing that all motor connections and controller-junction box connections are the same, a wireman can connect a motor up right the first time irrespective of its position on the car.

Suppose that on connecting up a car in the accepted standard manner one of the motors turns in the wrong direction. If ringing out the connections of the No. 1 controller to the junction boxes shows them to be right (the armature connec-

tions are always reversed in the No. 2 controller) and inspection shows the motor terminals are brought out of the bushings, through the spreader to the junction box in regular order, then the reversed rotation must be due to an irregularity in the controller or in the motor itself. If ringing out proves the controller internal connections correct, then the probabilities are that the motor has a so-called "left-hand armature."

In actual service on a road employing four-motor equipments of 57, 67, 80, 52, 58, 1000 and 800 (G. E.) and 56, 12A, 68, 49 and 101 Westinghouse, the 57, 1000 and 101 motors were in one similarly rotating class and the rotation of other motors was opposite. The standard features on all were those indicated. The instructions given the wiremen were: "On 57, 1000 and 101 equipments run motor wires straight from spreader to junction box on motors 1 and 3. Cross armatures on motors 2 and 4. On all other equipments cross armature terminals on motors 1 and 3 and run all wires straight on motors 2 and 4."

Standard starting coil connections greatly lessen the probability of getting the resistance wires confused and minimize the time of connecting or reconnecting after disconnecting for testing or equipment changes.

Standard disposal of the frames composing the starting coil may have to be limited to always placing the No. 1 frame toward the No. 1 end of the car, this limitation being imposed by the fact that the manner of placing the frames must be suited to the available room under the car—a very variable factor. However, if the R1 end of the No. 1 frame is so placed, the No. 2 frame being placed next, and so on, and the resistance wires out of the cable are brought through a spreader in the same order, the resistance wires will connect consecutively, and any confusion in the connection will be readily noticed.

The ideal starting coil connection is realized when the frames have their terminals on one side and the available floor space is such that the frames can be installed in a row. When the frames must be installed in a row along the short center line of the car, a very desirable way to install them, the No. 1 frame can be so placed that it is to the right or left of a person standing in the center of the car and facing the No. 1 end.

The preceding are merely suggestions adapted from actual experience in standardizing connections on a system employing ten kinds of motor equipments. The method to be pursued and the extent to which the standardizing idea can be carried depends on the complications existing in particular cases. In all cases, however, time, labor and material can be saved by the adoption of standard connections, the positions of the wires being fixed with the guiding object of keeping the most positive wires at one extreme position and the most negative at the other. Such connections rigidly enforced have proven an efficient check on the connections of field, and armatures from the winding room and on repair controllers. They have decreased air governor troubles incident to confusion of the governor wires, and have emphasized the desirability of having apparatus installed according to a layout adapted to the greatest possible percentage of the total number of cars maintained.

The through run between Dayton and Toledo over the Dayton & Troy, Western Ohio and Toledo Urban & Interurban lines has proved so successful that the companies have united in an agreement to purchase ten new cars at once to be used exclusively in this service.

NEW TYPE OF INSULATORS FOR HIGH TENSION RAILWAYS

The Vereinigte Isolatorenwerke Actiengesellschaft, of Berlin-Pankow, Germany, whose pioneer work in high-tenson insulation was described in the Aug. 11, 1906, issue of this paper, has just brought out a line of insulators for high-potential railway service. They are made under the Kleinsteuber patents. The metal cap in these insulators is distinct from the bell which is made of insulating material and is molded into a threaded ring which screws into the cap. This gives a long distance between the cap and the insulated bolt

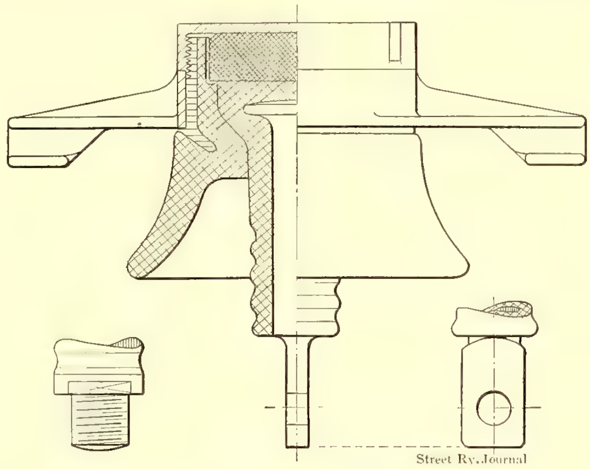


FIG. 1.—STRAIGHT LINE HANGER

and reduces surface leakage. Between the head of the insulator bolt and the metal cap there is a disc of insulating material. The lower end of the bolt varies in form according to the type of suspension adopted for the wire. Fig. 1 shows an insulator used on tangents, and Fig. 2 one for curves. The insulation of the trolley wire from the line insulator suspension is really double, first, because the insulator bolt is molded in insulating material, and second, because the bolt is also surrounded by a housing of insulating material.

During a dry test of the insulator shown in Fig. 1, no arc between the trolley wire and suspension took place until

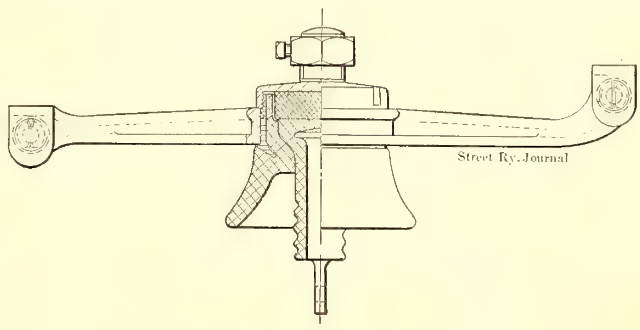


FIG. 2.—DOUBLE-CURVE HANGER

reaching the potential of 48,000 to 50,000 volts at 50 cycles; and in an artificial rain there was no arc until the potential exceeded 20,000 volts. When tested for mechanical strength, the insulators showed that they were capable of standing a vertical strain of 2500 kg (5500 lbs.) without any other deformation than a light bending of the suspension arms. After this test the insulator was subjected to 20,000 volts for half an hour, yet no electrical defects were discovered.

When these insulators are to be used with 12,000 to 15,000 volts supporting insulators are bolted to the bracket arm 1

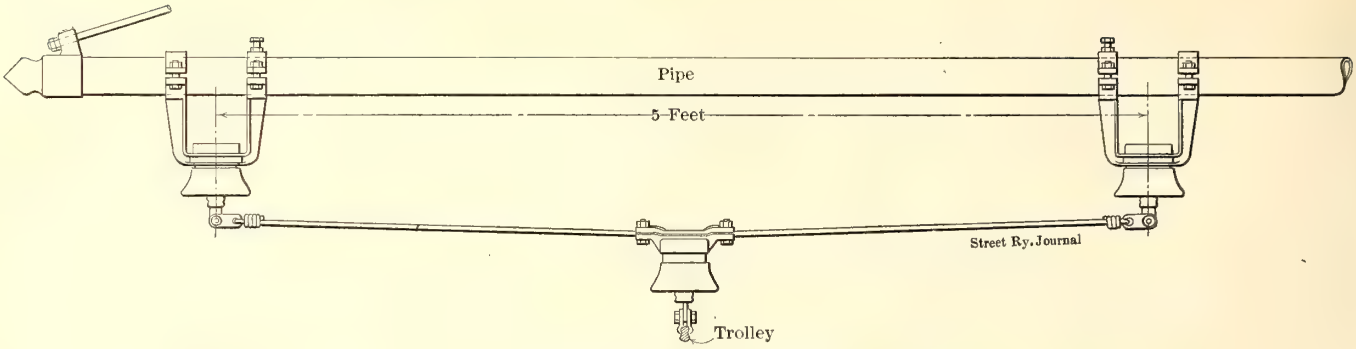


FIG. 3.—BRACKET CONSTRUCTION FOR TROLLEY LINES USING 10,000 VOLTS OR OVER

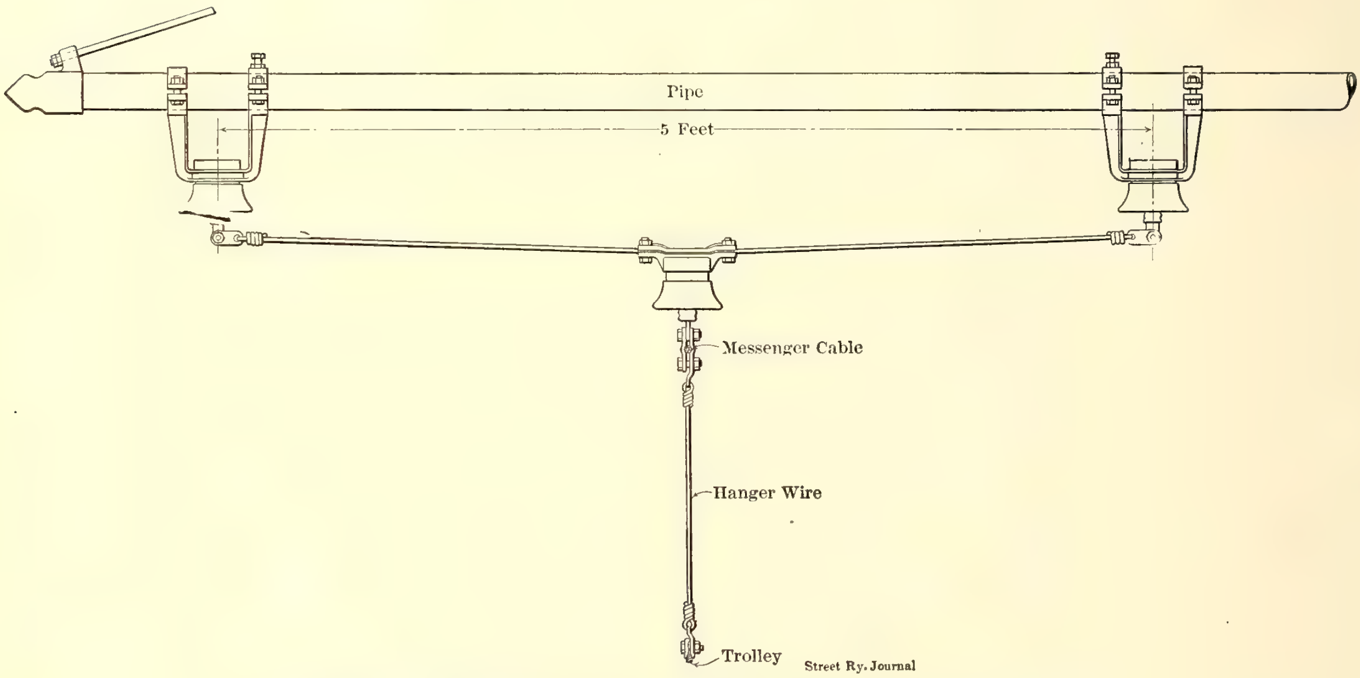


FIG. 4.—CATENARY CONSTRUCTION FOR STRAIGHT TRACK AND HIGH POTENTIALS

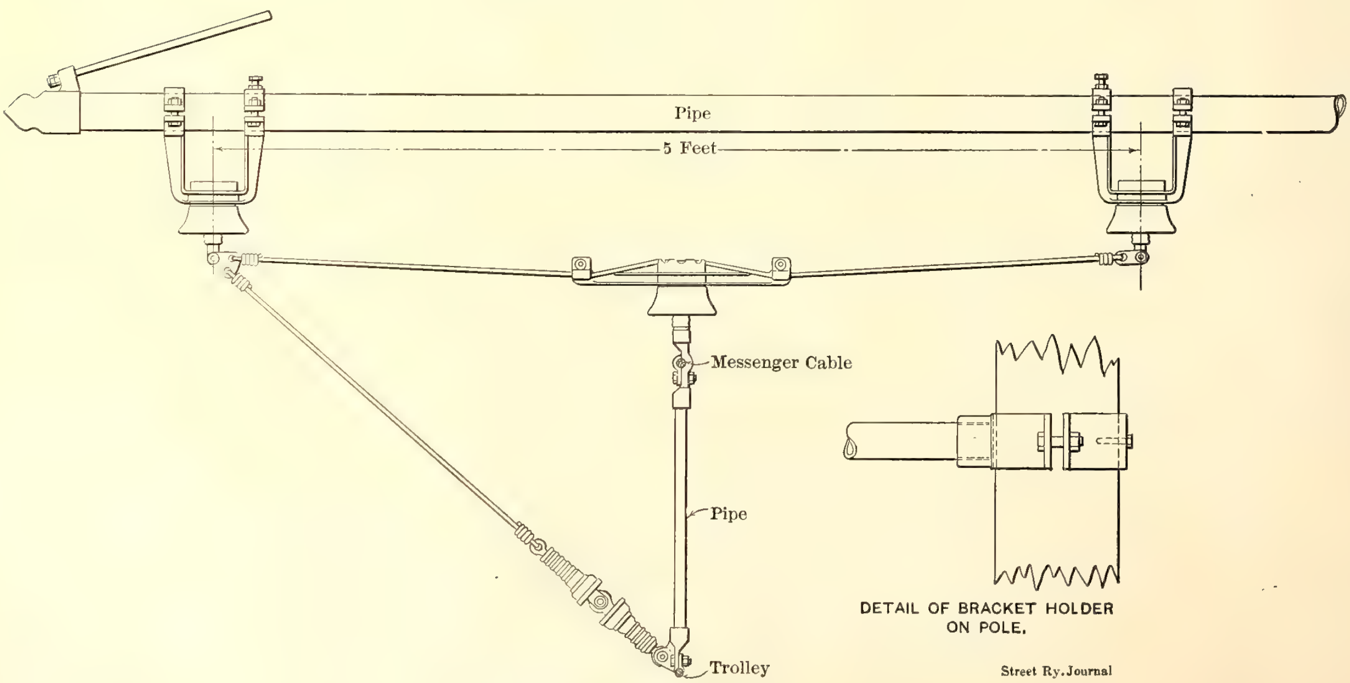


FIG. 5.—CATENARY CONSTRUCTION FOR CURVES AND HIGH POTENTIALS

meter to 1½ meters (3 ft. 3 ins. to 5 ft.) apart. As shown in Fig. 3, a span wire is then connected to the lower end of the bolts of the side insulators and the trolley insulator hung from its center. The suspension is therefore flexible, but the insulation is quadruple, since each insulator in itself is doubly insulated. Mechanical injury to the bolt would still leave

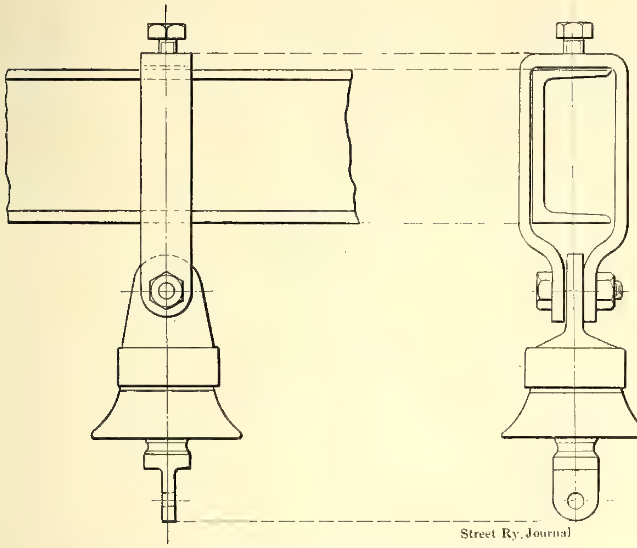


FIG. 6.—HINGED SUPPORT FOR HANGER

the insulating bell unimpaired, and vice versa. For potentials under 10,000 volts, a less elaborate arrangement than this is sufficient.

Similar construction is used for curves, except that the insulator to hold the curve is so constructed that it can not slide on the span wire. This method may also be used for catenary construction, in which event the lower end of the trolley insulator bolt is furnished with a clamp for the messenger cable, and the trolley wire is then suspended in the usual manner as shown in Fig. 4. To prevent the trolley wire from getting out of position at curves, the hanger wire is replaced by a piece of pipe the lower end of which is connected by a guy wire and strain insulators to the insulator on the outer side of the curve. This arrangement is shown in Fig. 5.

Fig. 7 shows a construction for catenary lines having a trolley voltage of 1000 to 5000 volts, where but one insulator is needed. In this case the insulator can be attached directly to the bracket or cross-arm. The clamp for the messenger wire is on the lower end of the insulator bolt. In this instance it is not necessary to have a flexible suspension for the trolley wire, as the connection of the latter to the catenary is such that bow-type current collectors will have no difficulty in maintaining contact. For these lower potentials a somewhat smaller insulator is used. The construction differs from the others only in the manner of hanging, which allows a double movement of the trolley wire. For instance, as shown in Fig. 6, the bell may be so made that the insulator can swing toward the trolley pole, and the flat construction of the insulator bolt allows movement in the direction of the trolley wire. This turning power of the insulators reduces the strains on the overhead line at high speeds.

Insulators of this type are now in use on the experimental high-tension direct-current line of the Vienna City Railway, which was described in the STREET RAILWAY JOURNAL of Nov. 3, 1906.

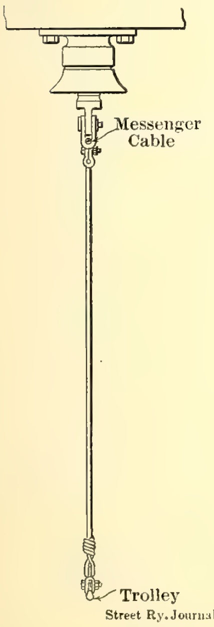
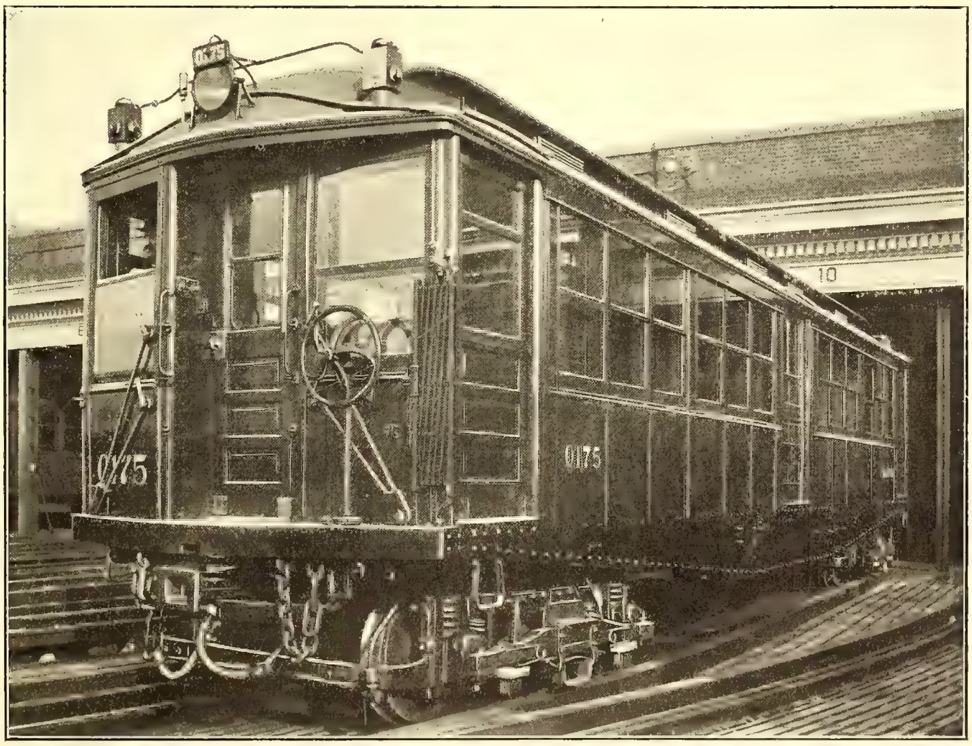


FIG. 7.—CATENARY CONSTRUCTION FOR VOLTAGES BETWEEN 1000 AND 5000

NEW CAR EQUIPMENT FOR THE BOSTON ELEVATED RAILWAY COMPANY

Forty-five new elevated cars, embodying the latest developments in the construction of steel passenger coaches, will shortly be placed in service on the lines of the Boston Elevated Railway Company. The new cars are being built by the Pressed Steel Car Company, and each is to have pneumatically-operated doors, one door being at each end with one in the middle of each side; a motorman's cab in the right-hand corner of each end, made of a combination of swinging doors, separate from the car doors; pantagraph gates, fire-



EXTERIOR VIEW OF STEEL CAR FOR BOSTON ELEVATED

proof floors, sides and vestibules. Each car is to be equipped with two General Electric "68" motors, two Brill trucks, General Electric type M automatic control, and Westinghouse electro-pneumatic brakes with graduated release and quick recharge features. One of these cars was exhibited at the Columbus Convention, but technical details will be of interest.

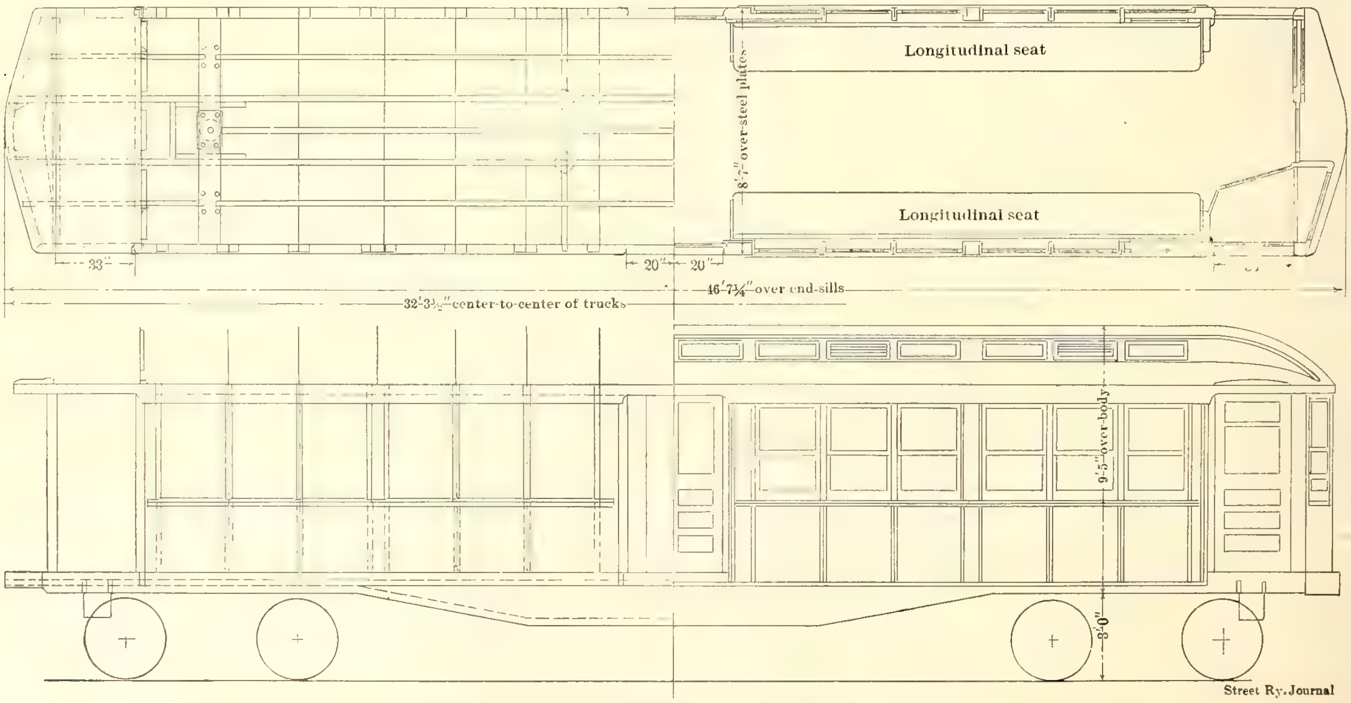
The new cars are of the "easy access" type, 46 ft. 7¼ ins. long over platforms, 8 ft. 7 ins. wide over the sheathing and 9 ft. 5 ins. high from the bottom of the sill to the top of the roof. The middle side doors are 3 ft. 4 ins. wide and the end side doors are 33 ins. wide. The seating capacity is forty-eight passengers.

The approximate weight of each car body is 26,000 lbs. The underframes are built entirely of steel, with side sills of special design. The center sills are built of 9-in. channels and the end sills are of steel. Each end of each car is provided with anti-telescoping plates on the top and bottom of the platform supports. All the posts are of steel and the double post section is made of T's, while corner and door posts are made of special shapes of pressed steel. A place is provided in the window posts in the rear end and side door pockets to receive an air cylinder for the operation of side doors.

The window sills are made of steel of special shapes, and the bracings and panelings of the double posts are of steel. The main panels are made of steel ⅛ in. thick riveted to the structural framing, the joints being painted before the panels were placed. All steel paneling is made in cold rolled sheets, and the top plates are made of steel, each plate running the full length of the car. Roof supports are also of steel, rafters being shaped to form a camber in the roof. Intermediate rafters are built of wood. The roof covering consists of ½-in. tongued and grooved whitewood, covered with cotton duck laid in a thick paste of white lead and linseed oil.

INTERIOR VIEW OF BOSTON ELEVATED CAR

There are eight copper gutters, one at each end over the hood, one over each side door and one over each side of each end platform, strengthened by a steel wire running the full length of the top of the gutter. Vestibules are constructed in the same manner as the car body, all uprights and cross material



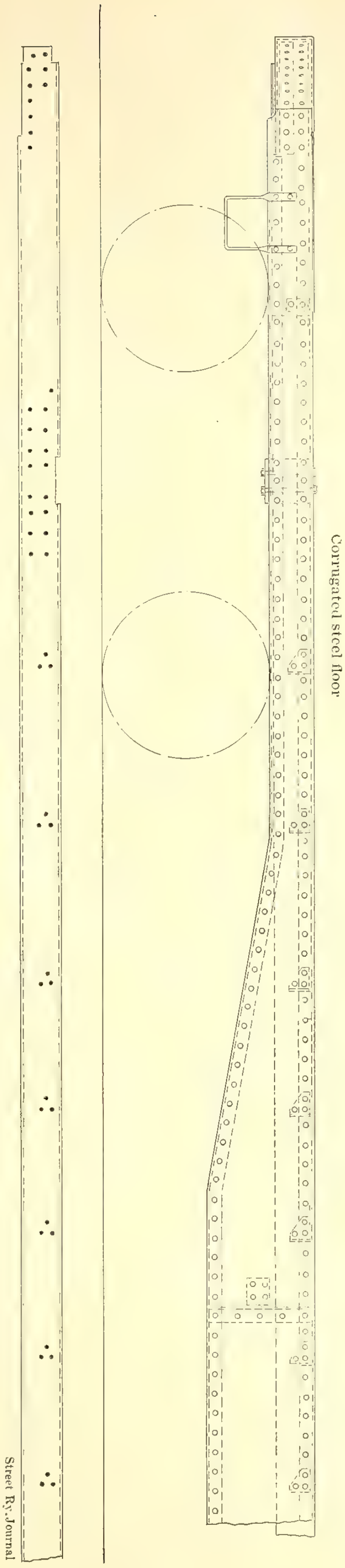
GENERAL ARRANGEMENT OF ELEVATED CAR

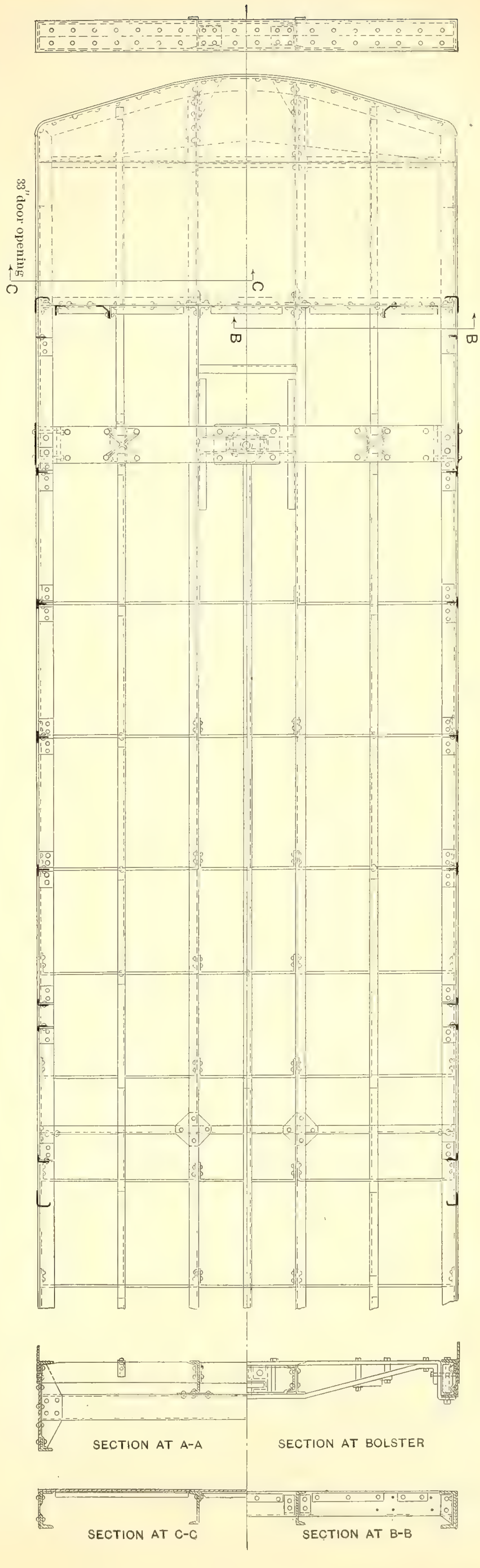
being of structural and pressed steel. The vestibule ceilings are made of steel, with an overhead pocket lined with transite, for the reception of switches. Each car is equipped with Perry copper ventilators. Vertical hand brake wheels are provided on the end of each car.

The pantagraph gates are constructed of 1-in. channel iron,

and the gates are of sufficient height and length to permit easy opening when the car platforms swing on a reverse curve of 82 ft. minimum radius, and also under changes of grade. Draw-bars and couplers are of the Van Dorn pattern, the sector bar being curved and made of ½-in. x 4-in. x 3-in. angle-iron, according to the Boston Elevated standards, and the draw-bars are of sufficient length to permit of full swing on 82-ft radius curves. The center plates are similar to the center plates of the company's standard, except where they fit the steel underframe, with a 1 13-16-in. hole drilled to receive the 1¾-in. king bolt.

The doors are made of mahogany and are equipped with rubber stop blocks to prevent the breakage of glass and elastic strikers to prevent injury to passengers in case any part of the person should be caught between the door and the casing. The interior paneling under the windows, and the window casing and sashes are of steel, as are all the principal moldings and head linings. The only wood in the car, outside of the doors, is the floor mat. The doors are hung with Coburn's anti-friction door sheaves and fitted with bronze anti-rattlers at the bottom. There are no bulkhead doors in these cars, but there is a steel finish at each end of the longitudinal seats. The advertising moldings are steel, rabbitted to take care of 11-in. cards. Trimmings are, in the main, of solid bronze. Curtains are of double-faced Pantasote, mounted on 1-in. Hartshorn rollers. The aisle and seat widths are of the standard Boston Elevated dimensions.





GENERAL ARRANGEMENT OF UNDERFRAME OF STEEL CAR FOR BOSTON ELEVATED SYSTEM

The principal data and truck dimensions are:

Wheel base, 6 ft.; diameter of motor-truck wheel, 34 ins.; diameter of trailing-truck wheel, 31 ins.; height, top of center plate above rail, car not loaded, 34 ins.; above with car loaded, 31 ins.; weight of car body, complete with electrical and air-brake apparatus, 34,000 lbs.; weight on motor-truck end, 52 per cent; weight of load, 18,750 lbs.; journal dimensions, 4¼ ins. x 8 ins.; wheels, M. C. B. standard, with steel tires.

EXECUTIVE COMMITTEE OF ENGINEERING ASSOCIATION MEETS IN NEW YORK

A meeting of the executive committee of the American Street & Interurban Railway Engineering Association was held this week to draw up plans for the work of the association during the coming year and select subjects for the next convention. A comprehensive plan, covering all branches of the service, was decided upon.

The committee met at the Transportation Club in New York on Monday, Jan. 7, and the following members of the executive committee of the association were in attendance: President H. H. Adams, of Baltimore; Vice-President F. G. Simmons, of Milwaukee; F. H. Lincoln, of Philadelphia; F. N. Bushnell, of Providence; W. T. Dougan, of New York, and Secretary S. W. Mower, of London, Ont. By invitation Secretary B. V. Swenson, of the American Street and Interurban Railway Association; H. W. Blake, C. B. Fairchild, Jr., and F. W. Lane were also present.

President Adams referred to the excellent work accomplished by the committees last year, and said that he expected that a great deal could be accomplished in the same manner this year, and that he hoped for even better results. He also said that all legitimate expenses incurred by committees or their members in the future would be defrayed by the association. He then remarked that one very forceful suggestion in regard to the work of the coming year was contained in the address delivered by President Rhoades, of the Claim Agents' Association, before that body in Columbus. President Rhoades had referred to accidents which occur from different defects in car equipment, and it had been suggested that the Engineering Association might work in conjunction with the Claim Agents' Association, so that the latter would suggest points to be remedied and the former take up the actual methods of overcoming the troubles. The question of a joint meeting with the Claim Agents' Association during the 1907 convention was considered and the following resolution, introduced by Mr. Simmons, of Milwaukee, was passed:

Whereas, there are many mechanical details in connection with the construction and operation of electric railways, which are of great importance to the claim agents of the various companies and regarding which they may desire to suggest alterations and improvements in present practice:

Therefore, be it resolved, that the executive committee of the Engineering Association hereby expresses to the Claim Agents' Association its desire that this matter be given consideration at their discretion, and such suggestions made and such action taken as may seem desirable;

And, be it further resolved, that in the opinion of the executive committee of the Engineering Association this matter should come up for comprehensive consideration at a joint meeting of the associations during the 1907 convention.

Mr. Lincoln, of Philadelphia, was appointed by President Adams a committee of one to take up this subject with Mr. Rhoades, and to report at the next meeting of the executive committee of the Engineering Association the best method of accomplishing the end in view.

Returning to the subject of papers, it was decided to ask Mr. Winsor, of Boston, to present a paper on gas engines in continuation of that read by him at the Columbus meeting. Such a paper could describe the experience of the present year with the gas-engine installation of the Boston Elevated Railway Company. Secretary Swenson announced that in the printed proceedings of the Columbus convention there would be an addendum, contributed by the author, to Mr. Winsor's paper on gas engines, giving the results of extended tests on the economy of the gas engines of the Boston Elevated Railway Company. The committee also voted to request W. W. Cole, general manager of the Elmira Water, Light & Railroad Company, to present a paper on the experience of that company with gas engines. Subsequent to the meeting Mr. Cole, who has made a very thorough study of the subject, consented to present this paper. Two papers on the subject of steam turbines were also decided upon. One of these will be presented by one of the engineers connected with the Philadelphia Rapid Transit Company, and F. H. Lincoln of that company was appointed a committee of one to arrange with his engineering department for its preparation. This paper will take up the subject of the practical operation of steam turbines, of which a great many types are in use by the Philadelphia Rapid Transit Company, including high and low-pressure, vertical and horizontal. It was also decided advisable to endeavor to secure a paper on the theory of the steam turbine, and Messrs. Swenson and Simmons were appointed a committee to secure such a report if possible from some high engineering authority on the subject.

The next subject of discussion was the question of standardization. The following were appointed the committee for the coming year: H. H. Wallerstedt, chairman; H. A. Benedict, of Albany; W. H. Evans, of the Indiana Union Traction Company; H. B. Fleming, of Chicago; J. M. Larned, of Pittsburg; H. W. Blake, of New York, and C. B. Fairchild, Jr., of Cleveland. The president stated that it was the earnest wish of the association that the committee on standardization should prosecute its work very diligently during the coming year and should arrive, if possible, at definite recommendations at least in regard to certain parts of car equipment.

The next subject discussed was that of track construction, and President Adams announced the appointment of the following committee, which was ratified by the executive committee: F. G. Simmons, of Milwaukee, chairman; Thomas K. Bell, of Philadelphia, and C. A. Alderman, of Cincinnati. Mr. Simmons, chairman of the committee, was asked to outline his views on the work of the way committee for the coming year. In reply he stated that he expected to be able to secure a paper which would cover the care of roadbeds and right of way for both urban and interurban lines. This paper would consider such branches of the subject as sprinkling, removing weeds, painting poles and other questions relating to the up-keep and general appearance of the roadbed. W. T. Dougan, engineer of maintenance of way of the New York City Railway Company, agreed to prepare a paper on "Rails and Rail Joints in New York City." It was also decided to commence an investigation of the subject of rail corrugation. Mr. Simmons reported that in Milwaukee the corrugations would appear in certain sections of track for a distance of two or three blocks and would not occur in other sections of track used under apparently similar conditions and laid with rails which were procured from the manufacturers at the same time and which were presumably rolled on the same day. Mr. Dougan reported that the corrugations in New York appeared principally on rails adjoining track intersections. Secretary Swenson was requested to secure information from the different railway companies in the association which had experienced trouble with corrugation, and the chairman of the way committee agreed to prepare for Secretary Swenson a list of questions on this subject to be included in a data sheet to be sent to the members. The way committee was also requested to secure data for presentation at the 1907 convention in regard to concrete ties, and to

investigate the extent to which these ties were being used or tested by steam railroad companies.

The following committees were then appointed: Committee on Control—J. S. Doyle, chairman; G. J. Smith, of Kansas City, and P. N. Jones, of Pittsburg. Committee on Maintenance and Inspection of Electrical Equipment—E. T. Munger, of the West Side Elevated Railway, Chicago, chairman; John Lindall, of Boston; W. D. Wright, of Providence, and L. L. Smith, of Schenectady.

R. B. Stearns, general manager of the Chicago & Milwaukee Electric Railway Company, of Highwood, Ill, was appointed the nominee of the association for the insurance committee.

The next, and final, subject for discussion at the 1907 convention was that of rolling stock. The first topic considered was the question of car cleaning, but as this duty related so closely to the operating department the association requested Secretary Swenson to inquire of the executive committee of the American Street and Interurban Railway Association whether in its opinion the subject lay within the province of the Engineering Association. Two other subjects were then selected for consideration at the next convention and committees were appointed to take up a study of them. The first related to the storage of cars in the open or under roof, and the committee appointed was: E. W. Olds, of Milwaukee, chairman; Martin Schreiber, of Newark, N. J.; John Hanf, of Buffalo. The second related to the design of operating and storage houses, and the committee appointed to study this subject was: F. N. Bushnell, of Providence, chairman; R. C. Taylor, of the Indiana Union Traction Company, and Nelson W. Graburn, of Montreal. It was decided to ask the technical press to co-operate with this latter committee in the preparation and publication of a series of plates illustrating the latest designs in car-house construction.

The final subject considered was that of the date of meeting. It was the consensus of opinion of the committee that the first meeting should be held on Monday afternoon of the convention week and that succeeding sessions should be held on the following mornings and afternoons until the convention was over. It was agreed with Secretary Swenson, of the American Association, that all the papers should be in his hands for printing by July 1.

The meeting then adjourned.

CREATING WINTER PLEASURE TRAFFIC ON THE WORCESTER & HOLDEN STREET RAILWAY

How a management can develop a successful business on its line during the dull winter season has been demonstrated by the Worcester & Holden Street Railway, running from Worcester out through Holden to Jefferson, Mass. Two winters ago the superintendent of the road, Albion B. Clapp, decided to try the experiment of a real winter toboggan slide made from snow and ice as an attraction for traffic during the months when traffic is usually lowest. Mr. Clapp was confident of the financial value of the slide, and built it as a private affair. Its success was immediate, and it has since proved extremely popular, drawing a large patronage to the road on the very coldest winter days and nights. The normal traffic of the road has been more than doubled, and besides adding to the profits of the company does much good in the form of advertising.

The slide is located in Jefferson near the end of the road on the side of a steep hill which descends at an average grade of 20 per cent for 500 ft., then for a distance of 300 ft. runs up grade to the banks of Eagle Lake, where the slide drops very abruptly to the lake and the toboggan glides out over the ice for several hundred feet. It is a thrilling sport and its popularity was assured from the start. The railway company supplies the power for numerous lights. As many go to look on as to participate in the fun.

After the trenches are put in condition, the expense of maintenance is not large. Car men are ready to put in a little extra time at the starting platform and can always be secured at short notice. One man on each slide is needed

AT THE HEAD OF THE DOUBLE TOBOGGAN SLIDE

to load up and send away the toboggans—they being started not nearer than fifteen seconds apart.

The toboggans are rented out at a small charge per hour, and in spite of the opportunity for deception no trouble is experienced in getting in all the money. A large rough building at the head of the slide was built as a storeroom for toboggans and is used also as a lunch room. The slide is about 1600 ft. in length and very fast, but no serious accidents have occurred.

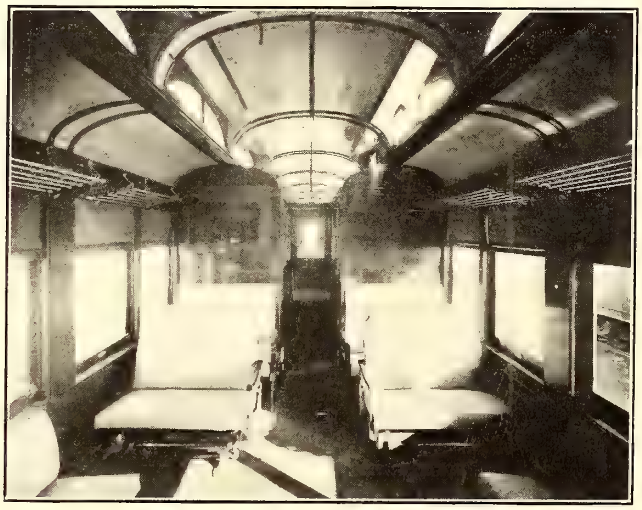
As a drawing card for traffic nothing better has been offered, for on the coldest nights, with the thermometer below zero, hundreds come out to try the sport. It is of

IN FULL CAREER DOWN THE ROUTE

course only in the cold countries that a sport like this can be maintained, but where a trolley road can take advantage of the climatic conditions, the severity of the northern winter can be made a source of profit. The toboggan slide idea was originated by Mr. Clapp, to whom thanks are due for the information contained in this article. The illustrations are reproduced from two of the different styles of souvenir post cards sold by the company.

SOME UNUSUALLY WIDE INTERURBAN CARS FOR A SOUTHERN ROAD

Some cars recently completed by the St. Louis Car Company for the Richmond & Chesapeake Bay Railway Company have several features which are radical departures from those usually encountered in interurban cars. The road upon which the cars will be operated at present extends from Richmond, Va., to Ashland, a distance of about 15 miles. Probably the most remarkable feature in the design of the cars is their extreme width. In fact, they measure 9 ft. 8 ins. over sills and 9 ft. 10 ins. over all. The over-all length is 54 ft. 1 in.



INTERIOR OF RICHMOND & CHESAPEAKE BAY CAR, SHOWING ARRANGEMENT OF PARTITIONS

The cars are intended to be operated in trains and are provided with M. C. B. couplers and spring buffers. The passageway between the cars is protected by extension diaphragms similar to those employed on vestibule steam coaches. Half of the cars constructed were built with baggage and passenger compartments and the remainder are straight passenger cars. The fact that the State laws of Virginia compel railway companies to provide separate compartments for white and colored passengers necessitated quite an unusual arrangement of the compartments of the passenger car. The car contains four compartments, two large ones and two smoking rooms. The smoking compartments are arranged opposite each other on either side of a narrow passageway near the center of the car. Entrance to each of them is gained through double swinging doors opening out into opposite ends of the narrow passageway. Each contains one long seat so placed that the passengers face the side windows of the car. A swinging door at the middle of the passageway separates the two sections of the car.

EXTERIOR OF RICHMOND & CHESAPEAKE BAY CAR

Another point in which a departure is made from ordinary practice is that the roofs of the cars are of tin instead of canvas as is usually found on interurban cars. The tin is laid on tongued and grooved poplar ceiling which is well leaded and the under side of the tin was painted before being soldered in place. The interiors are finished in inlay mahogany with semi-empire ceilings. The seats in the large compartments are the St. Louis Car Company reversible type with high backs and head rolls. The trimmings are of solid bronze.

PROGRAM OF THE MEETING OF THE STREET RAILWAY ASSOCIATION OF THE STATE OF NEW YORK HELD IN BUFFALO ON JANUARY 11

The quarterly meeting of the Street Railway Association of the State of New York, which was held at the Iroquois Hotel, Buffalo, on Jan. 11, as this issue was sent to press, was distinguished by the attention given to the subjects of track work and overhead construction. The papers on the program for the morning session were the following:

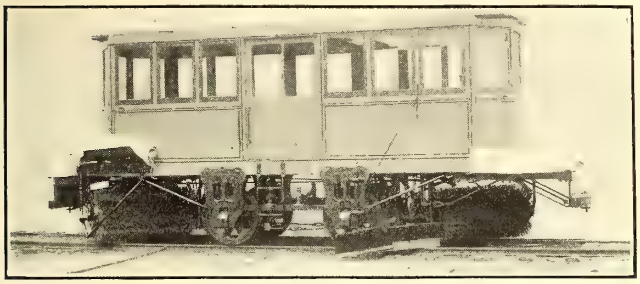
"Track Construction in Paved Streets," by I. E. Matthews, engineer maintenance of way of the Rochester Railway Company; "Concrete Stringers and Concrete Stringers with Ties and Steel Ties," by F. D. Jackson, superintendent of track of the International Traction Company, Buffalo, N. Y.; "Tie Plates, Braced Tie Plates and Tie Rods," by E. P. Roundey, superintendent of tracks of the Syracuse Rapid Transit Company; "Standard Rail Sections for Paved Streets, " by C. Gordon Reel, vice-president and general manager of the Kingston Consolidated Railroad Company; "Thermit Welding of Rail Joints," by M. J. French, engineer maintenance of way of Utica & Mohawk Valley Railway Company; "Electric Welding of Rail Joints," by an engineer connected with the maintenance of way depart- department of the Rochester Railway Company. These papers were to be followed by a general discussion on "Derailing Devices."

It was planned to take up the following papers during the afternoon session: "Rail Bonds," by H. L. Mack, superintendent of line of the International Traction Company; "Center-Pole Construction," by F. A. Bagg, chief engineer of the Fonda, Johnstown & Gloversville Railroad, and "Span and Catenary Construction," by B. Penoyer, engineer of track and roadway of the Schenectady Railway Company. A full report of the convention, including the papers read, will be published in the next issue of the Street Railway Journal.

The Oakland Traction Company is constructing twenty new 50-ft. electric cars which will be modeled after the California type of car, with cross seats such as are used on the Ellis Street lines in San Francisco. Work will also soon be commenced on twenty new 55-ft. cars with steel frame for the Haywards main line. Altogether seventy new cars were built for the company last year.

AN AMERICAN SWEEPER FOR BELGIUM

Among the shipments for export made last month by the J. G. Brill Company was one of its sweepers for operation over the underground section of the Brussels Tramways, Belgium. This type of sweeper has met the conditions abroad equally as well as in this country, and the car in the present instance is the second of its kind to go to Brussels,

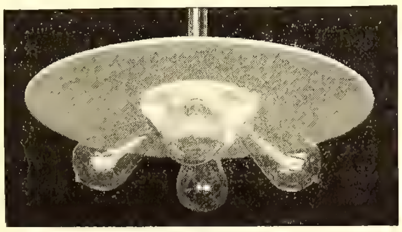


EXTERIOR OF THE SWEEPER FOR BELGIUM

its predecessor having been given a very thorough trial. The short brooms peculiar to this sweeper, which are set at an angle to throw the snow clear of the rails, and are capable of being set a little lower at the outer ends; the brush board and leveler clear away most of the snow in front of the wheels at the side opposite the front broom and also brush the snow still further away from the rails; the rear broom completes the work on that side of the car and leaves a clean track. It will be seen that the windows on all sides of the car enable the crew to keep a sharp lookout on all sides. The chief dimensions of the sweeper are as follows: Length over body, 21 ft., and over bumpers, 27 ft. 6 ins.; width over the side sills, 6 ft. 10¼ ins.; height over trolley board, 11 ft. 6 ins.; height to sills, 3 ft. 6 ins.; length of brush shear board, 3 ft. 2 ins.; length of wings, 2 ft.; weight without motors, 13,800 lbs. The regular truck for this class of service is employed, having a wheel base of 6 ft.

FEW PART WIRELESS CLUSTER

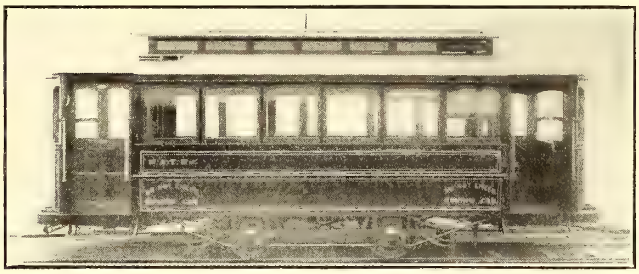
The few separate parts composing the Harter wireless cluster, manufactured by G. H. Harter, Chicago, are a strong recommendation for its use in electric car lighting. The body of this cluster consists of one piece. The sockets for the lamps and a short length of pipe for attaching the cluster to the ceiling are solidly embedded in an opal glass base by having these parts placed in the proper positions and then casting the glass around them. This construction assures against parts working loose from the jolting and jarring of the car. The only additional part composing the cluster is a bottom cap held in place by two screws. One of the terminal wires is soldered to the brass shells or lamp sockets while the other is carried around in a circle over the center of the bases of the sockets so as to form the center contact pieces. Aside from the advantages resulting from the one-piece construction this cluster has the added advantage that there are no exposed parts to tarnish. The opal glass, moreover, serves as an excellent reflector. The cluster is made in sizes varying from two to six lamps, and is furnished either with or without a shade.



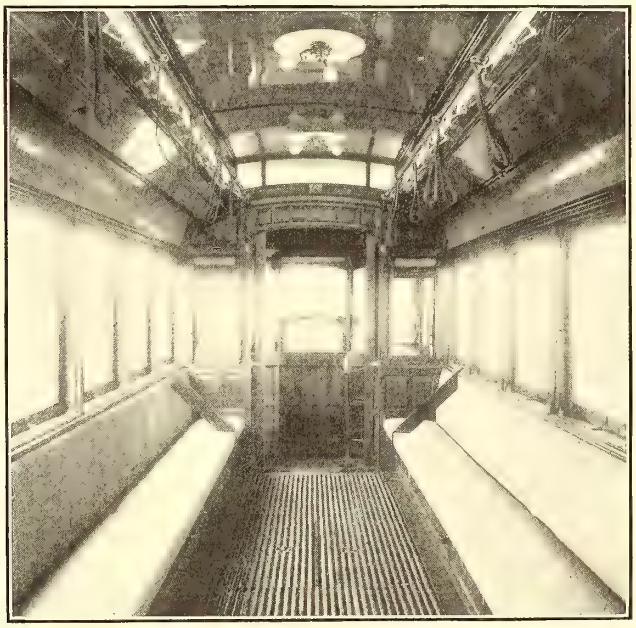
WIRELESS CLUSTER

NEW CARS FOR NORTHERN ALABAMA

A shipment of closed cars has been made from the works of the American Car Company for operation on the lines of the North Alabama Traction Company, of North Decatur, Ala. The conditions governing the distribution of traffic at Decatur are peculiar, the city being practically divided into five towns with a combined population of about 16,000. The point of transfer is in Central New Decatur at the new car house which has been completed recently; the main building is 90 ft. x 140 ft., with a 50-ft. x 140-ft. addition conforming to the street. At South New Decatur is located the company's amusement park, and the amusements are free. The new cars are of the drop-sash variety and are mounted on the No. 21-E single trucks with a wheel base of 7 ft. Two partitions are provided for the purpose of separating colored passengers from white. These partitions can be placed at any location desired, eyes being placed at each post and in a corresponding place under the seat for their reception. The interiors are finished in cherry. The chief dimensions are: Length over the end panels, 18 ft., and over the vestibules 28 ft.; width over the sills, 7 ft., and over the posts at belt, 7 ft. 8 ins.; the side sills are 3¾ ins. x 7 ins., and there is a sub-sill reinforced with 3½-in. x 6-in. angle iron; the end sills are 3½ ins. x 6 ins.; center sills, 3¾ ins. x 5¼ ins.



EXTERIOR OF NORTH ALABAMA CAR



INTERIOR OF NORTH ALABAMA CAR, SHOWING METHOD OF SEPARATING THE RACES

FINANCIAL INTELLIGENCE

The Money Market

Wall Street, Jan. 9, 1907.

There has been a decided change for the better in the local money market during the past week. The return to the banks of the moneys disbursed for interest and dividends on Jan. 1, the influx of funds from all parts of the country, and the substantial gain in cash by the banks on their operations with the Sub-Treasury, have been reflected in a freer offering of money by the local institutions, and a general lowering of interest charges on both call and time accommodations. As a result of these developments rates for day to day money fell sharply, while the premiums recently demanded for money for fixed periods have entirely disappeared. The easing off in rates for money at this time is perfectly natural, as the return flow of funds from the country usually assume large proportions after the first week in January, and the opinion prevails that the situation will continue to improve from now on. Flurries in call loan rates may be expected, but indications point to a further relaxation in the charge for time loans. The demand for the latter class of accommodation is extremely light, and there is a general disposition on the part of borrowers to hold off in the hope of getting better terms in the near future. Money for thirty days to four months is rather freely offered at 6 per cent, and while banks and other lenders offer six months' maturities at the same rate, they experience considerable difficulty in placing their funds on that basis. The sterling exchange market, after a period of extreme weakness, has recovered sharply, rates advancing to a point which prohibits the importation of gold from abroad. The European situation has been rather uncertain during the week. At the opening open market discounts at London receded sharply, and at times the quotation was fully 1 per cent below the official rate. Later, however, the market hardened perceptibly, owing to the shipment of gold to Brazil, and the indications of further heavy consignments of the yellow metal to Argentine and to Egypt.

The bank statement published on last Saturday was a disappointment. Instead of a handsome gain in cash, as predicted by the preliminary figures of the movement of currency, the banks actually sustained a loss of $402,100, and as the reserve required was $5,119,300 greater than in the preceding week, the surplus reserve was reduced to $147,825, which compares with a surplus of $571,000 in the corresponding week of 1906, and a surplus of $11,608,250 in 1905.

The Stock Market

The stock market experienced considerable improvement immediately after the turn of the year, which was stimulated chiefly by the better monetary conditions. The great majority of bankers had not expected call money rates to approach anything like ease until about the middle of January at least, and consequently when toward the end of last week rates fell to around 6 per cent, the stock market took on an appearance of decided strength. The rate for fixed date accommodations likewise experienced pronounced relaxation, falling to 6 per cent for all periods by the middle of the current week, or from 1 to 1½ per cent under the rates prevailing a week previously. Such developments of an unexpectedly favorable nature in the money market gave rise to a moderate bull campaign in stocks, which lasted several days. At the outset of the current week, however, monetary conditions again became unsettled, call rates running up to 10 and 15 per cent, and this induced a material reduction in the commitments of the bull contingent, and a consequent pronounced reaction in security prices.

The investigation of the Harriman lines by the Interstate Commerce Commission, which is now under way, is also beginning to create some uneasiness in financial quarters. Anticipation of further revelations not altogether of a nature calculated to inspire confidence, has made many large speculators timid about committing themselves heavily on the long side of the stock market, while investors are inclined to wait for further developments before purchasing. The renewed tension which developed in the money market this week, particularly in call funds, was not regarded by leading banking interests as indicative of a continuation of such rates for a prolonged period. As pointed out above, time money has fallen to 6 per cent, and currency is finding its way back to New York in large volume from the interior. Within another week it seems entirely probable that the bulk of the money disbursed in connection with the Jan. 1 settlements will have found its way back to the regular money market channels, and rates become consequently easier.

The most important development in the local traction situation was the decision of the Court of Appeals, handed down Tuesday, confirming the right of the Brooklyn Rapid Transit Company to charge a 10-cent fare on its lines to Coney Island. This decision settles a dispute which arose last summer and which caused no end of annoyance, both to the company and the traveling public. Needless to say the stockholders of the Brooklyn Rapid Transit Company are much gratified at the ruling of the Court of Appeals. In connection with pronounced strength which developed in Brooklyn Rapid Transit stock recently the old rumors were revived that a dividend would soon be declared upon this issue, but were not generally credited. Marketwise the stock of the Interborough-Metropolitan Company has been rather more active than usual on intimations from representatives of the company that the earnings are of a very satisfactory nature. The plans for new subway connections are also maturing slowly.

Philadelphia

Trading in the local traction issues was only moderately active during the past week, and although prices moved with more or less irregularity the net changes for the week were confined to the small fractions. Philadelphia Rapid Transit continued to lead the group both in points of activity and price fluctuations. In the early dealings the stock was pressed for sale, which resulted in a decline to 20¼, but later on buying by commission houses brought about an advance to 22½. At the close, however, the selling was resumed, and the price yielded to 21. About 10,000 shares changed hands. Union Traction was fairly active, but the stock moved in sympathy with Philadelphia Rapid Transit. From 59 at the opening there was a gradual rise to 60, but at the close transactions were made at 59¼. Upwards of 1000 shares were dealt in. Norfolk & Portsmouth Traction was an exceptionally strong feature, the price advancing from 27½ to 30, on light transactions. Consolidated Traction of New Jersey, after selling at 74, ex the dividend, rose to 75. Other sales included American Railways at 51, Philadelphia Company common at 48¼ and 48, preferred at 48, Railways General at 6½, United Companies of New Jersey at 252¼ and 252, United Traction of Pittsburg preferred at 49, and Lehigh Valley Transportation preferred at 24.

Baltimore

There was a decided improvement in the traction issues in the Baltimore market. United Traction securities were in better demand, and consequently prices moved up fractionally. The 4 per cent bonds sold to the extent of about $70,000 at 90 and 90¼, and upwards of $75,000 of the incomes changed hands at from 58½ to 59¼. The funding 5s were quiet but firm, about $8,000 selling at 86¾ and 86½. United Traction free stock brought 13½, and the certificates sold at 14. Other transactions were: Augusta Railway & Electric 5s at 101¼, City & Suburban 5s at 108¼, North Baltimore 5s at 115, Norfolk Railway & Light 5s at 97 and 97½, and Charleston Consolidated Electric 5s at 94. Hambleton & Company, in their letter of Jan. 5, say that as prices are very low it is to be hoped and almost anticipated that there will soon be a better market with greater activities and an improvement in values.

Other Traction Securities

The Chicago traction issues were extremely quiet during the week, but prices generally improved fractionally. Chicago Union Traction common sold at 5¼ and 5½ for a few hundred shares, and North Chicago moved up from 38 to 40 on the exchange of about 500 shares. Metropolitan Elevated common advanced from 26¼ to 27, and the preferred stock sold at 69½. Northwest Elevated brought 25¼ and 25, and South Side sold at 90. In the Boston market more or less irregularity accompanied the dealings. Boston Elevated, after selling at 152, dropped to 151 on light trading. Massachusetts Electric common, after an early decline to 17, advanced to 19, and then reacted again to 17½, and closed at 18. The preferred sold at prices ranging from 67 to 68½. Other sales were: Boston & Suburban at 12½, Boston & Worcester at 28¾ and 28½, preferred at 78; West End common at 92, and the preferred at 109 and 108.

Owing to the decision of the United States Supreme Court on the Central and Quincy Avenue franchises, it was expected that there would be a break in the stock market on Cleveland Electric securities, but in this all were mistaken. The bids were a little lower, but offerings held steady at 66. For some time owners have asked from 66 to 67 for this stock, and the fact that these franchise decisions have gone against the company seems to make little difference. Altogether, there has been but little trading in tractions the past week.

Security Quotations

The following table shows the present bid quotations for the leading traction stocks, and the active bonds, as compared with last week:

	Jan. 2	Jan. 9
American Railways	51	51
Boston Elevated	150	150
Brooklyn Rapid Transit	78¼	81⅞
Chicago City	150	160
Chicago Union Traction (common)	5½	5¼
Chicago Union Traction (preferred)	18	17½
Cleveland Electric	—	61⅝
Consolidated Traction of New Jersey	76	*75½
Detroit United	—	80
Interborough-Metropolitan	35¼	36½
Interborough-Metropolitan (preferred)	73½	73¾
International Traction (common)	—	a63
International Traction (preferred), 4s	—	82½
Manhattan Railway	140¾	143¼
Massachusetts Electric Cos. (common)	17¾	19
Massachusetts Electric Cos. (preferred)	68	68½
Metropolitan Elevated, Chicago (common)	26	27½
Metropolitan Elevated, Chicago (preferred)	69½	69½
Metropolitan Street	—	105
North American	87¼	87¾
North Jersey Street Railway	40	40
Philadelphia Company (common)	47¾	47¾
Philadelphia Rapid Transit	20⅛	20⅛
Philadelphia Traction	96¼	95¾
Public Service Corporation certificates	67	67
Public Service Corporation 5 per cent notes	96	96
South Side Elevated (Chicago)	89	89
Third Avenue	—	120
Twin City, Minneapolis (common)	102½	107
Union Traction (Philadelphia)	59	59⅛

* Ex-dividend. a Asked.

Metals

Statistics collected by the "Iron Age" show that the output of coke and anthracite furnaces was 2,236,153 tons in December, as compared with 2,187,665 tons in November. The production of the steel works furnaces has broken all records, having reached 1,463,035 tons in December. Scarcity of spot iron is still a marked feature in all of the leading pig iron markets, and promises to continue so for some time unless transportation facilities improve very materially.

Copper metal continues strong, with Lake quoted at 24 and 24½c., electrolytic at 23¾ and 24¼c., and castings at 23½ and 24c.

DECISION IN DENVER FRANCHISE CASES

The case of the franchises granted at last spring's election to the Denver Gas & Electric Light Company, the Denver City Tramway Company and the Northwestern Terminal Company were practically settled finally in favor of the companies when the Supreme Court of Colorado handed down a decision Jan. 7, to the effect that the County Court had no jurisdiction to try cases in which validity of franchises is contested. The court held that no charter of the city and county of Denver could confer such jurisdiction.

IMPROVEMENTS AT OMAHA

From 6 to 10 extensions in Omaha with a total of from 10 to 20 miles of new rails and two new interurban lines, one of which is to be 25 miles long, is the work decided by the board of directors of the Omaha & Council Bluffs Street Railway Company at its annual meeting held recently in New York. This announcement was made by C. W. Wattles, vice-president of the company, upon his return from New York. At this meeting the directors decided to make an application for the contemplated work, which will also include $250,000 for the increase in the power plant and the building of the four substations, one at Benson, one at Florence, one at Bellevue and a portable one at Lake Manawa. The matter of deciding the routes for the new lines is left to a committee of the local directors who, with engineers, will go over the ground. The company also will enlarge its car shops so it will in time be able to build its own cars.

CHICAGO "L" FIGURES

All the Chicago elevated railroads made traffic records in the year 1906. The Metropolitan led. The Northwestern had a big year, with an increase of 7.33 per cent. The South Side elevated did not do so well, owing to increased competition from the Chicago City Railway.

METROPOLITAN ELEVATED

	1906	1905	Increase	Per Cent
January	129,730	116,013	13,717	11.28
February	135,570	121,177	14,393	11.90
March	138,169	124,853	13,316	10.66
April	137,477	124,946	12,481	9.98
May	136,735	125,164	11,571	9.24
June	133,974	124,569	9,415	7.55
July	123,370	113,578	9,792	8.69
August	123,512	116,395	7,117	6.11
September	126,975	124,427	2,548	2.05
October	142,671	131,990	10,681	8.09
November	152,471	132,276	20,195	15.26
December	155,790	136,789	19,001	13.89

NORTHWESTERN ELEVATED

	1906	1905	Increase	Per Cent
January	81,191	73,728	7,463	10.12
February	83,572	78,773	4,799	6.09
March	85,154	80,500	4,654	5.78
April	84,224	79,779	4,465	4.98
May	81,748	77,863	3,885	4.98
June	80,165	75,837	4,328	5.70
July	73,308	67,488	5,820	8.62
August	73,176	68,938	4,238	6.14
September	77,508	74,307	3,201	4.30
October	88,384	80,642	7,702	9.55
November	93,238	83,597	9,641	11.53
December	94,904	87,199	7,705	8.84

SOUTH SIDE ELEVATED

	1906	1905	Increase	Per Cent
January	92,406	84,659	7,747	9.03
February	95,077	88,173	6,904	7.83
March	95,466	91,384	4,082	4.46
April	95,756	91,901	3,855	4.19
May	97,159	89,971	7,188	7.99
June	101,770	93,941	7,829	8.33
July	92,976	85,272	7,704	9.03
August	88,539	85,288	3,251	3.81
September	89,749	89,022	*727	*0.81
October	93,577	92,824	753	.07
November	94,281	92,156	2,125	2.30
December	95,212	97,495	*2,283	*2.34

* Decrease.

SUPREME COURT DECISION IN THE CLEVELAND CASE—OTHER MATTERS

The United States Supreme Court rendered a decision on Monday, Jan 7, to the effect that the franchises of the Cleveland Electric Railway Company on Central and Quincy Avenues and a portion of Erie Street, in Cleveland, expired March 22, 1905, affirming the decision of Circuit Judge Tayler, of Cleveland, in an injunction case of the Cleveland Electric against the city and the Forest City Railway Company.

Anticipating that the franchises would expire on March 22, 1905, the City Council gave the Forest City Railway Company a franchise on these streets, in the shape of a renewal of the old franchises. The Cleveland Electric at once brought suit to prevent the city and the new company from interfering with its property on these thoroughfares. Judge Tayler decided that the franchises expired as the city claimed, but that the grant made the Forest City was invalid, since a franchise granted one company cannot be renewed in favor of another. It was also shown that the Cleveland Electric had property rights in the streets and no provision was made in the franchises for taking care of them. In other words, the new company had no right to take possession of the Cleveland Electric's tracks, poles and wires and use them, without proper compensation which must be agreed upon.

The text of the decision of the Supreme Court was not given out. The opinion was delivered by Judge Peckham, and is understood to be unanimous. However, the court held that the language of none of the ordinances presented for examination could be construed as constituting a system of the lines owned by the Cleveland Electric, or that all the lines should be considered as constituent parts of a whole. The Central Avenue line is held to be an independent line and not a portion of the Euclid Avenue line. Its franchise expired on March 22, 1905, and not at the date of the expiration of the Euclid Avenue line. It is also held that the obligation of the company to maintain transfer relations with the Wilson Avenue line ends with the expiration of the franchise of the Central Avenue line. The decision indicates that the court meant to convey the idea that, whatever the language of the various ordinances, they could not be construed to mean that all the franchises of the company were extended to terminate on the same date, July 1, 1914. Where two constructions of the language of an ordinance are possible, the court holds, that the one which does not extend or enlarge the grant to corporations must be adhered to.

The court said that, whatever the language of the various ordinances, the city never intended to unite the lines owned by the Cleveland Electric Railway Company into a system, nor did the clauses that might have been added to them in the way of sleepers have that effect. Such things as may have been overlooked by the members of the City Council in franchises that have been granted must not be taken as opposed to the interests of the people.

The Cleveland Electric, however, cannot be compelled to surrender its property on these streets, nor be made to accept what the Council may fix as a value. It will be fully protected in this matter and possibly have plenty of time to take care of the property.

President Horace E. Andrews, of the Cleveland Electric, when asked for a statement on the situation by the STREET RAILWAY JOURNAL correspondent, said that not much could be said at this time, as he had not received a copy of the court decision and knew what it contained only from what the daily press had printed. The course to be pursued by the company in the future, Mr. Andrews said, must yet be decided upon, after the officers know the full text of the decision. Mr. Andrews said further, that he had implicit faith in the people of Cleveland to give the company fair consideration, and he believed the question would yet be settled to the satisfaction of all. As to the reduced fare that had been offered, seven tickets for a quarter, he said it is as low as can be given and maintain any kind of service. According to a hasty comparison between the Cleveland system and that at Columbus, where the same rate obtains, it was found that in length of lines the Columbus system is about 60 per cent of that of the Cleveland system. He said that any addition to the lines there would greatly increase the cost of operation and make the possible profits less.

Since the suit was filed by the Cleveland Electric and taken to the Supreme Court, the Forest City Railway Company has received a second grant, covering the same streets. Owing to the fact that a suit is now pending in the local courts attacking the validity of all the grants the low-fare companies have received, charging that Mayor Johnson is financially interested in them, there may be little done in the way of attempted possession of the streets until this case is decided. It is before Judge Phillips this week, and the decision in the demurrer filed by the Forest City some time ago seemed to indicate that the final decision will be against the new companies. If these cases are carried up, it will be some time before a decision is reached.

A public meeting of the City Council has been called for Thursday afternoon, to which representatives of the Cleveland Electric have been asked to discuss the question of possession of the street, as well as the compensation that the company will be asked to pay for the use of the streets since the expiration of the franchises. It is said that there was an understanding that the company would be willing to pay something for this privilege if the case was finally decided against it, but there seems to be a difference of opinion on the matter.

It is said that the Low Fare Railway Company will ask for franchise extensions from the grants made to it two weeks ago that will cover Central and Quincy Avenues, in an endeavor to get around the financial interest question, but the Sumner Avenue injunction, which is being tried this week, will probably have something to do with determining the relation that this company bears to the Forest City and the Municipal Traction Company. Secretary Davies, of the Cleveland Electric, has given notice to the City Council that, as the franchises on Central and Quincy Avenues and East Ninth Street have expired, he desires to bid for them. This would indicate that the old company is not going to give up and it is possible that such a fare will be offered that the new companies will not be able to secure the streets after all. In point of fact, the companies stand now just as they did after Judge Tayler gave his decision. Neither of them has the right to use the streets covered by the decision.

Last week Judge Ford issued a temporary injunction against the Low-Fare Railway Company, to prevent the construction of tracks on Sumner Avenue, on which it had been granted a franchise by the City Council. In the application for this injunction the Cleveland Electric Railway Company made the charge that the franchise was granted through fraud and corruption, and that in acting on the matter, the City Council abused the incorporate powers of the city. The attorneys for the old company went to the City Solicitor's office and asked that suit be brought to annul the franchise granted the company, but this was refused. Then they proceeded to prepare their own suit. The injunction was served after about 500 ft. of single track had been laid on Sumner Avenue. Service was also secured on the city, as a party to the suit. The line on Sumner Avenue is intended to connect the tracks of the Forest City Railway Company on East Ninth Street and East Fourteenth Streets, and the work was begun just south of the Erie Street cemetery at the Fourteenth Street end. The Municipal Traction Company had the contract for doing the work at cost, with a certain percentage of profit added. This arrangement is taken to show the connection the Low Fare Company has with the Municipal Traction Company and the Forest City Railway Company, which the Cleveland Electric looks upon as one and the same thing.

The suit also marks the beginning of the fight against this newest company, which had not before been taken into account, but hereafter will be considered in line with the other two companies and will receive the same careful attention. It brings the company into court where it is probable that its hand must be shown, and if it happens that it was incorporated in order to circumvent court decisions and the effect of the Mayor's connection with the other companies, the effect will be weakening in all the cases that have been brought against them.

The hearing was set for Friday, but the court merely increased the bond of the Cleveland Electric and let it go over until Monday, when a new term of court began. An amended petition was filed by Judge Sanders, asking that depositions be taken to show whether or not the Municipal Traction Company and the Low Fare Railway Company are one.

An answer in the Cooper suit has been filed by the Municipal Traction Company and the Forest City Railway Company, in which it is stated that Mayor Johnson and the Low Fare Company, in which it is stated that Mayor Johnson and the Low Fare Railway Company have no interest in that suit, either direct or indirect, and that they have been improperly enjoined

in connection with the other companies in the Superior Avenue matter.

Judge Beacom's decision in refusing to dissolve the Cooper temporary injunction against the low-fare companies on Superior Avenue is interesting. He said that the Board of Public Service had no right to grant a permit to build temporary tracks, that the resolution of the City Council granting a franchise or permit was not passed under correct procedure, and that an individual taxpayer whose property abuts on the street in question has the right to bring injunction proceedings under the circumstances, whether for the benefit of the public or not. The previous injunction granted by Judge Phillips, he said, does not constitute such an emergency as the companies allege that his court should allow some other action that will offset its effect. The Board of Public Service, he said, has an administrative or supervisory power, but not authority to grant permits such as were granted by it. The City Council must hear the reading of a measure such as it adopted on three different days or must suspend the rules, if read on the same day before vote was taken. Because this procedure was not followed, the resolution, which amounts to an ordinance, is void. This decision strengthens the position of the Cleveland Electric on its contention against the new company using this portion of Superior Avenue, and it is said that it cannot now be used under these decisions.

Altogether, thirty-two injunction suits have been brought against the Forest City Company, and it will necessarily be some time before they will all be decided.

AN IMPORTANT CONNECTICUT PROJECT

A petition signed by Jeremiah Stark, William H. Geer, Clinton E. Stark and George E. Manning will be presented to the General Assembly of Connecticut asking a charter for the Norwich, Colchester & Hartford Traction Company to construct an electric railway between Norwich and Hartford. The route proposed is from West Main Street along the westerly side of the Yantic River through the villages of Yantic, Fitchville and Bozrahville, the south part of Lebanon, the borough of Colchester and then on through Marlboro and East Glastonbury to East Hartford. The distance by steam railroad from Norwich to Hartford is 49 miles, while by the proposed electric railway it is but 38 miles, thus shortening the distance by 11 miles. The petitioners will ask for a broad charter, embracing passenger, freight and express franchises, together with the right to develop water power, to construct power stations and to buy or sell electric power.

CAR BUILDING IN LOS ANGELES

It is reported at Los Angeles that the St. Louis Car Company has under consideration a plan to erect in that city a complete plant for filling Pacific Coast car orders. In this suggestion the company is encouraged by the Huntington and Harriman electric railway interests, which are now suffering particularly from delays in receiving much-needed additional equipment.

Said an electric railway official of Los Angeles, recently, to a STREET RAILWAY JOURNAL representative: "Either Pacific Coast orders for electric cars must be filled more promptly through the Eastern plants of the car-building companies—or preferably through a plant located in this territory—or local electric railway interests will be forced to go into the car-building business themselves."

It is known that H. E. Huntington, not long ago, declared that if he could not get cars from Eastern builders promptly, he himself would build car shops in Los Angeles and turn out electric cars for the entire Pacific Coast market. During the past year the Huntington lines have been compelled to construct a number of cars in their own shops. Los Angeles companies use Oregon pine and Northern hardwoods exclusively in the cars they build. According to report, the St. Louis Car Company, or some other large Eastern concern, has secured a site near Los Angeles, in Eagle Rock Valley, for shops, adjoining the site of the proposed car houses of the Los Angeles Railway Company and easily accessible to the tracks of the Southern Pacific Railroad.

ANNUAL MEETING AND REPORT OF THE BOSTON "L"

The annual meeting of the stockholders of the Boston Elevated Railway Company was held Monday, Jan. 7. The directors were all re-elected with the exception of James Phillips, Jr., who was unable to serve longer. As now constituted the board of directors includes: Frederick Ayer, William A. Bancroft, John J. Bright, Samuel Carr, T. Jefferson Coolidge, Jr., Frank E. Peabody, James M. Pendergast, Nehemiah W. Rice, Quincy A. Shaw, Jr., William S. Spaulding, Walter S. Swan, Robert Winsor. A summary of the annual report follows:

			1906	1905
Gross			$13,527,185	$12,689,676
Expenses			9,306,950	8,617,653
Net			$4,220,235	$4,072,032
Other income			107,426	51,893
Total increase			$4,327,661	$4,123,916
Charges			3,475,882	3,288,831
Surplus			$851,779	$835,085
Dividend, 6 per cent			798,000	798,000
Surplus			$53,779	$37,085
Traffic statistics:				
Revenue miles	50,056,608	48,069,404	48,317,881	47,476,702
Passengers	262,267,240	246,941,776	241,681,945	233,563,578

Besides its ordinary taxes the company's contribution to the public during the last fiscal year amounted to $500,461, made up as follows:

Compensation tax for use of streets, act of 1897	$115,987
Interest at 4 per cent on $4,154,974, cost of paving by the company	166,199
Cost of maintaining street paving by company	150,659
Amount of subway rental devoted to sinking fund	57,617
Removal of snow (estimated)	10,000
Total extraordinary payments to the public	$500,462
Add taxes assessed on real estate	244,333
Add taxes assessed on capital stock	673,694
Total	$1,418,489
To the above add balance of subway	143,651
Also the rental of East Boston tunnel	49,709
Total	*$1,611,849

* Equal to about 12 per cent of the gross revenue of the company for the year.

Out of 3221 stockholders 2788 live in Massachusetts and own 112,598 shares, or nearly 85 per cent of the 133,000 shares of stock.

The company has made arrangements to increase its power supply by the construction of two gas engine plants, supplying 1675 kw, by the installation of a turbine generator rated at 2000 kw, and by the purchase of about 3600 kw, making a total of upward of 7275 kw, an increase of about 20 per cent.

Forty-five "easy access" elevated cars, and 150 "easy access" semi-convertible surface cars, seating fifty-two persons each, have been bought. There was spent $737,354 in renewals and repairs of surface tracks, exceeding the amount spent the previous year by $114,504, and the year before that by $283,683.

The company controls 441.4 miles of surface track, an increase of 9.4 miles, and owns 16 miles of elevated track, making a total of 457.4 miles of track.

The company has continued its liberal policy toward employees. The aggregate of increased payments to employees under provisions of three years ago amounted to $171,391, made up of these items:

Compensation to learners	$31,383
Guaranteed minimum wage	14,032
Increased wages for long service men	64,305
Pensions	9,081
Rewards for "satisfactory service"	52,590

Beginning Jan. 1, 5300 car-service men will receive a further increase of wages. Those who have been in the service more than two years receive an increase of 10 cents a day. Those who have served for less than two years receive an increase of 5 cents a day. All new or extra men, which includes substantially all who have served less than two years, are guaranteed a minimum wage of 25 cents a day more than they are now receiving.

CHICAGO COUNCIL DECLARES FOR IMMEDIATE SETTLEMENT

During the last few weeks interest in the Chicago traction affairs centered in the question of whether the City Council should take final action on the traction ordinances immediately or first submit the ordinances to the people by means of a referendum. At a meeting of the City Council Jan. 8, that body, by a vote of 26 to 40, and against the wishes of Mayor Dunne, declared itself in favor of immediate settlement. A referendum vote could not be taken until April, and consequently a decision for it would mean a delay of several months in the settlement of the franchise questions and a rehabilitation of the properties. Mayor Dunne has been the strongest supporter of a referendum. His views, however, are probably largely influenced by the pledges made to the people.

The two franchises, one for the Chicago City Railway and one for the Chicago Union Traction Company, have practically been completed and will be submitted within a few days to the Council committee on local transportation. The franchises have been criticised, but this has been against clauses in detail, rather than against the general plan. Ex-Mayor Carter H. Harrison, in a letter to a morning newspaper, made two objections. He thought the compensation to the city should be on a percentage of the gross receipts, rather than a percentage of the net receipts basis, as provided in the draft of the franchises. He also thought the power to control the street car service should be left to the City Council rather than delegated to a newly created board of supervising engineers. In answer to the first criticism, Walter L. Fisher has replied to the effect that the city is not giving franchises of the usual type, but in effect is entering into partnerships with the railway companies. The Chicago City Railway franchise provides that this company may build into the North Side, now occupied by the Union Traction Company, in case this latter company does not fulfill the terms of its contract with the city. Partly for the purpose of getting around the objection of several that the Chicago City Railway could not, by the terms of its charter, build lines into the North Side, the Chicago City Railroad Company has been incorporated. The new company will probably be named in the Chicago City Railway Company's ordinance as the company to build into the North Side.

ELECTRIC RAILWAY ASSOCIATION FOR OKLAHOMA AND INDIAN TERRITORY

The Oklahoma Electric Railway & Gas Association has been organized by interests connected with the electric railway and gas interests of the territories. The officers elected were: F. H. Tidnam, of Oklahoma City, president; Chas. W. Ford, of Oklahoma City, secretary; F. B. Stearns, of Shawnee, first vice-president; H. C. Stettmund, of Chandler, Okla., second vice-president; E. M. Cooper, of Wilburton, third vice-president; J. H. Merrill, of McAlester, treasurer. Various committees were appointed, among which the important ones are: Executive, J. Crowe, of Guthrie; J. C. Fisher, of Shawnee; C. F. Mercer, of Geary, and H. C. Stettmund, of Chandler. Advisory, F. Benton, of Lawton; R. D. Long, of Muskegee, and W. E. Fertig, of Muskegee. Finance, O. H. Weddle, of Shawnee; J. L. Bowers, of Kingfisher, and J. R. Debbins, of Guthrie. The annual meting will be held in May, at a place to be decided by the executive committee, the members of which are said to favor Oklahoma City.

TRACTION MATTERS IN NEW YORK

Bridge Commissioner Stevenson, of New York, on Friday, Jan. 4, submitted to the Board of Estimate a new terminal and approach plan for the Brooklyn Bridge. This plan is the result of expert study of the bridge conditions by a special commission appointed about six months ago by the Commissioner at the suggestion of Mayor McClellan. This commission is composed of William A. Burr, professor of civil engineering in Columbia College; William Barclay Parsons, former chief engineer of the Rapid Transit Commission, and Ira A. McCormick, general superintendent of the New York Central Electric Division. The plans contemplate the immediate rearrangement and reconstruction of the Brooklyn Bridge terminals and approaches so that six-car elevated through trains can be run across the bridge under a 45 second headway. The present trolley loop at the Manhattan end of the bridge will be transferred to an underground loop under the "Zeitung" triangle, and reaching to Duane Street, while the space now occupied by this trolley loop would be turned into a free approach to the bridge promenade. The mezzanine floor would then be converted into a special four-pocket terminal, extending over Park Row for elevated six-car trains, and the top floor, which is occupied by the present elevated terminal, will be a practical duplication of the mezzanine terminal, with special provisions, however, for future connection with elevated loop tracks connecting the two bridges, which the commission recommends. The request of the Commissioner of bridges for the issue of $3,250,000 corporate stock for the purpose of reconstructing and enlarging the terminal facilities was laid over for a week by the board. His request for $30,000 to provide means for the reconstruction of the bridge railway track floor of the Brooklyn Bridge was granted.

A large delegation from the citizen's central committee, claiming to represent four-fifths of the property owners of Brooklyn, appeared before the Rapid Transit Commission at their meeting Thursday, Jan. 3, and advocated the immediate construction of an elevated loop to connect the Manhattan ends of the Brooklyn and Williamsburg Bridges. In the course of the hearing some of the speakers in favor of the proposition stated that if something were not done at once to relieve the intolerable conditions on the Brooklyn Bridge, an appeal would be made to the Legislature to abolish the present commission.

President Winter, of the B. R. T., in response to a question by Comptroller Metz, stated that his company was willing to lease and operate an elevated loop, to run from the end of the Williamsburg Bridge, thence through Delancey Street, and down Centre Street to the Brooklyn Bridge, on the same terms as the present subway system is operated by the Interborough, or 4½ per cent on the cost of construction. He also stated that, in his opinion, if the board would give his company permission to connect its elevated lines with the tracks at present on the Williamsburg Bridge, and bring the trains to a terminal at the Manhattan end of that bridge, it would divert a great deal of traffic that now of necessity uses the Brooklyn Bridge, and would relieve the crush at the latter place to a great extent.

Vice-President Bryan, of the Interborough, stated that his company would be willing to enter into an agreement with the B. R. T. for the operation of a loop down the Bowery and Park Row, to be placed over the present elevated road, provided the Interborough be given a franchise for the third-tracking of the Second and Third Avenue elevated lines. While this company is opposed to an elevated loop, it was stated on behalf of Mr. Belmont that he would do all in his power to aid the commission in the solution of this problem, whatever scheme was selected by the commission as the most feasible. Mr. Belmont would recommend a subway connection between the two bridges, and if such a line be finally decided upon, he will bid for it.

Chief Engineer Rice submitted a report upon the proposed plan of John B. McDonald for a subway loop connecting the two boroughs by means of the bridges. His criticisms were that it would take three years to build; that it would seriously interfere with several routes now planned, and that it is vitally defective in not having some connection with Brooklyn at the South Ferry end. If this route should be decided upon, the Third Avenue subway, as at present planned, could not be built.

President Orr and Messrs. Smith, Starin and Metz, of the Rapid Transit Board, held a meeting Tuesday, Jan. 8, to discuss transit relief for Brooklyn. The meeting was specially called as a result of the sharp criticism of the board indulged in by some Brooklynites at a hearing Thursday, Jan. 3. It resulted in a long and somewhat heated discussion, and finally it was decided to inform the Board of Estimate that the board favored the construction of the so-called McDonald loop, with a suggestion that the subway be built first and leased afterward. Then, it was believed, an arrangement could be made whereby the fare for a ride on the loop would be fixed at 3 cents.

The board also suggests that extensions can be made in Brooklyn along Broadway and Fourth Avenue, and declares positively that the loop subway can be completed and the cars put in operation "by the time the Manhattan Bridge is open to travel." It has been variously estimated that the Manhattan Bridge will be completed in from two to three years.

CONFERENCE ON TAX QUESTION IN WISCONSIN

Considerable difference of opinions developed at the recent conference in Madison, Wis., between the State Tax Commission and seventeen representatives of the principal street and interurban railroad companies of the State, regarding the best method of ascertaining the actual value of the property of such corporations for purpose of taxation under the new ad valorem tax law passed by the last legislature. Under this new law the commission is required to fix the value of a company's road in each county and each town, city, and village within or through which it runs. The commission suggested that perhaps the best method for doing this would be to find the receipts for each such district by counting the passengers at certain points on the road for certain periods of time.

The railroad men declared that such a thing would be practically impossible, as traffic is exceedingly variable and the majority of the men in charge of cars do not have the time or capacity to do such work. Even special agents placed on cars for that work would not be able to do it accurately, and even if they tried the result would not show the average gross received as the periods in which the counts were made would not be long enough to insure approximately correct figures. The best way of determining the receipts for any given length of road, the railroad men said, was to divide the gross receipts of the entire road by its total mileage, making due allowances for density of population of the several districts through which the road passed.

The roads will pay taxes under the new law next year. At present they are paying a license fee based on gross earnings. The railroad men at the conference were: Attorney C. M. Rosecrantz and Controller C. N. Duffy, the Milwaukee Electric Railway & Light Company and the Milwaukee Light, Heat & Traction Company; Attorney Roy P. Wilcox and General Manager George B. Wheeler, Chippewa Valley Electric Railroad Company; General Manager Herbert Warren and Director A. M. Robertson, Duluth Street Railway Company; Vice-President N. C. Draper, Eastern Wisconsin Railway & Light Company; Director B. E. Edwards, La Crosse & Onalaska Street Railway; President Thomas Higgins, Manitowoc & Northern Traction Company; President F. W. Montgomery, Madison & Interurban Traction Company; General Manager Edward Daniels and Attorney F. J. Trudell, Menominee & Marinette Light & Traction Company; General Manager Irving P. Lord, Waupaca Electric Light & Railway Company; Vice-President E. B. Kirk and Attorney H. I. Weed, Winnebago Traction Company; Secretary-Treasurer H. D. Smith, Wisconsin Traction, Light, Heat & Power Company.

SUBWAY PERMITS IN LOS ANGELES TO HARRIMAN

By a unanimous vote the City Council, of Los Angeles, has granted to the Los Angeles-Pacific Railway permits for subways extending from Fourth and Hill Streets to the western city limits, by way of Fourth Street and Vermont Avenue. In their present form, the permits are not affected by the twenty-one-year time limit in the city charter. They are practically perpetual. Discussion of the ordinance granting these permits revealed that the Harriman interests contemplate not a single tunnel, but two tunnels side by side—one to be used by outgoing trains, the other for trains coming to the city. At present the company will build but a single tunnel. This will contain two tracks.

It is announced that the construction of the tunnels will begin before March 1, 1907, and officials of the road say trains will be running over the new thoroughfare by Jan. 1, 1909. Bonds have been given to finish the work within three years.

Simultaneously, with the granting of the subway permits, the City Council instructed the City Clerk to advertise for sale, railway franchises crossing Flower Street, Vermont Avenue and other places in the vicinity of the western city limits.

The Harriman interests also desire subway permits to pierce the Temple Street highlands, to connect First Street with Sunset Boulevard, and in this connection a franchise for an electric railway is now being advertised for sale along Hill Street from Fourth to First Streets. These latter subway permits will be considered by the Council later. The aggregate length of the subways will be about 7 miles.

B. R. T. UPHELD IN CONEY ISLAND FARE CASE

In a unanimous decision handed down Tuesday, Jan. 7, the Court of Appeals decided that the Brooklyn Rapid Transit Company, as the laws affecting railroads stand to-day, is entitled to charge a double fare to Coney Island. The decision is based on the ground that steam railways cannot be subjected to the rules of street railways. Judge Haight, who wrote the opinion, pointed out that the Brooklyn Rapid Transit Company operates its Coney Island line over roads which were leased by that company, and which, though now operated with electricity, had steam railroad charters, to which the lessee company was entitled.

The suit to determine the right of the Brooklyn Rapid Transit Company to charge a 10-cent fare from Brooklyn Bridge to Coney Island was the outgrowth of the riots of last August, when many passengers refused to pay the double fare and were ejected from the company's cars. The climax of the trouble was reached on Aug. 12, because of a statement by Justice Gaynor that the Brooklyn Rapid Transit Company did not have the legal right to exact more than 5 cents for the trip to Coney Island, and that a person resisting the collection of the extra fare was therefore not liable to arrest.

STREET RAILWAY PATENTS

[This department is conducted by Rosenbaum & Stockbridge, patent attorneys, 140 Nassau Street, New York.]

UNITED STATES PATENTS ISSUED JAN. 1, 1907

839,857. Railway Car Frame; William F. Keisel, Jr., Altoona, Pa. App. filed Feb. 28, 1906. Details of construction relating more particularly to the platform and vestibule.

839,874. Railway Tie; Norman J. McLean and Ernest Swanson, Bay City, Mich. App. filed April 30, 1906. A metallic tie in which the portions which are subjected to wear are keyed to the main portion so as to be readily removable.

839,972. Rail-Tie and Fastener; Willis F. Walker, York, Pa. App. filed Sept. 26, 1906. Comprises oppositely-disposed channel irons having in-turned flanges. tie-straps connecting and secured upon the outer faces of the channel irons, end strips connecting the ends of the channel irons, said strips being concave-convex in cross-section, and a plastic filling between the channel irons and end strips.

840,074. Splice Bars; William J. Mattern, Lewistown, Pa. App. filed March 2, 1906. The fish-plates have downwardly projecting members which are inserted in suitable openings in the tie and are secured thereto by a bolt running longitudinally of the tie and embedded therein.

840,087. Contact-Shoe for Electric Railways; Henry C. Pealow, Batavia, Ill. App. filed Nov. 9, 1905. Consists of jaws spring-impelled toward one another which grip the third rail.

840,095. Automatic Signal; Judson Shoecraft, Eskridge, Kan. App. filed April 20, 1906. The track rails are divided into sections and energized by batteries. Only one signal is used at each station, and is adapted to move into different positions for danger and caution signals.

840,135. Signal Apparatus; W. Britton Lane, Evanston, Ill. App. filed July 25, 1906. A pair of special rails or trolleys are laid between the usual track rails and contact with depending shoes on the locomotive for signaling purposes.

840,180. Car Fender; Etta W. Wheelock, Arlington, Mass. App. filed July 14, 1906. Details of construction.

840,197. Air Brake; Lewis E. Black, Nashville, Tenn. App. filed April 27, 1906. A brake cylinder provided with a piston rod, an auxiliary reservoir and triple valve, a brake lever movably secured to the brake piston rod, a cylinder carried by the brake piston rod adapted to shift the lever thereon, said shift cylinder adapted to be operated by exhaust pressure from the triple valve.

840,193. Device for Operating Brakes and Brake Rods; Geo. W. Barlow, Shrewsbury, N. J. App. filed May 24, 1906. Employs a cylinder for the piston of the brake rod which is adapted to actuate a suitable brake device, there being around the rod between one cylinder head and a collar a helical spring adapted to return the piston and rod to an initial position. This cylinder is actuated by a communicating pipe with a vacuum chamber, and in the line of pipe is interposed a two-way valve.

840,219. Rail Fastener; William P. Johnson, Kerrmoor, Pa.

App. filed Aug. 31, 1906. Means for fastening the rail to a metallic tie.

840,239. Rail-Joint; Mathias Nemecek, McKeesport, Pa. App. filed Aug. 8, 1906. The fish-plate on one side is formed integral with the base, and the other fish-plate is moved up against the rail on the other side and is dove-tailed to the base.

840,247. Automatic Car Stop; James S. Pates, Monongahela, Pa. App. filed Sept. 8, 1906. Designed especially for coal-tipples with the locking mechanism connected to the dumping track section or platform and operated by the latter to lock the stop in car obstructing position only when the track section or platform is tilted, thereby preventing the car from running into the tilted dump.

840,258. Sound Deadening Means for Railways; John Schenbeck, Chicago, Ill. App. filed April 30, 1906. Concave-convex plates engage the flange and under side of the head of the rail and are bolted through the web thereof.

840,283. Pleasure Vehicle; Walter T. Adams, Hays Borough, and John R. Divers, McKeesport, Pa. App. filed June 18, 1906. A pleasure railway in which a car is suspended from an inclined cable, the invention residing in the braking apparatus.

840,368. Rail-Joint; Joshua H. Price, Cleveland, Ia. App. filed May 31, 1906. The base of the rail is grooved and provided with recesses in said groove at regular intervals. The tread of the rail is adapted to fit the groove and has lugs engaging the recesses. When one side of the tread is worn it may be reversed.

840,424. Rail-Joint; John E. Beaver, Warwick, Ohio. App. filed March 20, 1906. A rail-joint designed to obviate the use of bolts and similar fastenings embodying parts liable to work loose and allow spreading of the rails.

840,428. Electrical Signaling System; Edward R. Brodton, Atlanta, Ga. App. filed Sept. 3, 1904. Details of a system having a plurality of trolley rails laid between the usual track rails, and which have electrical connections to alarm devices in the locomotive.

PERSONAL MENTION

MR. D. L. PRENDERGRAST has been appointed secretary of the Boston Elevated Railway Company pro tem in place of Mr. John T. Burnett, resigned.

MR. JAMES J. HUMPHREYS, traveling auditor of the United Gas Improvement Company of Philadelphia, is dead, aged 63 years.

MR. M. E. KAPER has been appointed division passenger and freight agent of the Indianapolis & Eastern Railway, and the Indianapolis & Martinsville Rapid Transit Company. Mr. Kaper will make his headquarters at Greenfield. He succeeds Mr. J. W. Fletcher, resigned.

MR. J. W. W. BRYANT, division superintendent of the Nashville Railway & Light Company, of Nashville, Tenn., is dead. Mr. Bryant has been connected with the street railway company since the time of the mule cars.

MR. J. R. HARRIGAN, formerly general manager of the Columbus, Buckeye Lake & Newark and the Columbus, Newark & Zanesville, and more recently manager of the Canton-Akron lines, has accepted the position of manager of the Buffalo & Erie Traction Company, of Buffalo.

MR. WILLIAM A. HOUSE, second vice-president and general manager of the United Railways & Electric Company, of Baltimore, Md., has been appointed acting president of the company to succeed to the duties of the late Gen. John M. Hood, and Mr. William Early, private secretary to Mr. Hood, has been elected assistant secretary of the company.

MR. EDGAR S. FASSETT, general manager of the United Traction Company, has been appointed to the same position with the Hudson Valley Railway, which is now a subsidiary line of the United Traction Company. Mr. Fassett will continue to have his headquarters in Albany and will also continue to have charge of the United Traction Company.

MR. CHARLES S. MELLEN, president of the New York, New Haven & Hartford Railroad, has announced the appointment of Mr. Lucas S. Storrs as vice-president of the New England Investment & Security Company, the holding company of several Massachusetts street railways, with an office in Boston. Mr. Storrs was formerly at New Haven as expert and engineer of tests.

MR. JAMES SMITH, who retired from the Toronto Railway Company a few years ago, after being prominently connected with the company from the time its inception, is dead. Mr. Smith is survived by a widow and six children, of whom Mr. James G. Smith is superintendent of tracks of the Toronto Company, Mr. John M. Smith is controller of that company, and Mr. Alexander Smith is master mechanic of the York Radial Railway.

MR. E. S. PATTEE, auditor of the Twin City Rapid Transit Company, of Minneapolis, has been appointed secretary and controller of the company, and Mr. D. J. Shouse, formerly assistant to Mr. Pattee, has been appointed auditor of the company. Another appointment recently made by the company is that of Mr. Joseph Mersch to the position of chief inspector, in which office he will perform the duties formerly discharged by the assistant superintendent.

MR. WILLIAM J. CLARK, of New York, general manager of the foreign department of the General Electric Company, has been appointed by Governor Hughes, of New York, as a delegate from that State to the national convention for the extension of the foreign commerce of the United States, which will be held at Washington, D. C., beginning Monday, Jan. 14, 1907. For many years Mr. Clark has been interested in and studied the conditions of foreign commerce. His book, "Commercial Cuba," is recognized as an authority on the subjcet. He has been a delegate to many important commercial conventions, and in 1905 was a member of the United States delegation at the International Railroad Congress, held at Washington.

MR. D. F. CARVER has resigned as general superintendent of the Rochester Railway Company to become assistant general manager of the Aurora, Elgin & Southern Railway Company under Mr. Edwin C. Faber. Mr. Carver before going to Rochester was connected with the Public Service Corporation of New Jersey as chief engineer of the railway department, and before that was connected successively with the Brooklyn Rapid Transit Company and the Cleveland Electric Railway Company. Mr. Carver was tendered a farewell banquet by his associates in the Rochester Railway Company before leaving Rochester, and was presented by them with a handsome dress-suit case as a token of their esteem. Mr. E. J. Wilcoxen, superintendent of the Sodus Bay division, and Mr. J. W. Hicks, superintendent of transportation, will share between them the duties formerly performed by Mr. Carver as general superintendent.

MR. PERRY A. GIBSON, of Erie, Pa., a State Senator from 1897 to 1900, and general manager of the McKeesport, Connellsville & Greensburg Street Railway Company, is dead. Mr. Gibson was born in Washington Township, Erie County, Aug. 25, 1857. He received his education in the public schools and was graduated at the State Normal school at Edinboro and the Iowa State University. He was admitted to practice in the United States Court as an attorney June 15, 1886, and subsequently was also admitted to the Supreme Court of Illinois. He was elected to the State Senate from Erie County November, 1896. Recently Mr. Gibson devoted most of his time to electric railway interests, and at the time of his death was in Pittsburg on traction business. He conceived the idea of establishing an electric railway between Erie and Cambridge Springs. He was also the promoter, and, at the time of his death, prominent in the management of the projected line between Cambridge Springs, Corry, Union City and Erie.

MR. ALBERT H. STANLEY, general superintendent of the Public Service Corporation of New Jersey, controlling more than 300 miles of city and interurban lines, assumed the duties of general manager of that corporation on Jan. 1. Mr. Stanley entered the employ of the company in 1903. Since the resignation of Mr. W. W. Wheatly as general manager of the company, however, there has been no office with this title, although Mr. Stanley's duties have virtually covered the work formerly coming under the jurisdiction of the office of manager, part of the work being shared by Col. Edwin W. Hine, whose title is assistant to the president. Mr. Stanley, before going to New Jersey, was general superintendent of the Detroit United Railway Company. In January, 1906, the personnel of the Public Service Corporation was so reorganized that the position of superintendent of transportation was created, to which office Mr. Newton W. Bolen, up to that time a district superintendent of the company, was appointed, thus permitting Mr. Stanley to devote more of his time to the executive duties of his office as general superintendent, the district superintendents under the new order all reporting to Mr. Bolen.

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During 1906 the Street Railway Journal printed and circulated 426,950 copies, an average of 8210 copies per week. Of this issue 8200 copies are printed.

The Quarterly Meeting of the New York State Association

A considerable portion of this issue is devoted to papers read at the quarterly meeting at Buffalo on Jan. 11 of the Street Railway Association of the State of New York, and to an abstract of the discussion. The meeting was one of the most valuable which has ever been held at which the subject of track construction for street railway lines has been discussed, and amply justifies the policy of the State Association in holding quarterly meetings.

The program contained six topics, viz., track construction, rail sections, rail joints, derailing devices, rail bonds and overhead lines. On the first subject three papers were presented by the track engineers of Rochester, Buffalo and Syracuse, the three largest city properties in the western part of the State. Mr. Matthews, who represented Rochester property, advocated as the most durable construction on streets of heavy traffic, wooden ties spaced 2 ft. to 2½-ft. centers and carried on a 6-in. concrete base. This construction can be slightly cheapened by employing concrete beams under the rails instead of using an entire concrete bed, and this plan is entirely satisfactory where the street traffic is not heavy and where the subgrade is good. The most substantial Buffalo construction, as described by Mr. Jackson, differs from that in Syracuse in the use of steel ties instead of wooden. The concrete is carried the entire width of the roadway and 6 ins. under the ties; beam construction has also been used, but is not now considered so desirable. The paper by Mr. Roundey, of Syracuse, did not take up the subject of subconstruction, but was devoted principally to the advocacy of tie rods instead of brace plates. The latter are difficult to spike in the first place, and as the tie gets old the efficiency of its holding power decreases, allowing the rail to tip outward. The greater ease of paving when brace plates are used instead of tie rods was formerly considered an important advantage of the brace plate, but as this point was not mentioned by Mr. Roundey it has evidently been found by him to be of no great practical importance. There were no papers advocating ballasted track, but a representative of one of the companies using this construction to a large extent was present in the person of Mr. Stanley, of the Public Service Corporation of New Jersey. While not claiming that it was perfect, Mr. Stanley discussed this construction at considerable length, and is evidently still to be convinced that the more rigid construction on concrete is desirable from every standpoint.

The subject of rail sections was taken up in an interesting paper by Mr. Reel, of Kingston, who strongly advocated the use of standard T-rail. Owing to the large number of engravings accompanying this paper, its publication is deferred until next week. Most of those present agreed with Mr. Reel that T-rail could be used satisfactorily on streets of light traffic, but there was some dissent to his claim for it in streets with considerable vehicular traffic, in spite of the instances cited by him of satisfaction given in Denver, Minneapolis, Milwaukee and other cities. There seems to be no doubt that where teams follow the track they will

wear ruts in the paving close to the rail unless the railway company provides a more durable street surface in the form of a steel girder. We believe, however, that in the cities where the T-rail is widely used, the teams do not hug the track as in those where grooved or girder rail is employed; hence the vehicular wear is distributed over the entire street and there is no tendency to form ruts along the side of the rail. It is not a necessary duty of the street railway company to provide a runway for heavy drays, however convenient to the teams such a track may be, nor is it desirable from the standpoint of safety for vehicles to be attracted to the portion of the street containing the track rather than to other parts of the highway. They may have to use a part of the track in narrow streets, but need not be encouraged to do so, and in wide streets, especially if the tracks are near the side of the street and T-rails are used, we believe that the tendency of the vehicles is to keep away from the tracks. One feature of Mr. Reel's paper was the presentation of testimony in favor of T-rails from city engineers in the cities in which that form of rail is employed. These letters spoke most favorably of this form of construction.

Rail joints were treated in papers on thermit welding, by Mr. French, of Utica, and electric welding, by Mr. Wilson, of Rochester, and very valuable information was brought out in the discussion. Mr. Clark, particularly, gave an interesting account of a form of joint originated by him for Cleveland conditions, and giving very good satisfaction in that city. The advantage of eliminating the necessity of a bond by welding rail was one of the points dwelt upon in the discussion.

Derailing devices was the subject of a topical debate, in which it proved to be the consensus of opinion that sending the conductor forward to flag the crossing could not be avoided. Whether it was desirable to have him throw a switch after reaching the railroad crossing was another question, provided his presence there could be insured in any other way. It also seemed desirable to locate derailing switches not too near nor too far from the crossing, as in the former case the car might run through the switch on to the crossing, while in the latter case there is chance for danger to originate after the car had passed the switch; 40 ft. to 70 ft., the regulation distances in Ohio, seemed to meet general approval, as approximating the proper maximum and minimum.

The subject of bonds was discussed in an interesting paper by H. L. Mack, of the International Railway Company, of Buffalo. This company has used nearly all types of bonds, and it is significant that Mr. Mack believed that the best bond is the one "in which the greatest care is exercised in its application." In other words, a good bond can be rendered practically worthless by carelessness, and a bond poor in principle can be made effective by the proper installation. Mr. Mack of course has his preferences, and they are discussed carefully in his paper.

The session concluded with a discussion on overhead lines, in which Mr. Bagg, of Gloversville, pointed out the advantages of span wire construction, and Mr. Eveleth described the latest form of catenary suspension. While catenary construction was originally designed for alternating-current roads, it is equally well adapted to any high-speed line and is being used to a considerable extent on direct-current railways. In fact, for high-speed work it is practically essential to good service.

The Design of Rapid Transit Cars

In Mr. Fox's paper, which is concluded in this issue, we present a rather exhaustive study of a very important and difficult problem. The fact is that modern conditions have made so great a change in the requirements imposed on cars that old precedents are of little value save as guides as to things to be avoided. The typical American center-aisle car as used on ordinary steam railroads is most convenient and has made headway even in foreign practice. It was never designed, however, with a view of providing facilities for exceedingly rapid ingress and egress. A long central aisle effectively prevents this, but in ordinary railway service there is no resulting delay, since the handling of baggage and express matter rather than the movement of passengers is the thing which chiefly determines the length of the stops. It is only within comparatively few years that the suburban passenger train carrying no baggage car has become common, and has brought with it an acute necessity for easier movement of the live load. In a similar fashion the street car of the earlier days gave sufficiently good exits and entrances by the end door. One of the ancient 16-ft. bodies could be quickly enough cleared of all the passengers it could hold, particularly when schedule speeds were low and people were not in so desperate a hurry as now. The coming of long double-truck cars made a disastrous difference in the conditions, but there have been no corresponding advances in design, and street cars have either followed the earlier practice or have been made cramped and uncomfortable copies of ordinary railway carriages.

When necessity for rapid transit forced itself into prominence the perfectly natural step was from the ordinary railway car to the longitudinal seats of the tramcar. The result was the compromise found in the early cars on the New York elevated roads, with cross seats in the middle and longitudinal seats with wide aisles at the ends of the car. This car has given fairly good satisfaction under New York working conditions, but has the obvious objections of poor circulation and the rather contracted doors. The whole story is that one cannot drive through end doors the horde of passengers that is crowded into a rapid transit car under modern conditions. The end doors worked well enough so long as the car was not used much above its seating capacity, but beyond that they failed.

Now the most essential thing in considering any improved design is the expressed or implied purpose with respect to seating the passengers. The car which provides the minimum of seats is likely to have the clearest space in which to move a crowd and probably the best chance of getting a car which could be rapidly emptied and filled would be one with merely such longitudinal seats as would be permitted by end doors and one or two wide side doors. On the other hand the introduction of many seats means a lower carrying capacity, because in the same area more people

can be carried seated than standing. The proper policy to pursue must depend then upon local conditions. If the distances are long and the track clear the tendency will be to provide the majority of passengers with seats. When, however, the congestion is great and the distances short it becomes simply a question of the best method of taking care of the maximum number of passengers. The car which in this country is carrying the largest crowds with the quickest station stops is one with a wide side and end doors and longitudinal seats between the doors; in other words, the present Brooklyn Bridge car, to which Mr. Fox apparently fails to give the due amount of credit. While it is a fact that the great crowding of the Brooklyn Bridge terminal is deplorable, it is very questionable if any improvement could be made in loading and unloading trains at that terminal so far as speed is concerned. Whether one side door is more desirable than two or more narrow ones is a question. In either case, to reduce the station stops to a minimum, a guard would be required at each door, since a crowd of struggling passengers cannot safely be left to itself. In this connection we doubt whether the policy of bisecting the center door by a post on the theory that it would direct the streams of passengers is expedient, as we fear that injuries would be caused by its use. Of course the possibility of using side doors depends upon the conditions at curved platforms. Sill extensions to the cars themselves would usually not clear other points in a narrow subway, while sliding platforms at the station, although used to some extent, do have an element of danger unless they are withdrawn at exactly the right moment. Nevertheless, the tendency in rapid transit rolling stock is undeniably in favor of the side-door car. The question then, where the conditions admit of their operation, narrows down to the use of a single or a multiple side-door car.

The Illinois Central type is the most conspicuous example of the latter, and experience in Chicago has shown that it can be loaded and unloaded with astonishing rapidity. The accident liability with the Illinois Central type, according to the evidence, is extremely low, but we cannot help feeling that under subway or elevated conditions the situation might be changed. That is, in the latter service the question is not one of simply taking from a station the passengers who are waiting there to board the car, but the situation is complicated by the stream of passengers who are constantly arriving on the platform and who will insist upon boarding a car so long as a closing door can be stopped with the foot or an umbrella and then pried open. Mr. Fox considers this point at length in his discussion of multi-door cars, and refers to the open surface car and to the open cars on the Manhattan Elevated, somewhat unfortunate precedents, as neither of these is conspicuous for its freedom from accidents. We do not mean by this that a multi-door car is necessarily dangerous, but only when there is a stream of passengers and the doors are closed by a single guard at the end of the car. The liability could be reduced by providing platform guards during the rush hours. Two guards for each car would probably be sufficient to close the doors by hand, as in European conditions, leaving the doors to be opened by the guards on the trains. The train guards could also close the side doors during the light hours, thus dispensing with the platform guards at those times.

Mr. Fox's suggested modification of the Illinois Central car is very ingenious, consisting as it does of seats and doors arranged as in a Continental railway carriage, combined with the open saloon and center aisle of the American car. A car so constructed excels in seating capacity, and if not filled with standing passengers is very accessible in all its parts. Its construction is so novel that it is difficult to analyze the possibilities of its use, but our fear would be that when crowded with a standing load it would be difficult to escape from, owing to the very narrow passages required to gain the seating capacity. The combination of feet, umbrellas, bags, and bundles that have to be dodged in our present cars would be very much in the way in the narrow side exits of the proposed car and might easily cause delay, not to say extreme annoyance, to both seated and standing passengers. As a whole the type strikes us as better adapted to express service under a no-seat-no-fare rule than to the exigencies of congested local traffic. In other words, we are brought back to our original question, i. e., can enough cars be run so as to give all or most of the passengers seats, or must a considerable number of the passengers stand? For the latter service a multi-door car with a single row of vis-a-vis longitudinal seats in the center seems to us more practical. Openings could be left in the center row of benches, as passageways. Such a car would at least place the fixed seats where they interfere least with the flexible movement of the crowd, while the multi-doors would enable one-half of the side of the car to be thrown open at station stops.

There are many possibilities in cross-seat construction that have not yet been touched, and we are glad to see them come up for keen discussion, but the task of designing cars practicable for rush hours is a very difficult one. It is even an open question whether there can be any great shortening of stops at stations without considerable additional discomfort and, for that matter, danger. Possibly it may in the long run be necessary to use island platforms uniformly receiving passengers on one side of the car and discharging them on the other simultaneously, at the more important stations, and limiting the access of crowds to the working platforms beside. Station design is at least as important as car design in alleviating congestion, and the one must to a considerable extent depend on the other. Mr. Fox's plans will repay a good deal of study, and must be considered in connection with platform construction and the general means of checking congestion in the approach to the cars. The certainty that new subways will soon be constructed renders the subject an important one. The fact that a new type of car cannot be exchanged with those on the present subway is not an insuperable objection. If of demonstrated value in loading and unloading, it is possible that the capitalized saving through reduction of station stops and present car weights may be sufficient to warrant the substitution of a side-door car to replace the present subway type.

SUGGESTIONS ON RAPID TRANSIT WITH PARTICULAR REFERENCE TO ROLLING STOCK—III

BY JOHN P. FOX

In the last issue of this paper the writer described a proposed type of car with eleven doors on each side, mentioned its advantages for rapid transit service and discussed the objections often urged against side-door cars.

The body of the car is carried by a steel underframe, consisting of 9-in. channels for side and end sills, and 9-in. I-beams for center sills. In order that the car sides may project as much as possible over curved platforms, with a minimum thickness of the flooring, the posts are carried on an 8-in. angle riveted to the side sills. This allows the car floor to be nearer the platform level than if a projecting floor framing were placed on the underframe as is common in Europe. The door posts are 3-in. channels, and the intermediate posts, if needed, are 3-in. tees. The plate is a 5-in. x 3-in. angle. The roof might be the same as with the present subway cars, of composite board carried by fireproof wood and angle carlines. Finish of steel, aluminum and transite, without fireproof wood, if it can be avoided.

AISLES

The writer still prefers one center aisle to the two side aisles of the Illinois Central, but is open to conviction on the matter. The loss of seats with two aisles would appear too great with the New York subway, and one thing affecting the opinion of the passengers is the absence of any corner seats so much sought for. Mr. Dawson prefers the single side aisle of the German cars, but this does not seem so convenient, where the doors on both sides are used, as the center aisle. As to the width of aisle, Types 7000 and 8000 have only a 16-in. aisle. With all passengers seated, an aisle may obviously be narrower than with many standing. All the width the writer personally requires is 10 ins. at the seat level and 20 ins. at the top of the seat backs. The aisle in a Berlin Stadtbahn car measured only 13½ ins. at the seat and 18 ins. above. On the upper deck of one English double-deck car, where great economy of space is necessary, the aisle measured 12¼ ins. at the seat, and 16⅛ ins. between seat backs. If it is necessary to defend a 16-in. aisle in a 120-seat car, one must ask what clear width of aisle is left in a present subway car with 120 passengers in it?

BUFFERS AND UNDERFRAME

The buffers, fastened to the end sills, as shown in Figs. 17 and 18 in the last issue, are represented as corrugated buffer blocks, like the cast-steel ones on the Metropolitan District cars in London. The corrugations are to reduce the chance of telescoping in an accident. The heavy steel underframe of a side-door car should give much greater safety in case of collision than the construction of the steel subway cars, provided the underframes can be kept in line, for the weak point of the subway cars is that the side girder has to stop at the end doors, leaving only 5-in. and 6-in. beams at the car ends, instead of the 9-in. beams of the side-door cars. It is a question how far to design a car to meet accidents, and when English car construction was criticised after the Salisbury accident as being too light, though the construction there must have been greatly intensified by the fact that the brakes were never set, one heard the defense made that English railways were so safe that there was no need to make cars collision proof. It may be that more money should first be spent strengthening other weak points of a railway.

CONTACT SHOES, CONTINUOUS WALKS AND TRACK CONSTRUCTION

The fire in the New York subway on June 1, 1906, emphasized again the danger of a third rail in case of derailment, and the need of an overhead conductor, at least for new subways. While the clearance between car roof and subway beams was considered too small at first for any overhead conductor, European precedents seem to modify this opinion, the writer having found a minimum clearance in use as small as 1½ ins., and conductor rails only 2 ins. thick and 4½ ins. from tie to surface. The writer has found it possible to design a heavy conductor, properly insulated, whose under surface would be only 1½ ins. below the subway beams. A continuous board of some fireproof insulating material would be suspended below the latter and the insulators placed between the beams where the hollows of the concrete arches are 6 ins. deep. The writer has no preference for any type of contact shoe, merely indicating a kind so long used in parts of the Orleans tunnel in Paris. The shoe should have some device for pulling it down, of course, so as to stop any short circuit that might occur.

Fig. 19 illustrates contact shoes, conductors and other possible subway improvements, not wholly matters of cars, but which may be of interest. A great need in every subway is a safe means to get passengers quickly out of the trains in case of fire or smoke or any serious delay. By shifting the track in the present subway one side as shown, it would be possible to construct continuous walks alongside the trains, at least 3 ft. wide if side-door cars are used. The 4 ins. indicated between the car roofs and subway braces need not be so little, especially with a segmental car roof, but is used as the minimum space allowed in tunnels in steam railroad practice with speeds of 36 m. p. h. or even over. One railroad has reported a minimum clearance at this point of only 1 in., but found that cars would naturally sometimes scrape in passing. Of the types of track construction shown in Fig. 19, that farthest to the left is an attempt to carry out the suggestion of the "Engineering News," with stringers on steel ties, asphalt about the rails somewhat as used with German surface tracks, and ledges in the concrete serving in place of guard rails. The right-hand express track, under car 6000, tries to adapt the Philadelphia plan of screwing the rails down to wooden blocks, bolted here to Z-bars and a 15-in. channel, which is the best the writer could do with the present shallow space in the concrete. The right-hand local track has the rails fastened to 8-in. angles which serve as guard rails where there is no wear. These ties rest on Z-bars and steel ties and the rails are surrounded with asphalt or any other desirable composition. Car 8000 is shown as at a station platform just as now exist on the New York subway, and shows how the much wider car would require no alterations at stations. If a walk were desired with this type of car, it could only be about 24 ins. wide between sides and subway posts. If the clearances shown between cars and posts seem small, it may be remembered that in the Budapest subway the space between cars and sidewalls and also posts is only 7⅞ ins., with a 31½-in. space for employees between passing trains. If continuous walks were used, employees would take refuge under them.

CURVED PLATFORMS

Fig. 20 illustrates the minimum radii of curved platforms with which car type 6000 can be used. The running board projects 11½ ins. beyond the underframe, and its top is 4¼ ins. above the platform, which then is the step up into the

car. This allows a 2-in. space between the under side of the 8-in. angle and the platform, but this clearance of course can be increased if a higher step is not objectionable. On the Mersey Railway a similar clearance at one place as small as 1 in. gave no trouble, but was not thought desirable. As to platform curvature, allowing a horizontal space of 2 ins. between running board and platform edge, a minimum radius of about 300 ft. is possible. Allowing the extreme of a 6-in. gap, the minimum radius of a concave platform is 228 ft. With a 6-in. gap and a convex platform, it is possible, by having the guard stand in one of the end doors, the other being left closed, to use nine doors with a radius of 151 ft. City Hall station would then be the only place not provided for by the car itself, on account of its 150-ft. radius curve with a concave platform. But the wider gap at this one station could easily be filled in by the use of extension platform bridges, as found at the South Ferry elevated station and so common in the Boston subway.

DOORS

The doors as illustrated are thick enough to have a sliding window and a sliding shade in a metal frame. It seems doubtful if any of the windows ought to open at all, however, except the guard's, and those in the doors especially for safety's sake. As to the operation of the doors, the mechanism has to be very compact, and so ball-bearing hangers would be used, which on one heavy door the writer tested, about 3 ft. wide, required only 8 ounces pressure to start. With any such easy movement, it seems well to avoid operation by air and use hand levers, if these can be installed, or some other hand mechanism like the Illinois Central. The failure of the center doors in London and the difficulties with pneumatic operation in Boston make one a little shy of air. Of course the Boston mechanism was of an early type, and it took time to avoid leaks; but even now one will find air escaping, pump governors struck, and occasionally an air pressure too low to release the brakes. The writer has heard of two roads where the air for operating doors has at times exceeded the air used in braking, and in one case only about 30 per cent of the air compressed reached the brake cylinders. The additional wear on ordinary compressor equipments must be considerable. With a side-door car, however, there need only be two cylinders to a car, instead of the six or eight with center-door types, and the leakage should be reduced to a minimum. For convenience, air operation would probably be best in the side-door types illustrated, except Type 5000, Fig. 16, where there is ample room for hand levers. A difficulty with the independence of the doors of a center-door car is how to lock the doors securely when shut, so as to insure safety if the air mechanism fails. The first pneumatic-end doors in Boston had latches opened by foot pedals, as shown in the Street Railway Journal for Aug. 6, 1904. But when the center doors also were equipped with pneumatic apparatus, the operation of a separate latch and valve for every door was too much, and now the doors are held closed by air only. But it is not altogether satisfactory to have to start a train with a door in the center merely kept closed by its own friction. There should at least be some way to lock such a door closed if the mechanism has failed, and a signal system would be an added safeguard if it rang bells on the cars when any door opened while the train was in motion. On the Illinois Central cars the doors are held firmly closed by a ratchet and pawl, which can be operated by foot pedals at each end and the center of the car.

As to the edge of the door, the pneumatic cushion in Boston has also been somewhat disappointing, though the

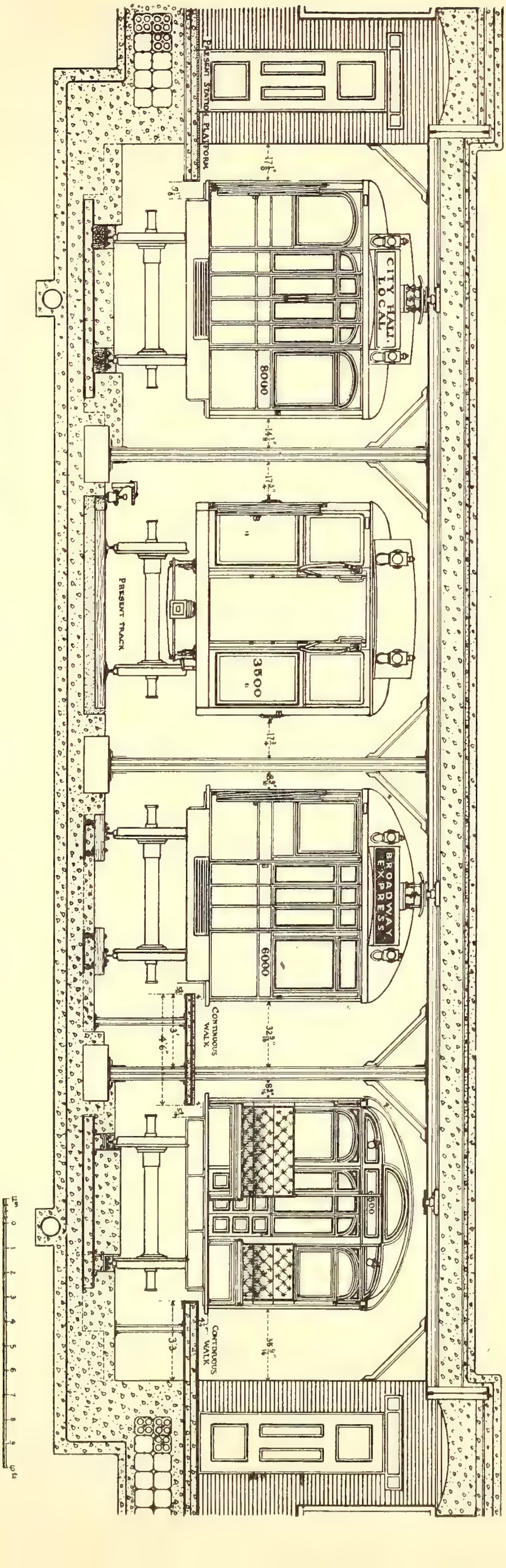


FIG. 19.—CROSS-SECTION OF NEW YORK SUBWAY, SHOWING PRESENT AND POSSIBLE TYPES OF CARS AND TRACK CONSTRUCTION

trouble is perhaps more with the adjustment of the space between door and jamb. In the first cars with pneumatic doors in Boston it seemed impossible for any one to be held between the door and the frame, as the rubber allowed anything to be pulled out. But when all the cars came to have the doors altered, some of the latter closed too far and as a result one woman was nearly dragged off into the street. When a tight door closes with a bang at the end, it takes great care by a guard not to have any accidents. People in Boston were at first afraid of the mysterious self-closing doors, but now they often try to push in through the last crack.* It would seem as though a number of side doors, attached to one operating rod as in the Illinois Central cars, with a separate adjustment for each door, would allow a more definite space to be maintained for safety when closed. Then, in leaving a station, it would seem well for the guard not to close the doors tight till, while looking out the window and along the platform, he is sure no one is caught in any door. Then he can close the doors tight. Emergency brake cords should be run along each side of the car just over the doors, both inside and out, so that even a person caught may instantly stop the train.

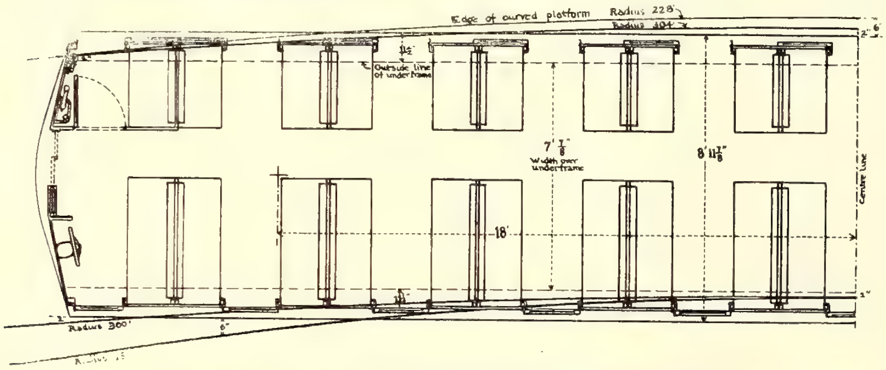


FIG. 20.—TYPE 6000 AT CURVED STATION PLATFORMS

CIRCULATION

One interesting experiment with the Boston cars has been the attempt to train the passengers to circulate always in the same direction, viz: out through the center door and in through the end doors. The guards at every stop request passengers to leave by the center door, and signs both inside the car and at the stations give the same directions. At first the people were somewhat confused by the fact that the center doors were not always opened except at terminals, but after pneumatic operation of all doors at all times was inaugurated there was less confusion. But people little by little forgot their training, and began to go out at the end and in at the center even before those inside were out. This breaking up of the regular circulation was probably started by the congestion in the rush hours, when it was impossible sometimes to get in or out the proper door. Then people began to use the nearest door more and more at all hours, in spite of the requests of guards, and now the rule is not much heeded. It is not surprising that people try to get in and out the quickest way, although a regular circulation might in the end be more satisfactory. Apparently the only rule that can be strictly enforced is that passengers must be allowed to get out first. Even that is not always possible in Boston. The writer wonders whether the continuation of a regulation to leave at the center and enter at the end doors may not hinder now more than it helps, for the reason that it tends to increase friction between passengers. Passengers who follow directions naturally resent the obstruction of those who disregard rules, and as a result tempers often suffer besides the length of stops. It would seem well to accept the inevitable, and tell passengers to leave by the nearest door, concentrating attention on keeping passengers out till all are off a car, as New York passengers had to learn in the subway.

One trouble with a wide door is that it tempts persons to push in before inside passengers get out, and this is a frequent and annoying occurrence with the Boston center doors, in spite of efforts to stop such causes of blocking and friction. With the narrow doors of side-door cars, passengers would have to wait their turn, just as in the New York subway now, with the added advantage of being able to see easily and quickly when all inside were out, as the passengers from a side-door car would generally come straight from their seats, making it necessary for one about to enter a door to look at a space only about 8 ft. deep; whereas now one needs to see half the interior of a car, while standing passengers often cause twice the amount of obstruction to view possible with a 100 or 120-seat side-door car.

FLOOR

The use of smooth floor surface seems desirable in place of wearing strips for purposes of cleanness. Some European railways use linoleum, but that would not last long with heavy traffic. Two or more roads are trying lito-silo, a non-conducting, fireproof composition, which is not slippery, and is being used in the new Great Northern & City cars as described in the STREET RAILWAY JOURNAL for Jan. 6, 1906. The composition is laid on a smooth floor of steel plate, which is strengthened with transverse flanged troughs whose flanges keep the composition intact. One advantage of a smooth floor is that people are not so likely to spit on it, because any dirt shows more.

LIGHTING

The STREET RAILWAY JOURNAL has pointed out so well the need of better car lighting, and the greater effectiveness of softened lights, that there is little to say on the subject except in suggesting a new method to be criticised. The clumsy shades shown in Fig. 17 are supposed to be of either very dark translucent glass, or even metal, so as to cut off all sight of the lamp filaments from wherever one is seated. The present subway cars have lights enough, but some persons find the bare filaments very disagreeable, especially as they are multiplied by reflections from windows and polished surfaces two or three times over. While the use of frosted, holophane, or prism globes would greatly improve things, it would seem worth while to make a trial with solid shades, throwing light downward, and possibly allowing some opening for lighting advertisements, but the best shade would seem to be the common cone-shaped one, with mirrors inside, used with such effect in store windows. They allow a very wide angle of lighting without showing any bright surface, and if placed just over the heads of seated passengers should make newspaper reading easy without eye-strain. The extinguishing of car lights in the last subway fires in Boston and New York, while no panic fortunately resulted, shows the need of some kind of emergency lights as sometimes found in Europe. The Berlin cars have candle lamps,

* The increase of this bad habit is perhaps partly due to the leniency of the guards in trying to prevent accidents, because people take advantage of the ease of reversing the movement of a pneumatic door.

which need no attention, and the candles are locked in. A better plan would be to use a small storage battery with some of the lamps, though the most satisfactory thing would be to have the lighting circuits independent of the power except when the former gave out, just as with the subway stations, using another conductor and sliding contact as in the Glasgow District Subway.

NOISE

Continuous walks as shown in Fig. 19 would tend to shut in some of the noise from the trucks and track, just as station platforms do now. The shutting of all windows and vestibuling of the cars, as referred to later, would cause a further reduction. Wood-centered wheels, so universal on English steam cars and used on all of the cars of the Central London except those carrying motors, might help still more. These wheels have teak centers with steel tires, and makers have been ready to guarantee them as safe for driving wheels on motor trucks, but they have not yet been so used to the writer's knowledge. Much of the quiet of some foreign subway trains is due to the removal of all motors and apparatus to the ends of the trains, as on the Central London and some other London tubes, where no passengers sit over the motors. The cars are light, and do not even carry air compressors. The concentration of apparatus in roomy, fireproof cabs at the ends of trains has more advantages than reducing noise, in the greater safety, less chance of causing panics, as from short circuits, economy of first cost, and opportunity for better inspection and maintenance than where so much apparatus is under the cars. The frequency of failures with present American subway and elevated cars would seem to suggest a more careful consideration of the European practice in this respect. Is not the splitting up of trains overdone in this country? It has been found too expensive on some European roads, the providing of empty seats at slack hours being much cheaper than attempting to keep down the seats at all hours. The London & South Western Railway has an excellent practice with its eight-car electric-lighted suburban trains. Each train is made up of two groups of four cars, the latter permanently coupled for economy. At slack hours four cars are run; at the rush hours, eight cars. There is never any need to send one car to the shops, for each train goes through the shops at such frequent regular intervals as to make intermediate repairs unnecessary. It would be interesting if some American road would find the exact cost of splitting up trains at the slack hours, and see if the saving of the very short trains is enough to make up for the tendency to discourage traffic from overcrowding. An English steam road that runs the same trains all day long at twenty-minute intervals, with electric-road fares, and without cinders or dust, will get more passengers than many American electric roads.

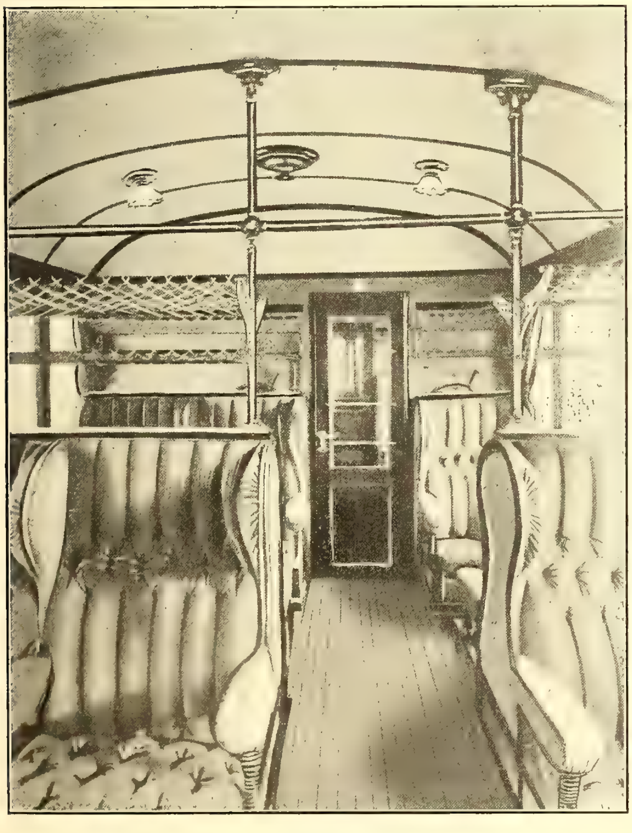


FIG. 22.—INTERIOR OF SECOND-CLASS VESTIBULED CAR, GOTTHARD RAILWAY, SWITZERLAND

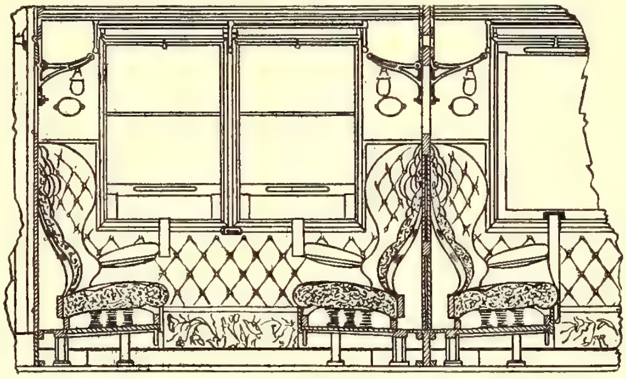


FIG. 21.—SEATS IN FIRST-CLASS VESTIBULED CAR, WESTERN RAILWAY OF FRANCE

POSTS

It is curious that the prevalence of grab posts in some of the Continental cars has not been followed in this country, where there is so much more need of them, and they are so much safer, more convenient and lasting than straps. They should be placed at least on the top of every fixed seat back, and probably at the corner of every seat next to the aisle. Grab handles should, of course, be located on each side of the doors, especially to keep passengers' hands out of the way. In some European rapid transit cars there are baggage racks over the cross seats, as illustrated in Figs. 21 and 22. As our subways grow warmer, some practical joker may demand not only the hat hooks supplied on the Central London, but coat hooks, ice-water tanks, and refrigerating coils underneath the seats.

SEATS

In a side-door car the seats must obviously face each other, but it is to be hoped the public will see the advantages of the arrangement already common in many rapid transit cars, the Illinois Central, and sleeping cars. The ordinary American cross seat has points of superiority in its always facing forward, and its foot rests, but it is out of the question for congested service with short stops. Vis-a-vis seats must be carefully designed both to make them popular and successful. As to the spacing, 60 ins. is the ordinary minimum in Europe where there are side doors, or 54 ins. where there are no doors, as on the latest Berlin surface cars. The minimum spacing the writer has measured is 52 ins. on a Liverpool elevated car. In this country even closer spacing can be found on cars in Escanaba, Mich., where it is 50 1-3 ins. Rattan cannot be used for this type of seat without

great waste of room, as seen in the 70-in. spacing in the present subway cars, which even then allows a space between knees of only about 11½ ins. at the most, which is the same that one would get with the 56½-in. spacing in Figs. 17 and 18. The reason for this surprising result is simply that the thickness of the rattan seats through the backs is 13½ ins. greater at the critical point just above the cushion than with the compact type illustrated. The writer would use a spring back, but raise it so as to fit the small of a person's back. The longitudinal upholstered seats in the Boston surface cars have an excellent profile, and merely need the addition of springs in the back and springs under the cushion, as shown in the sections. The best models for seat or chair construction are the steam railroad seats of England and France, where a cushion is usually placed on a spring frame as illustrated in Figs. 17, 18 and 21. There may be more work to take care of this combination than the cushion alone or the nearly bare springs which make American seats so uncomfortable with any length of ride; but the immense gain in comfort might pay simply as a matter of policy. As to seat material, now that vacuum cleaning is being used on railway cars, it is to be hoped that rattan will be employed as sparingly as possible. Where an impervious covering is needed, let it be some imitation leather that can be shaped to a person's body and not make one sit on a hump and lean against a hump. When the writer first began to study seats in Europe, several years ago, he was a strong advocate of plain wood; but a few months' travel on luxurious cushions (see Fig. 22) played havoc with one's Spartan theories. Our seat manufacturers have long tried to change the human anatomy in the interests of economy with their convex seats, but while one may admire their heroic warfare against nature, it seems time to admit defeat and to apply some science to the most unscientific thing about a modern car. Let the cushion be soft, and a hard-riding car can be forgiven.

The seat backs in Figs. 17 and 18 are 42 ins. high above the floor. Higher backs would have the disadvantage of making it harder to see empty seats, and for the guard to watch the doors, but would have the advantages of reducing draughts on passengers' necks, of confining the odors of persons who do not wash often to a more limited space, of reducing noise somewhat, and of assisting in the downward ventilation discussed later. The tendency in European side-door cars is towards lowering the partitions between seats, except perhaps in Germany, where, in the Berlin Stadtbahn cars, the partitions between compartments all extend up to the roof, though with door openings along the side aisle. The swinging doors there are closed by the passengers or a platform man.

SIGNALS

Where automatic electric signals are used, and the starting signal is not given till every door is closed and contacts made, the side-door type has a great advantage over center-door cars in needing only two contacts to a car, in connection with the single operating rod on each side. With a five-car train at a local station only five contacts would have to be made, where with a center-door train there would have to be thirteen. At a terminal the numbers would be 10 against 26. The greater the number of contacts the greater the chance of failure, and so it is not surprising to find frequent failures with these automatic signals, especially at terminals, where more doors are opened. Such failures will delay a train as much as twenty seconds at a single station after all the doors are shut. When the guards at last find that the signals will not work on a train, they then give hand signals promptly and reduce the delay.

The question has been raised whether an automatic starting signal should not give warning if any door begins to open on the road. While this might be needed with doors held closed only by air pressure, it would not be so necessary with the Illinois Central cars, where a strong and positive locking device is in use. If a train is to be started before all the doors are tightly closed, instead of an automatic signal system the guards might operate the door mechanism with one hand and close a signal circuit with the other at the safe moment, only it might be necessary for preventing the guards from giving the signal carelessly and too early to allow the circuit to be closed only when the doors were shut to a safe amount.

The use of automatic signals sounding only at the head of a train has one disadvantage, in giving the passengers no warning as to just when a train will begin to move. If the start is likely to be jerky, it seems safer to continue to have a bell sounded on each car, as this will cause people instinctively to brace themselves or to take hold of a strap or something firm.

SIGNS

A much neglected factor in the matter of reducing the time of stops is the question of signs. The excuse sometimes given for their absence is the time taken to change them at the end of a run, although enough time may be lost in passengers having to ask the guards where a train goes to change the signs a dozen times over. The real trouble is plainly that it is too much like work to get the signs up and see that they are properly used. This is illustrated by one road which for years had no illuminated signs on its open cars, and at night, where the streets were not bright, it was necessary for persons to hold up car after car and ask the motorman where he was going. The loss of time, current and brake-shoe metal was apparently never considered. An electric road is no place for affectation in the matter of signs, and the neglect of this point is inexcusable.

As to subway or elevated trains, passengers cannot be expected always to understand markers, and an illuminated destination sign at the front of a train is a necessity and not a luxury. The large sign on the cars in Figs. 17 and 19 may be smiled at, but it is no larger than those on the Berlin elevated or subway or surface cars even, or the new Metropolitan trains in London, and the Lancashire & Yorkshire trains out of Liverpool. Even the express trains on the latter road, which make no stop for over 17 miles, have the same illuminated signs, giving the destination and the word "Express" as well. Even more important than end signs is the need of signs on the side of a train. While train indicators may be satisfactory if as brilliantly lighted as in the Berlin subway, every train should have signs along the sides so that one is always in sight, as on the Mersey Railways and so many European surface cars. And there should be destination and route signs inside a car also, for those who are strangers or got on a train in a hurry. The latter again are not luxuries, but simply common-sense devices whose importance is realized in Europe.

While the English signs are the brightest in use, the sign system of the Grosse Berliner Company is the model one in the world, and needs application on subway and elevated trains as well as all surface cars. On both front and rear is a large destination sign, Fig. 23, large route number, and the route color (now being given up as unnecessary), all illuminated. On each side, running the whole length of the car, is a black-and-white sign with letters that can be read and

are not simply ornamental, giving every street in order through which the car passes, with the destinations, and the route number repeated at each end. In the front and rear windows of each side of the car are placards printed on both sides so as to be read from both outside and inside the car, repeating all that is on the other signs, and giving in addition everything else a passenger could want to know, such as the correct time for leaving on every trip, the time to reach intermediate points on the road, rates of fare, and even the time to make the trip in both rush hours and slack hours, week days and Sundays, the location of the office, etc. Nothing is concealed from the passengers as in some of our cities, and the city authorities have been obliged to limit the number of cars in some places instead of to demand more.

The desirability of station annunciators is another question. An interesting offer was recently made to one American company to experiment with loud-speaking telephone transmitters for use in cars to announce stations and in stations to announce trains. The difficulties of hearing in noisy subways and on exposed elevated stations, and in seeing and reading signs and indicators, make the need of such experiments desirable. In a train or station one person's voice could be distributed everywhere, and the transmitters would sound like a megaphone. The next best thing would be for the guards to use megaphones, or, as one railway official desired, phonographs might announce the stations.

TRUCKS

Two improvements in subway trucks may be needed, though not illustrated in the article. One is a device worked out in Germany some time ago, which would catch any derailed truck and hold it within a few inches of the rails and keep the wheels off the tires. The other is a wheel guard to try and reduce running over employees, suicides and other persons on the track. In the Philadelphia subway there appears to be sufficient depth of space between the rails for a train to pass over a fallen person, as has actually happened at the Brooklyn Bridge, without hurting a man. The Central London Railway has a very deep space of this kind. The safest track would evidently be one with considerable space below the rail head, or with the floor as high as the rail, as again in the Philadelphia subway. For the first condition, a guard in front of each wheel, as found in Europe, might at least save a fallen person from being run over. For the second construction, the Liverpool plow guard, as illustrated in the JOURNAL for August 15, 1903, would evidently make it impossible to run over a fallen person, judging by the five years' perfect record of this wheel guard on the Liverpool surface cars. With a more permanent track construction than the present one, and the resulting reduction of track repairs, there would be less need of these safeguards, except perhaps at stations.

VENTILATION

The most radical departure in the side-door cars submitted is probably in the matter of ventilation, and it takes some courage to advocate such different methods from those at present employed. But any one who has ridden in the subway on one of the hottest days, and had dirty neighbors in the next seat, knows how bad conditions can be. The very breeze that sweeps through the cars after the suffocating heat of a station stop simply brings more smell. While trains are in motion in summer the heat is more endurable, but the noise demands the closing of the windows, and in winter, when windows are closed, the air gets close, especially during stops. As the subway gets hotter and hotter in the future, like those in this country and some in Europe, fans in the cars will simply be a necessity if only to stir the air up. In the Budapest subway, fans were installed which started up automatically whenever a car stopped. On the Mersey Railway powerful exhaust fans are installed in combination cars, to work all the time, and the lead of this model public service corporation seems well worth following. Any system of ventilation which depends on the movement of a car may be satisfactory under steam railroad or interurban railway conditions, with long runs without stops; but for the small, congested spaces of city cars, with long stops

FIG. 23.—BERLIN SIGNS, GROSSE BERLINER STRASSENBAHN

and not infrequent blockades, it seems impossible to keep the air up to the standards demanded by health and the encouragement of traffic without the use of ventilating fans, except when cars can be in the open air with all windows wide open. Managers hesitate to add the complications of fans, but the public will demand and require them some time. The first American company that introduces scientific ventilation may get a very substantial return from a pleased public, and the expense might well be charged to advertising.

As to the best method of ventilating cars, an important discovery was made not long ago by Dr. G. W. Fitz, a well-known authority on hygiene, who has made careful investigations of car ventilation. He found that the tendency of a person's breath is downward, and that by circulating air in a car down, much less fresh air is needed than with an upward movement, because the downward air that reaches the nose or mouth is all fresh, while air moving upward is contaminated by air expelled by each person. Downward circulation is often considered too drafty, but in the case of a car, passengers always have their hats on. Downward circulation would obviously be the most effective in dealing with odors from passengers, as the odors would be carried directly down to the floor away from other people's noses. Upward ventilation presents the most difficulties with a side-door car, as air ducts must be carried along under the floors, and air brought down from the roof to avoid dust. Heaters are of course easily placed under the seats.

The question has been raised whether it is safe to carry 120 passengers in so small a space as the ordinary car, even if they are seated, on account of the danger of spreading disease from the close contact of persons, the increased risk in case of panic, etc. Perhaps the answer to this is that the orderly seating of all passengers in clean cars, the maintenance of a uniform breathing level, the downward direction of all vitiated air, and the keeping down of floor dust, would sufficiently satisfy the chief requirements of health, though it might be better in the future to plan to provide each passenger with more seat space. If people were more careful about keeping clean, and not coughing in others'

faces, there would be less need of improvement in car sanitation; but there is no doubt that where part of the passengers are standing and others are seated the former will be apt to cough in the faces of the latter. On the other hand, the side-door car affords the widest separation between people's faces, the abundance of seats would seem to make possible a uniform breathing level, and downward ventilation would seem to be the most effective remedy for the remaining difficulties.

The system of ventilation suggested for the new types of subway cars illustrated is probably evident from the use of as a short circuit of fresh air immediately out of the top of the car might result.

The transoms seen in Fig. 17 over each window were put in so that each passenger could have the pleasure of opening or shutting something near him, according to his taste, but it would be best to keep even the transoms closed. Transoms are a common means of ventilation in European subway cars, but for American congestion at least they are not adequate. The mechanism is apt to wear and the transoms to get stuck, so that with slow speeds and shorter stops little air enters the car. This is a more serious matter where cars

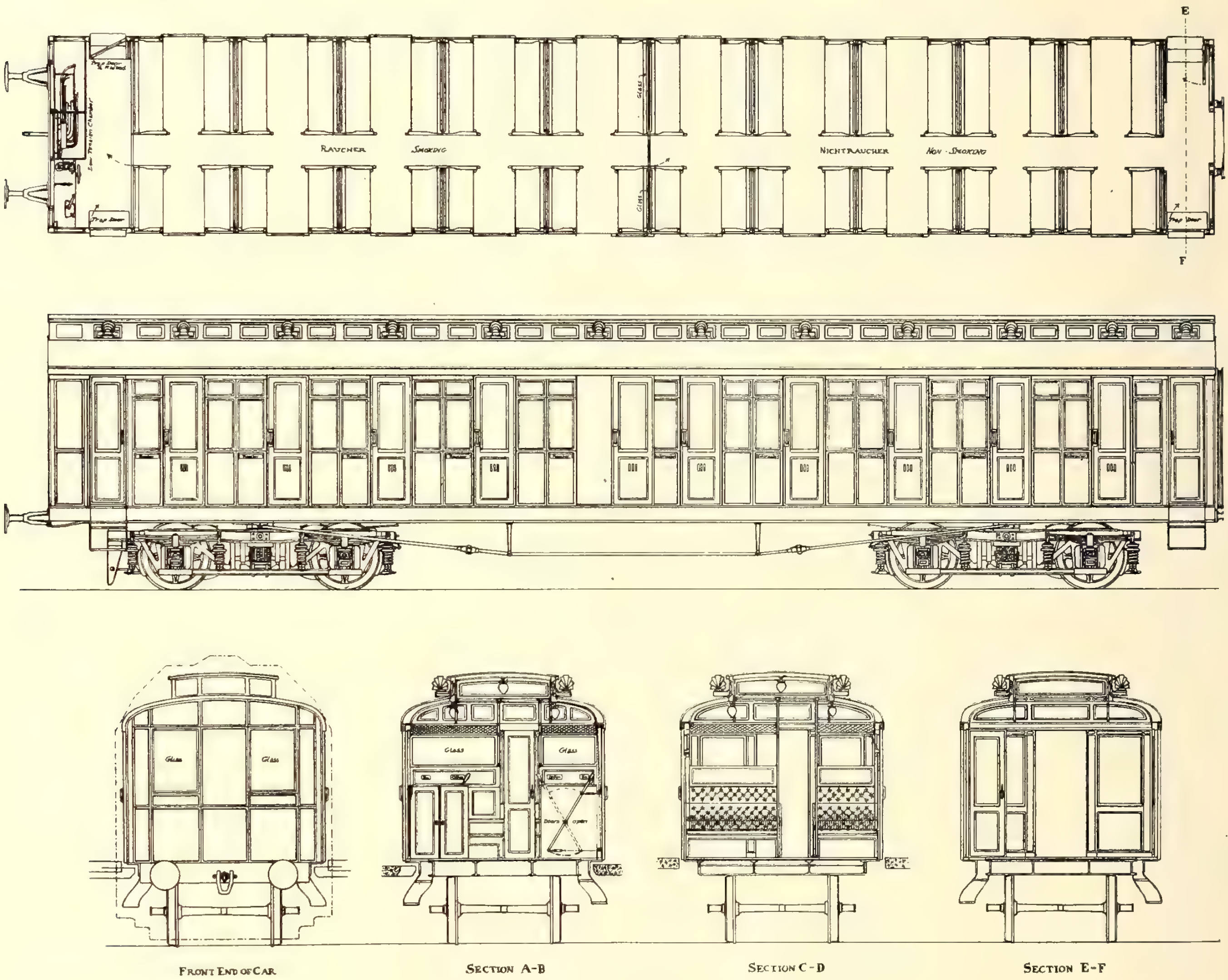


FIG. 24.—STUDY FOR A EUROPEAN SIDE-DOOR CAR

elliptical roofs. The interior ceilings are kept much as now, except for the absence of deck sashes in the clerestory. At each end of the car would be a motor-driven centrifugal fan, taking in air probably through the transom over the brake wheel, and blowing it through one of the ducts in the car roof, down through openings over each seat as shown in the longitudinal sections, the exhaust air passing out through gratings in the floor in front of each door or under the seats. Such a plenum system would seem the best if it proved successful. In winter the air would be warmed by electric heaters at the fan or along the ducts as needed. It has been found to take much less current to heat a car in winter when air is blown through the heaters than with no circulation at all. A thorough test of electric car ventilation is urgently needed. With the suggested plenum system it would be obviously undesirable to have any windows open, are vestibuled than where platforms are open and there is more opportunity for ventilation in other ways. Smoking cars, when used at the end of the train, also give trouble all the time in one respect, for the smoke cannot be kept out of the car ahead. Although the end doors of cars are kept closed in winter, the smoke surges forward whenever a train stops, through the small window through which the guard calls the stations, into the preceding car. In summer the latter car is even more smoky, because the end doors are open.

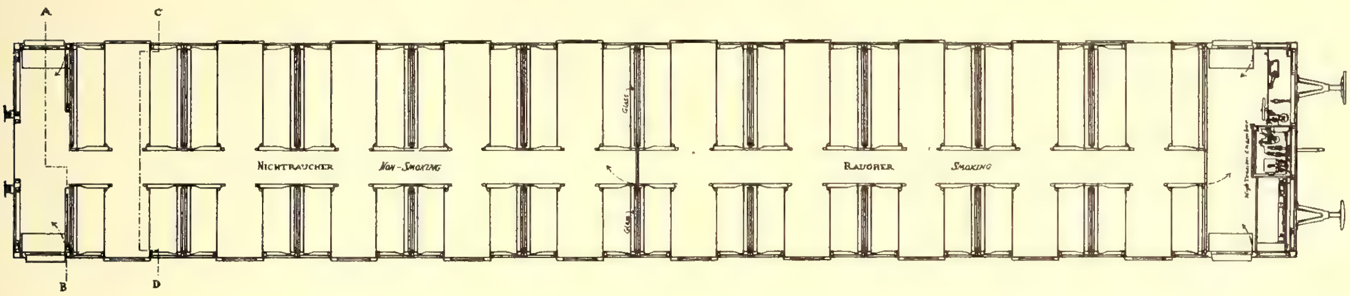
Another troublesome feature in American railway practice is the ventilation of the first car in summer. In order to get enough air the front door is usually kept open in pleasant weather, which gives an agreeable breeze at low speeds, but at a high speed it is sometimes difficult to keep one's hat on. and reading of newspapers is very difficult. The children

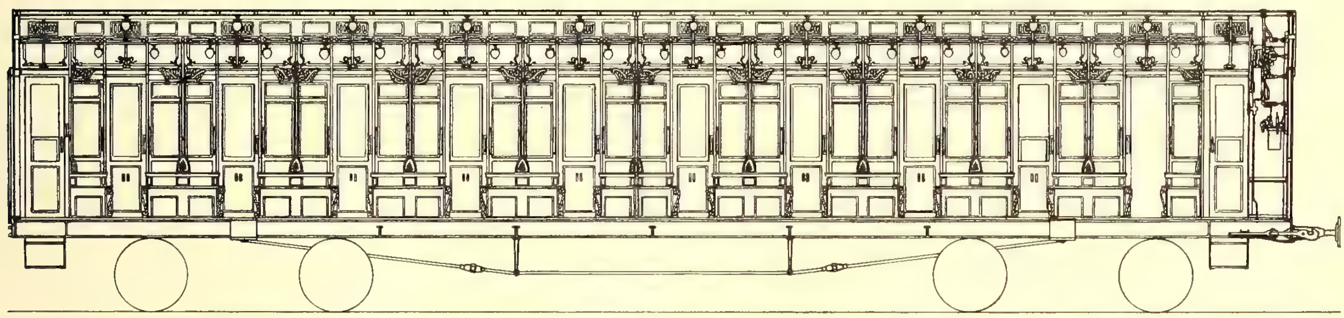
like it, but it is rather disagreeable for men and women, especially the latter. The blowing about of the dust from the car floor is very objectionable, and the Boston cars, perhaps even more than the New York, show the need of fan ventilation with moderate and well-regulated currents.

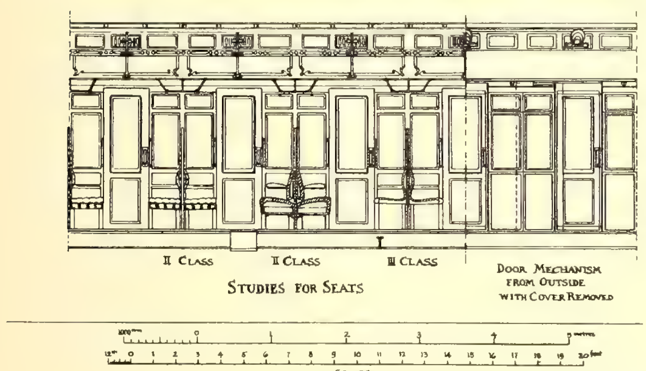
VESTIBULES

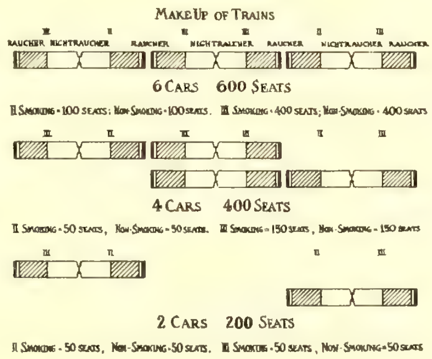
While no vestibules are shown on any of the cars, they appear to be very desirable on subway cars for several reasons: (1) To keep air from entering or leaving the car except at the desired points, so that no drafts may interfere with systematic ventilation, and (2) to make it as easy as possible for passengers to distribute themselves through a train and avoid any congestion in any part of a train While the present subway cars have wide doors opening between them, probably passengers would distribute themselves better if passing between cars was not accompanied by strong drafts and dust and there were no space down which one could slip. It has been suggested in New York that the capacity of trains might be increased by increasing the length of the train beyond that allowed by the length of the platforms. This would answer if passengers who rode in the end cars would understand that they would have to transfer to other cars before arriving at the station at which they wished to alight. Possibly these end cars could be used for parlor cars, for which an extra fare would be charged, and thus attract more intelligent users who would know enough to transfer to other cars before reaching their desired station; otherwise the plan is hardly practical.

The need of vestibuling the cars of a train is strikingly illustrated in Boston, where the sharpness and frequency of the curves have led the company to allow no passing between cars whatever, even at stations, the end doors being narrow and used only by the guards. This is a return to a custom which is being given up in Europe, and is probably one of the causes of the long stops in Boston, as it renders impossible the distribution of passengers from the crowded to the less crowded cars. The station arrangements in Boston tend to bunch passengers in one part of the train, in the rear cars when going north and in the front cars going south, so that there are often seats in one car when another is crowded. The length of stop, of course, is determined by the most crowded car. Vestibuling does not prevent the concentration of passengers getting on, but helps with those getting off. It is not so necessary with a side-door car and plenty of seats, as with the Liverpool overhead cars and English suburban trains, for with plenty of seats there is less blocking of the doors. But even with the fifteen-car trains of the Great Eastern Railway at the rush hours there is trouble from the lack of aisles and vestibules, for passengers naturally crowd into the center cars of such long trains.









100 SEAT CAR

	FT IN	METRES
LENGTH OF BODY	56' 7"	17.245
LENGTH OVER BUFFERS	59' 2½"	18.047
WIDTH OVER POSTS	9' 6"	2.896
WIDTH OVER DOORS	9' 9"	2.972
WIDTH OVER STEPS	9' 10"	3.000
WIDTH OF UNDERFRAME	8' 3"	2.514
WIDTH INSIDE WALLS	9' 4"	2.845
HEIGHT, RAIL TO ROOF	13' 4"	4.060
HEIGHT, RAIL TO FLOOR	4' 2"	1.270
BETWEEN TRUCK CENTRES	36' 3"	11.049
BETWEEN WHEEL CENTRES	8' 2"	2.500
HEIGHT OF DOOR OPENING	6' 3"	1.905
WIDTH OF DOOR OPENING	20"	.508
SPACE BETWEEN SEATS	24"	.610
AISLE BETWEEN POSTS	22"	.559

Doors opened by passengers, closed by hand levers,— one guard handling one or two cars

FIG. 24.—(CONTINUED)—STUDY FOR A EUROPEAN SIDE-DOOR CAR

SUGGESTED TRAIN FOR TWO CLASSES, WITH SMOKING AND NON-SMOKING COMPARTMENTS

Fig. 24 represents an attempt to adapt the Illinois Cen-

tral type of car to European conditions. The problem chosen by the writer for solution was to design a unit adapted for single-phase operation, to handle at the rush hour a very heavy traffic, consisting of passengers of two classes, and of smokers and non-smokers, the lower class seats to predominate if possible. A maximum economy in employees was desirable.

When one tries to combine features from different countries, the result may not satisfy anyone, but the indulgence of critics is asked, as the task was rather difficult. The conditions selected were those of trains to be made up of two-car units, vestibuled and with aisles, so that a person could board a train at any point and find his desired class and seat later except that the second-class seats were only in the end units. The passing through one class to get to another might not be desirable, but is necessary if the shortest possible stops are wanted.

The two cars in each unit are permanently coupled and vestibuled. The doors are sliding ones outside of the car body, to be opened by each passenger, as on the Illinois Central and after the present custom in Europe, to be closed simultaneously by the guard with one operating rod. As in previous types, the guard would stand at the end of each car at an open window, so as to watch easily both the inside and outside of the car in closing the doors. If economy in trainmen were more important than economy in length of stops, one guard could close the doors on two adjacent cars. This would allow two men to handle two cars, three men four cars, and four men six cars with 600 seats. The economy of this feature may be seen by the fact that to furnish 600 seats with the present New York subway cars would take twelve cars and twelve men instead of four.

The reasons for using sliding instead of swinging doors have already been given. The doors would be hung on ball-bearing hangers to reduce friction, and all would be closed by moving one operating rod. The force needed to close such doors would be so slight, only a few pounds probably, that a hand mechanism is used, as on the Illinois Central, and not air. European roads would hardly care to use as much air as American roads, as greater economy of operation is desired. As European passengers are already used to opening their own doors with handles, the latter are employed instead of the ingenious hand holes of the Illinois Central cars. Similar sliding doors and handles are provided on the Berlin Elevated and Underground Railway.

The operating rod of the door is connected by chains to a vertical lever, seen on each side of the guard's vestibules. The doors are unlocked by pushing the top of the lever away from the car sides, and closed by pulling the lever in the opposite direction. The lever can be further locked in the closed position. Each door would have a spring connection with the operating rod, so as to allow enough opening when closed to release any clothing caught. The cars, of course, should have emergency brake cords run along over the doors both inside and out.

The windows in the doors can be lowered, but not the others, as is already the custom in Europe. Passengers can open the lower transoms by hand and the upper ventilators by the handles over each door. Heating apparatus, if needed, would be placed under the seats, and the heat could be turned on or off by the passengers, as now. Fan ventilation seemed a little too radical to suggest in this case.

Several types of seats are shown, wooden for the lower class, and upholstered for the higher. The seat backs are made very high, but low enough for the guard to see passengers inside the doors. Baggage racks and abundant posts and handles are provided. As persons pass between the seats, brackets will keep them off the feet of those seated.

The car construction is the same as in previous examples, and so needs no description. Adjacent units are not connected by vestibules, but this might be done by placing the high and low-tension chambers at the right, and swinging the end doors of the cars when open for passage so as to shut off more or less from the passengers the motorman's apparatus. While the ordinary vestibule for side buffer cars might be used, it would be obviously better at the end of a train to use a more compact vestibule. If baggage were to be carried on this train, the motorman's cab might be made larger and the motorman handle the baggage during the stops.

To allow passengers or employees to board the cars where there are no platforms or only low ones, steps are provided at the car ends, covered by trap doors, after the American wide vestibule practice. The doors over these steps, however, can be opened at high station platforms without opening the trap doors, which might be taken advantage of in cold or stormy weather at unprotected stations, making unnecessary the opening of the side doors. Trap doors can, of course, be lifted from outside the car as well as inside.

HORSE CAR LINES TO BE ELECTRIFIED IN NEW YORK

Mr. Oren Root, Jr., vice-president and general manager of the New York City Railway Company, announced last week that the directors of the company have authorized the president to make contracts, order materials and do everything necessary to expedite the change-over of the present horse-car lines to electricity. The order of lines to be changed over has not yet been entirely settled, but the company has notified the State Railroad Commission that one of the first lines will be that on First Avenue. Construction will be commenced as soon as the frost is out of the ground and will be completed at the earliest possible date. Another line which will probably be electrified soon is the Twenty-Eighth and Twenty-Ninth Street line. President Vreeland, referring to this decision, said:

There has been a very grave misunderstanding on the part of the traveling public, caused by the horse cars being operated of late years in Manhattan. The problem from an operating standpoint has been one of the most difficult to solve.

We all know of the vast public and private improvements which are being made in and around New York, creating new centers for the distribution of passengers. New bridges are being constructed across the East River, and new tunnels are under way. Up to a few months ago it was not definitely known what arrangements the city and private corporations would make at the new terminals in New York to accommodate the traveling public. It would have been futile to plan for accommodating passengers arriving over the Blackwell's Island Bridge without knowing where the city was to put the terminal.

As a matter of fact, however, passenger traffic business in and to New York will undergo a complete change of conditions within the next few years, and the New York City Railway Company by putting into effect the plans adopted to-day will be in a position to give the traveling public greatly increased facilities.

The Indiana, Columbus & Eastern Traction Company inaugurated on Jan. 7 a new limited service between Zanesville and Columbus, Ohio. The distance of 64 miles is made in two hours. Of this time it takes the car about 45 minutes to run through the 8 miles of streets in the terminal cities and larger towns, so that the remaining 58 miles out in the country are covered in 1¼ hours. So far only one car has been put on this service. It starts at Zanesville in the morning and makes two round trips.

PAPERS READ AT THE BUFFALO MEETING OF THE STREET RAILWAY ASSOCIATION OF THE STATE OF NEW YORK

TRACK CONSTRUCTION IN PAVED STREETS

BY I. E. MATTHEWS,
Engineer Maintenance of Way, Rochester Railway Company

An absolutely "permanent way" is a dream which will never be realized, but is the ideal condition toward which we aim. The increasing weight of rolling stock has been met by altering the sections of the rail from the flat-strap to the girder and gradually increasing the weight and depth of the rail; thus affecting the depth of foundations and increasing the cost.

Joints are one of the greatest sources of trouble to the maintenance of way engineer. Owing to the difficulty of removing the paving, many slight defects in joints are neglected until it is absolutely necessary to make repairs, and then the cost is much greater than it would have been if repairs had been made at the first indication of trouble. This condition of affairs leads to a considerable amount of rough track, not quite bad enough to warrant ripping up the pavement, and yet by no means a track in first-class condition. It is therefore imperative that the joints be as substantial and durable as the rail itself. In order to eliminate joints, it is now customary to use rails 60 ft. in length, and if the idea be indefinitely extended we obtain a continuous rail. This is accomplished to some extent by the electric or cast welding of the rail ends; but as this is the subject of another paper I will not consider this matter further at this time. The question of joints, tie plates and bonds have also been made subjects for special papers, so I will omit them too.

Smooth track to true gage is an essential feature to electric roads. Wooden ties spaced 24 ins. to 30 ins. center to center, and laid in or on concrete foundations probably give the best support to track. It has generally been advocated that the rail should have an elastic support, such as the wooden tie affords, but more recent practice would seem to indicate that the metal tie thoroughly embedded in concrete would be an improvement on the older method. In keeping the track to gage the braced tie-plate is preferable to the tie-rod.

Passing from the above general remarks, we may consider some of the variations in construction. Obviously the selection of the proper track construction for any given street will depend, as indeed does the pavement itself, on the class of traffic which will use it. For a street of heavy traffic, one would expect to use stone blocks for paving material with a correspondingly heavy track construction. Where traffic is light, brick or asphalt might be selected as paving and a lighter track construction would be used. In either case a concrete foundation at least 6 ins. in thickness under the ties is recommended. This is costly, but necessary to good permanent track construction. Where the foundation is quite solid and has never been disturbed by gas or water-pipe trenches, sewers or other excavations—a condition rarely, if ever, found in our modern cities—this concrete foundation might be replaced by broken stone or gravel with fairly good results.

Under the concrete foundations and about 1 ft. outside of the outside rails there should be laid a 3-in. farm tile drain in coarse gravel with joints covered with gunny cloth, to be laid parallel with and the full length of the track, connecting with surface sewers or manholes. It should be at least 2½ ft. below the grade of the finished pavement and covered with coarse gravel for a width of 6 ins. and up to the bottom of the concrete foundation under the pavement. The sub-grade should be crowned so as to render the drain more effective.

The type of construction best adapted to streets of heavy traffic is the 9-in. full-grooved rail, well tied with Georgia pine ties, spaced 24 ins. to 30 ins., center to center, and laid on a 6-in. concrete base. The concrete should be mixed—Portland cement one part, sand three parts, and broken stone which will pass through a 2-in. diameter ring, six parts. This concrete should be laid at the same time as that for the foundation of the adjoining pavement and should be carefully tamped under the ties and rails. A fine concrete or grout of one part Portland cement to two parts sand should be poured around and under the rail, in order to give a firm and uniform bearing to the rail. The space between the flange and head of the rail should be filled with a Portland cement mortar in the proportion of one to three. The stone blocks, resting on 6 ins. of concrete and with joints thoroughly grouted, complete this construction. It is the type used by the Rochester Railway Company on streets of heavy traffic, the paving blocks being of Medina sandstone. The cost of the construction has averaged $5.80 per lineal foot of track. Using the same track construction, but with brick paving, the cost has been $5 per lineal foot of track.

In recently rebuilding the University Avenue line of the Rochester Railway Company, we adopted a concrete beam construction under the rails. The beam is 12 ins. in depth below the base of the rail and is 18 ins. wide under the outside rails, and 14 ins. wide under the center rails. Wooden ties are spaced 5 ft. center to center, the beam being carried to a depth of 8 ins. under the ties. Ninety-four-pound 9-in. girder rails, held to gage by brace tie plates at each tie, rest solidly on the continuous concrete beams. The pavement between the tracks and 2 ft. outside is of Medina block, the paving in the street beyond being asphalt. This construction costs $5.06 per lineal foot of track. University Avenue is an outside street and would not be classified as one with heavy traffic; however, by using the concrete beam we were able to obtain a stone block pavement at about the same cost as the brick pavement with solid concrete foundations. One point should be emphasized—to render the continuous concrete beam construction satisfactory, the concrete foundations of the track and pavement should be thoroughly bonded together. If the sub-grade has been disturbed and there is any possibility of future settlement taking place, I should hesitate using the concrete beams.

I am of the opinion that a material reduction in the cost without lowering the standard of construction from that given above can be effected by the use of the high T-rail in paved streets.

The municipal authorities to a large extent seem to be opposed to the growing use of T-rail in paved streets, but there are now upon the market paving brick of such shape that the paving around the rail gives practically the same

effect as the groove in the girder rail, and in many Western cities this type has become the standard. It is claimed that the groove or flangeway so formed is superior to the grooved girder rail. In streets of heavy vehicle traffic the cost of maintenance of the paving might become excessive with T-rail, but on all other streets I am of the opinion that the T-rail would be preferable to the grooved rail, both because it is cheaper in first cost and because it gives the bearing of the wheel squarely over the center of the base. The base being wide, there is no tendency to overturn, and the flangeway formed by the special paving blocks gives a groove which is as self-cleaning as that of the grooved rail. Another consideration which should receive attention is the increasing number of interurban cars which are entering our cities with their greater depth of wheel flanges. Very little wear can take place on the ordinary grooved or girder rail before the cars are running on the wheel flanges. With the T-rail, however, the amount of wear that can take place before the track is entirely worn out is independent of the car wheel flanges.

The STREET RAILWAY JOURNAL of June 3, 1905, discussed, editorially, the persistency with which city engineers in certain municipalities cling to the idea that the grooved rail is the only suitable rail for paved streets, and then advanced the idea that the grooved rail was dangerous to interurban cars, citing some examples from Cleveland, where serious derailments had occurred, due to the grooves in the rails not being deep enough to admit the flanges of the interurban wheels.

Wherever T-rail in paved streets has been given a fair trial it has been notably successful. I believe the honor of the first use of T-rail in paved streets belongs to Denver, Col. They use a 72-lb., 6-in. Shanghai T-rail laid on wooden ties only 21 ins. between centers, tamped with gravel. Extreme care is taken, however, to have the ground thoroughly settled before placing the ballast. Other cities in which T-rail construction in paved streets has been adopted to a large extent are Indianapolis, Milwaukee, Minneapolis and St. Paul. The two latter cities are notable because it was there that T-rail was first used in streets paved with asphalt, where girder rail had been the rule before. The rail used is an 8-in. Shanghai T, weighing 79 lbs. to the yard. A concrete beam supports each rail and is 22 ins. to 24 ins. wide and 12 ins. deep under the rail. Around and above the base of the rail are placed 3 ins. of natural cement, if the paving is of brick, and less if the paving is of granite.

The most notable instance of recent adoption of T-rail construction in the East was in Boston some two years ago, when they installed about 2½ miles, following closely the practice of Minneapolis. As the writer has not built any T-rail track in paved streets, he is not in position to present any figures as to actual costs. John A. Beeler, of Denver, who, I believe, designed the first Shanghai rails, made some estimates of track construction which are given in "Herrick's Electric Railway Hand-Book," in which he states that stone block paving on concrete base with 70-lb. T-rail, track on wooden ties 21 ins. between centerrs and ballasted with gravel, cost $4.43 per lineal foot of track. Using the same track construction and paving, but with a 6-in. concrete foundation, the cost is stated at $4.90 per lineal foot of track. This is 90 cents per foot of track less than the cost of the same type with girder rails in the city of Rochester. The difference between track on gravel ballast and concrete base as shown above is only 47 cents per lineal foot of track. This additional 10 per cent of cost would insure a more serviceable and durable construction and in the end give the best satisfaction.

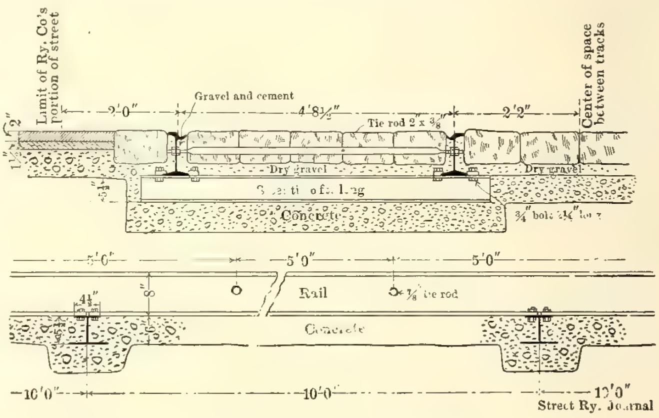
In conclusion, I would suggest the high T-rail with wooden ties on a concrete base, or steel ties on the concrete stringers as the ideal track construction in paved streets; excepting, however, in streets of heavy traffic where the grooved girder rail would be superior on account of the better protection afforded to the pavement adjacent to the rail.

CONCRETE STRINGER, CONCRETE STRINGER WITH TIES, AND STEEL TIES

BY F. D. JACKSON,
Engineer of Way, International Railway Company, Buffalo

A complete description of the Buffalo track system was contained in two very able articles by Mr. Wilson appearing in the "Street Railway Review" for March and August, 1903. An article on the same subject was also published in the STREET RAILWAY JOURNAL for Oct. 31, 1903.* The present paper will treat, not of all the styles of construction used in Buffalo, but of two distinct types, viz: concrete stringers with and without ties, and solid concrete in the track.

Realizing, as we do, the necessity for providing substantial substructure in electric railway roadbeds to take care



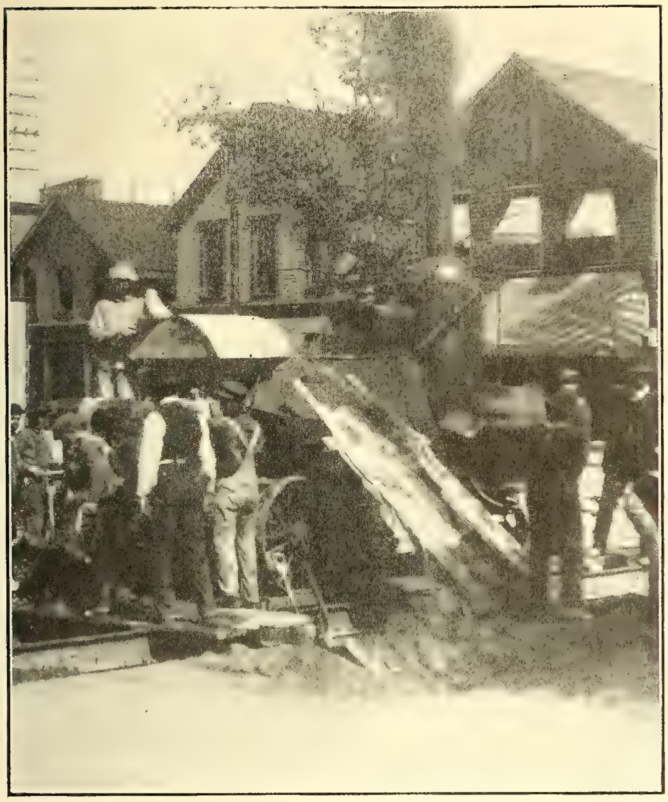
GROSS SECTION OF CONCRETE AND STEEL TIE TRACK WORK ON FILLMORE AVENUE, BUFFALO, N. Y.

of the increasing weights of cars, which at present are 30 tons, the tendency to-day is in the direction of providing a foundation for the rails which shall be as nearly rigid as possible. Many engineers question the advisability of so rigid a construction, claiming undue wear to the rails, on account of the inelasticity of the roadbed. Measurements made of rails on a line operating a one-half minute service do not bear out this statement. We find the head of the rail has worn ⅛ in. in about four and one-half years, which would give a life for the rail under this very frequent service of more than sixteen years, before the ¾-in. flanges would commence to touch the bottom of the groove. There is also a very important thing to consider, namely, that the life of the pavement adjoining the rails is prolonged, and its cost of maintenance is cut down very considerably. On the other hand, elasticity in the roadbed favors the life of the rail. The desirability of either form of construction must therefore eventually be determined by comparing the cost of renewing rails more frequently, the pavements remaining

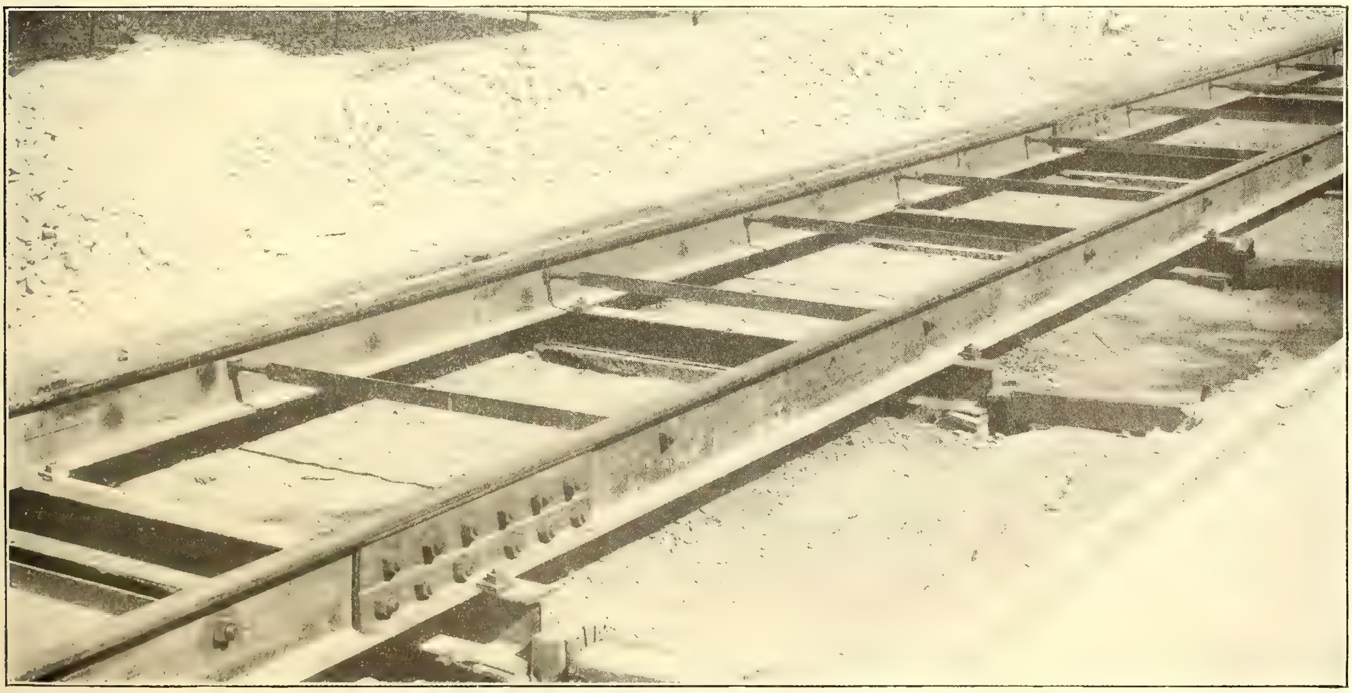
*See also STREET RAILWAY JOURNAL, July 21, 1906.

in good condition, and of paving more often and securing a longer life of the rails.

Buffalo has carried the concrete stringer idea further than most roads, by laying a solid bed of concrete the entire



PORTABLE CONCRETE MIXER AT WORK ON FILLMORE AVENUE, BUFFALO, N. Y.



VIEW SHOWING STEEL TIES AND THE TIE-RODS IN PLACE ON FILLMORE AVENUE, BUFFALO, N. Y., BEFORE CONCRETE WAS LAID

width of the roadbed, 6 ins. deep and 6 ins. under the ties, instead of having a concrete beam under each rail. This style of construction is used with tracks laid in block paving. On the other hand, in streets paved with asphalt we have gone to the other extreme, and have placed a concrete beam 12 ins. wide by 8 ins. deep under each rail. This beam is not bonded to the concrete which forms the paving foundation, so that in fact there is no concrete except under each rail. The solid concrete construction with stone paving has been adopted as our best style of work, and the following data will show to what extent it has been used:

Of the 194 miles of city tracks, 62 miles are of the concrete beam construction and 87 miles of the solid concrete construction. The remaining 45 miles is old-style work and is mostly on lightly traveled lines where sand, gravel or stone is used for ballast.

Two streets have concrete beam construction without ties, viz: Clinton Street, Bailey Avenue to city line, 5300 ft. double track, and Jefferson Street, Dexter to Main, 2998 ft. double track. In each case the rail is 9 ins., No. 94-204, with standard twelve-bolt joint, with tie rods at 8-ft. and 5-ft. centers, and toothing and asphalt. These two pieces of track were built in 1897 and to-day are in fair condition. On Clinton Street 16-ft. single-truck cars are run on ten-minute headway, and no repairs have been made to the track. On Jefferson Street double-truck cars are run on five-minute headway. Repairs on portions of this track have been made. One reason why this style of track has held so well is that after the rails were well surfaced and lined, concrete was tamped well up against the base of the rail. The remaining 59 miles of track of the concrete beam type employ ties. Two sections of rail were used: 9-in. and 6¼-in. girder and two kinds of ties; steel channels, 7 ins. x 5 ft. 9 ins., and yellow pine ties 5 ins. x 7 ins. x 7 ft., at 10-ft. centers. With the steel channels no tie-rods were used. With wooden ties, tie rods at 10-ft. centers and brace tie-plates were employed, most of the track being built in 1899. With this style of construction the rail gets out of surface and line, affecting both pavement and rolling stock.

In the 87 miles of solid concrete construction there are several notable features. Nearly all this track is 9-in. girder, mostly welded, but some with the standard twelve-bolt joints. Only 2.2 miles of this type of track are laid with 6¼ in. rail. Most of the welding was done in 1899 and 1900.

Yellow pine 5-in. x 7-in. x 7-ft. ties are used at 5-ft. and 10-ft. centers; tie-rods are employed at 10-ft. centers, and in a few cases brace tie-plates at 6-ft. centers. Various kinds of paving are used, including common stone and a little brick, but most of the paving is No. 1 block stone. Some of this track was laid in 1893, but most of it about 1900.

The construction which we consider most up to date is solid concrete, with Carnegie steel ties, and tie-rods at 5-ft. centers. Five miles of double track of this style of construction were put in this past year on Fillmore Avenue and 1.1 miles of double track on Sycamore Street. A trench 18 ft. wide was dug to 15 ins. below the surface of the street. The 9-in. rail was laid and bolted with four bolts and clips to Carnegie steel ties spaced 10-ft. centers. These per day of ten hours, this work includes the space within the rails, 2 ft. on the outside and 2 ft. in the devil strip. By the use of the continuous concrete mixer a uniform mix was secured for the entire job with a saving of about 10 per cent of cement. The pavers followed behind the concrete gang, using 3 ins. of coarse gravel for a cushion and on that the No. 1 Medina block stone was placed. Full stone paving was employed between the rails and in the devil strip, and toothing was laid along the outside of the track to receive the asphalt, which was placed up against it. The stone paving was then pounded and slushed with a grout composed of a mixture of one part Portland cement to two parts of sand, which completely filled up the voids between the stones, making a perfect bond. This style of construction costs about $5 a running foot of single track,

VIEW SHOWING COMPLETED AND UNCOMPLETED PORTIONS OF TRACK ON FILLMORE AVENUE, BUFFALO, N. Y.

ties are of I-beam section, top flange, 4½ ins.; bottom flange, 8 ins.; depth, 5½ ins.; 6 ft. long and weigh 19.7 lbs. per foot. The track was then surfaced and lined by blocking up under the ends of the ties, and ⅞-in. tie rods spaced at 5-ft. centers were put in. A 6-in. trench was dug under each tie. Concrete, proportioned one part of Lehigh Portland cement, three parts of clean, sharp sand and five parts of 2½-in. stone, was then put in by a Foote continuous concrete mixer. This mixer in operation is shown in one of the accompanying illustrations. One pair of wheels ran on the asphalt outside the track and the other pair of wheels on 5-ft. planks properly blocked up so that no weight was brought upon the track. The concrete was shoveled into the trench to a depth of 6 ins., was well tamped under the rail, and was then thoroughly pounded after being leveled to the top of the ties. Three ties were kept tamped ahead of the mixer to insure thorough work at the ties. Four hundred feet of single track were concreted as against $4.50 where wooden ties and tie-rods at 10-ft. centers are used. Part of this increase in cost is due, not only to the extra cost of steel tie over wood and to an extra tie-rod, but also to the higher price of labor and material.

Where it is necessary to keep cars moving over a stretch where track is being reconstructed, portable cross-overs are used and cars are kept off the new work for at least seventy-two hours to allow the cement to set. Special care should be taken to see that concrete is thoroughly tamped under and around the ties and under the rails, following this up by thorough pounding.

The fact that we have considerable track with concrete beam under each rail, laid since 1897, and more of the solid concrete style laid at a later date, gives opportunity to make a just comparison between the two styles of construction. That we have so much of the solid concrete construction indicates which style of work we prefer.

In Lockport, on Main Street, we have 4217 ft. of single

track laid with 100-lb. A. S. C. E. rail on solid concrete in a brick-paved street, with a special brick along groove side of rail. Over this track three sections of wheels run, namely, wheels with 2-in. tread, 5/8-in. flange; 2½-in. tread, ¾-in. flange and M. C. B. wheels. Over this track 100,000-lb. gondola cars are run. This track was constructed in 1903, and to date is standing up perfectly.

TIE PLATES, BRACED TIE PLATES AND TIE RODS

BY E. P. ROUNDEY,
Engineer Maintenance of Way, Syracuse Rapid Transit Company

Our attention was first called to the inefficiency of braced tie plates as a means of holding girder rails to gage when the cars on several of the lines in Syracuse began to leave the tracks; and in every case we found the track in the neighborhood of the place of derailment to be from ½ in. to 1 in. wide gage. The track construction on these lines is as follows: 9-in. half-groove rail, Lorain section 90 - 317; oak ties 6 ins. x 8 ins. x 8 ins.; 6 ins. of coarse gravel ballast; and malleable iron brace plates every 6 ft. The concrete for the paving, which is both brick and asphalt, extends from the bottom of the tie to about 4 ins. above it. The track has been down about ten years.

The derailments became so numerous a short time after putting some new heavy cars on the lines that we decided to place tie rods in all of our tracks having the half-groove rail and brace plates. When the track was opened for the tie rods, we found the ties in fair condition, but many of the brace plates were bent backwards and others twisted away from the head of the rail, being practically of no use for holding the rails to gage. The track had been gradually widening out under the small cars, and when the large heavy cars were run it only took a short time to widen the gage until the track was unsafe.

Tie rods have been placed in most of this track now and we have had no more trouble with derailments. The great objection to brace plates, judging from our experience, is due to their being spiked to wooden ties. They are dependent for their efficiency on the holding power of the spike, and as the ties get old the continual tipping of the side bearing rail loosens the spikes and allows the brace plates to twist and become loose; they also cut into the ties as the ties decay, thus allowing the rail to tip outward. A great deal of care should be taken when putting on brace plates, as the spikers will often twist them when spiking and get a poor bearing under the head of the rail; crooked or uneven ties will also make trouble in getting a good job.

We have some steel brace plates, on a piece of track which has been down for about three years, and have had no trouble as yet, but the cars are small and ten minutes apart. When this track is to be paved we will place the tie rods 6 ft. apart, in addition to the present brace plates. The use of brace plates would be advisable in laying track in an unpaved street, which would be paved in a few years, as a strong steel brace should hold the track when the ties are in good condition, and when the street is paved, put in the tie rods.

The objection to tie rods in an unpaved street is that as the filling between the rails settles the rods are exposed to wagon traffic and become bent or broken. The theoretical objections to the brace plates, as compared with the tie rods, are as follows: The brace plate depends for its efficiency on the condition of the tie, and braces each rail independently; if the braces on one side fail, the gage will widen; with the tie rod, if the rails get out of line they will move together and maintain the gage. On ordinary girder rail track a ½-in. or so wide gage will not cause derailment of cars, but with the half-groove type, especially Lorain section 90 - 317, ½-in. wide gage usually means trouble.

The lip on this rail is thin and narrow, and flattens down under wagon traffic, often breaking off in places. When a car comes to a place where the track is ½ in. or more wide gage, the flanges of the wheels on one side get inside of the lip of the rail, and when the track comes to gage again the opposite wheels are forced over the head of the rail, causing derailment of the car.

With this type of rail, which necessitates tight gage for safety, tie rods are the best fastening. If a strong steel brace were used in connection with a steel tie, it should make an efficient device for holding the rails to gage.

There is not much to be said in favor of the use of ordinary tie plates on rail in a paved street, as the concrete between the ties will support the rail and keep it from cutting into the tie any appreciable amount. However, the concrete in the older tracks in Syracuse does not seem to be of any use for holding the rails to gage.

ELECTRICALLY WELDED JOINTS

BY P. NEY WILSON,
Roadmaster, Rochester Railway Company

I shall not go into the subject of the details of electric welding so far as the equipment is concerned. This matter has been covered, I understand, very thoroughly in past meetings of this organization. Joints are unquestionably the most important detail in the permanent way department. It is my opinion that no mechanical joint is equal to a good weld. Viewed from the financial standpoint, or from the standpoint of the purely practical track foreman, the weld is the thing. We know that we can make a good roadbed if sufficient funds are available. Unless the joints are welded, we cannot by any means be positive that we can hold our joints.

As I have been connected with the Rochester Railway only about one week, I am not familiar with the performance of the electric welded joints in that city. I shall therefore read a detailed statement of cost of welding 3087 joints in Camden, N. J., which is the South Jersey Division of the Public Service Corporation.* You will note that the credit for the sale of old fish-plates and copper bonds represents rather a large figure. I admit that I was somewhat surprised at this figure myself, but it is based upon actual cash received from a local scrap dealer in making sale of the old material. I might add that the sale of the bonds figured very materially in making this figure so high. We used a bond devised by ourselves, which cost in material alone $1.25 per joint. As the material was almost entirely composed of copper we naturally had a very good return in the way of a credit.

We paid little or no attention to expansion and contraction, as I am strongly of the opinion that in improved paving there is little change in the temperature of the earth and correspondingly there is very slight expansion and contraction. In the total of 3087 joints we had 32 breaks in one year, or about 1 per cent. On Broadway and on Kaighns' Avenue we had a total of 779 welded joints, and

* See also Street Railway Journal for Jan. 6, 1906.

none broken. These two streets were paved with asphalt on concrete. The entire number of broken joints occurred on Haddonfield Pike and Moorestown Pike, where the track was laid on sand and paved roughly with rubble-stone. The condition of the paving was such that in the winter months the snow and ice had an opportunity to get in around the rail. I regard this condition as the cause of the broken joints, as the same section of rail was welded in each instance.

The bonding of joints is so closely identified with the joint itself that one should be considered with the other. This feature is very important, as the question of installing a rail bond is, to my mind, simply a choice of evils. With the weld we know we must have a perfect bond. From the general manager's standpoint I think the matter should be approached in this way: In the case of old track with more or less battered joints, prices should be obtained upon a step-joint for raising the receiving rail sufficiently to surface the lowest spot in the dish with the abutting rail. To this figure should be added the cost of the bonds (loose and battered joints are usually accompanied with bad bonding); then add labor cost and incidental material and reach a total. This total should be compared with the cost of welding.

In the work at Camden I found that the cost of electric welding was less than the estimated cost of placing step joints. I found by making tests of electrical welding joints that the conductivity was equal to or greater than the solid rail section, using the Conant tee-pole bond testing machine.

I have heard the opinion expressed by several managers that they would not weld new track, but that welding was all right in the case of battered joints. Personally, this appears to me as a discrimination without a difference.

SUMMARY OF COSTS OF ELECTRICALLY WELDING 3087 JOINTS IN CAMDEN, N. J.

Cost of labor	$7,031.24			
Cost of material	581.00			
		$7,612.33		
Credit from sale of old fish-plates and bonds *		2,816.59		
			$4,795.74	
Cost of welding 3037 joints, at $5.25 each			16,206.75	
Cost of replacing asphalt, 899.6 yds., at $2.53, and 117 yds., at $2.51			2,569.65	
Total cost of operation				$23,572.14
First cost per joint:				
Labor				2.277
Material				.188
Labor and material				2.465
Cost per joint, labor and material, after credit is deducted				1.553
Final cost per joint, all labor, material, welding and asphalt charges				7.635
Cost per mile, under similar conditions, 30-ft. lengths				2,627.52
Cost per mile, under similar conditions, 60-ft. lengths				1,343.76

*Scrap value of the iron, $15.60 per gross ton, copper at 15¼ cents per pound; actual price received from the scrap dealer.

COST PER JOINT, PAVING AND RAIL SECTIONS ON ABOVE STREETS

Haddonfield Pike, 7-in. girder (P. S. Co., section No. 238, and Cambria No. 824), rubble stone on sand, all 60-ft. lengths; 989 joints	$6.684
Moorestown Pike, 9-in. girder and 7-in. girder (P. S. Co., sections 238 and 200), rubble stone on sand, all 60-ft. lengths; total, 1128 joints	6.704
Broadway, 7-in. girder (P. S. Co., section No. 238), asphalt between rails and part of shoulder, Belgium block along rail, on 6-in. concrete; Kaighn Avenue, 7-in. girder (P. S. Co., section No. 238), bricks between rails and shoulder, on 6-in. concrete, all 30-ft. lengths; total, 779 joints	10.438
State Street and River Road, 7-in. girder (Cambria, section 334), rubble stone on sand; 115 joints with 30-ft. lengths, 76 joints with 60-ft. lengths; total, 191 joints	6.632
Total, 3087 joints	7.635

	Haddonfield Pike	Moorestown Pike.	Broadway and Kaighn Ave.	State St. and River Road.
Number of joints	989	1,128	779	191
Cost of labor	$2177.55	$2528.19	$1944.94	$380.56
Cost of material	140.85	142.85	239.78	57.61
Total cost	$2318.40	$2671.04	$2184.72	$438.17
Credit from sale of old fish plates and bonds	900.00	1030.19	712.146	174.26
Net cost	$1418.40	$1640.85	$1472.574	$263.91
First cost per joint, labor	$2.201	$2.241	$2.496	$1.993
First cost per joint, material	.142	.127	.307	.201
First cost per joint, labor and material	2.343	2 369	2.803	2.294
Cost per joint after credit is deducted	1.434	1.454	1.89	1.382
Cost per joint for welding	5.25	5.25	5.25	5.25
Final cost per joint, all labor, material and welding	6.684	6.704	a10.438	6.632
Total cost of operation	6610.65	7562.85	8138.17	1266.66
Cost per mile, 30-ft. lengths	2352.76	2359.80	3674.17	2334.46
Cost per mile, 60-ft. lengths	1176.38	1179.90	1837.08	1167.23

a This figure includes cost of replacing 1016.6 square yards of asphalt, $2,569.65 or $3.298 per joint.

I learn from Mr. Kleinschmidt that the Lorain Steel Company has recently successfully applied the process to T-rail track on interurban lines, having welded a stretch of about 6 miles from Providence, R. I., to River Point. In this track expansion joints are used every 1000 ft. The same company has also welded the third rail on some 2 miles of elevated track in Brooklyn. Another interesting piece of welding was the new T-rail tracks on the Brooklyn Bridge. As this rail is laid directly on the plank, it is evident that the electric weld was the only form of welded joint that could be used. There are, I believe, five expansion joints on each rail, and no reports have been reported to date.

In August, 1905, 1770 joints were welded in Rochester. The cost of welding was $5 per joint. The total cost, including welding and replacing pavement, etc., was $11.25 per joint. Up to Jan. 29, 1906, there had been 114 breaks, or about 6½ per cent.

On Monroe Avenue, Rochester, out of a total of 303 joints there were 48 breaks, or 15 per cent. This was a Trilby rail, and I believe Mr. Matthews attributes these failures to the type of rail, especially on account of the weak web. The fact that 415 joints were welded on Park Avenue and Mt. Hope Avenue and Main Street, and none broken, seems to prove the above statement.

I would like to conclude by asking a question: The cost of placing a step joint with bonds on old and battered joints is about one dollar more than welding. The cost of placing an improved mechanical joint is about the same as a weld. Why don't the general managers weld?

RAIL BONDS

BY H. L. MACK,
Superintendent of Lines, International Railway Company, Buffalo

The object of rail bonding is to join the ends of rails so as to afford an unbroken circuit through them for the return current. The carrying capacity of the bonds can be determined in the same manner as that of the feed wires. If the tracks or rails of one line carry return current from two or more lines, the carrying capacity of the bonds can be determined by that of the feeder for the two or more intersecting lines. If the flow of current is greater than the carrying capacity of the rails a supplementary return cable or cables should be used and should be provided with frequent connections to the rails. Supplementary wires can also be used with good results where trolley tracks cross

steam railroad tracks at grade, but are of no value around curves or special work, except where the uniform bond cannot be applied. Grounding the rails to water or gas pipes is of no value for increasing the capacity of the return circuit and damaging results often occur through such practice.

The question is often asked, What is the best bond? The best bond is that in which the greatest care is exercised in its application, as the workman can make the bond an effective connection, or so much junk. Too much care cannot be taken in such application, which should not be made until the hole in the rail is perfectly bright and free from rust, dirt or moisture. The terminal on the bond should also be bright and free from moisture before being put in. Bonds should not be applied in damp or wet weather, as moisture will start corrosion and greatly reduce their efficiency. In drilling rails for bonds the best results may be obtained by drilling dry, and in no case should any oil be used on the drill, as oil forms a coating at point of contact and greatly increases the resistance of the bond. Where holes for bonds are drilled in the rails at the mills they should be drilled 1-32 in. smaller than the diameter of the terminal of the bond, as the rail often becomes rusty before it is used, and if the holes should be drilled large enough at the mills they would be too large after reaming out. The hole should be reamed out to exactly the diameter of the terminal. No type of bond should be installed by unskilled labor if good results are expected. One man should have charge and be responsible for the installation of all bonds and keep as near as possible a complete record.

The International Railway Company has used nearly all types of bonds which it was thought would give good results. After long experience and a careful study of different types, we have adopted as a standard the compressed terminal bond which we have used for several years with very good results. During the summer of 1906 we had the entire system gone over with the Albert B. Herrick Autographic Test Car to determine the condition of the bonds. The test proved very valuable, as well as interesting. In the city of Buffalo there are about 106 miles of electrically-welded track; the test showed this track to be a uniform conductor for the entire length, as when the rail ends are welded together the resistance at the joints is no greater than at any other place in the rail.

The type of compressed terminal bond which we use is a No. 0000 10-in. x 12-in. flexible with ⅞-in. terminal. Two of these bonds are put under the splice bars at each rail joint, and if they are carefully installed I believe they are most reliable and after four or five years' service will show less resistance than any other type of bond which is on the market. At the present time we have this type of bond installed on some of the track which was laid in 1897 and 1898, and the tests taken in the summer of 1906 showed the resistance of the joint to be less than 4 ft. of adjacent rail. I think this record very good in view of the fact that the importance of a bond or a complete return circuit was not considered as serious at that time as at the present.

In 1900 we laid about 12 miles of track and bonded it with 10-in. x 12-in. No. 0000 Crown pin figure 8 bond, with ¾-in. terminal. Two bonds put in at each joint under splice bars. A recent test made did not show these bonds to be as efficient as the compressed terminal bond. As the compressed terminal bond had been installed nine years, and the Crown pin bond but five years, this would show a marked difference in the efficiency, but in justice to the Crown pin bond, I may state that there was not the care exercised in applying these bonds that there should have been to give the best results, as the work was rushed and not enough time was taken to permit careful installation. The bond has some advantages over any other type of bond when rebonding is necessary and trains or cars are run at frequent intervals and at high speed, and when it is not desirable to interfere with the service. Its application is very simple, as it is only necessary to drive in a pin; the drilling and bonding can be done without placing any obstacle on the rail, such as a screw compressor, to cause fear of derailment. This advantage applies principally to high-speed interurban lines or to steam roads undergoing electrification.

I believe that we were one of the earliest users of the soldered bond, which we started to use in 1893. After a number of tests, both electrically and mechanically, we thought we had solved the bonding problem. We not only used these bonds on all new track and track relaid, but we went in very extensively to rebonding. In about three years we had occasion to change some special work where these bonds were used, and to our surprise we found some of them practically of no use at all, as the tinning between the bond terminal and the rail had very nearly all disappeared and rust had taken its place. It is needless to state that we discontinued for the time the use of soldered bonds. The bond which we used was made in our shops; the terminal was about 2½ ins. in diameter, carefully planed off; the rail was also carefully cleaned off with a special tool made for the purpose; the bond terminal and rail were both tinned before installing the bond, so it is quite evident that our experience with soldered bonds has not been very satisfactory. About one year ago we had installed by one of the leading makers of soldered bonds about 500, and I have just recently made a test of a number of these bonds and am pleased to state the test was very satisfactory. I do not believe enough is known of soldered bonds to determine their exact location in the scale. I would like to see a soldered bond not only stand as a competitor to other types of bonds but to rank first in the list, as I believe it is the most practical in application and has the highest electrical test when first applied. What remains to be determined is the life of the bond.

CATENARY LINE CONSTRUCTION

BY C. E. EVELETH

The primary cause for the change from bracket and span construction, as ordinarily used for direct current, to catenary construction was the difficulty in obtaining suitable insulation in the old types of construction. With the trolley wire supported by a messenger wire, which in turn can be directly supported on porcelain insulators, there is no difficulty in obtaining sufficient insulation for almost any voltage. This type of construction resulted in a more flexible trolley wire and one which a wheel follows with much less jumping. By additional points of support the deflections of the trolley between supports could be decreased as much as desired. Another advantage of this system is that when used with trolley wheel collectors there is little chance of the overhead work being pulled down by the wheel catching on the supporting wires when it comes off the trolley wire. It is only at curves that there is anything which could give trouble from this source, as the tangents are entirely clear even at anchors.

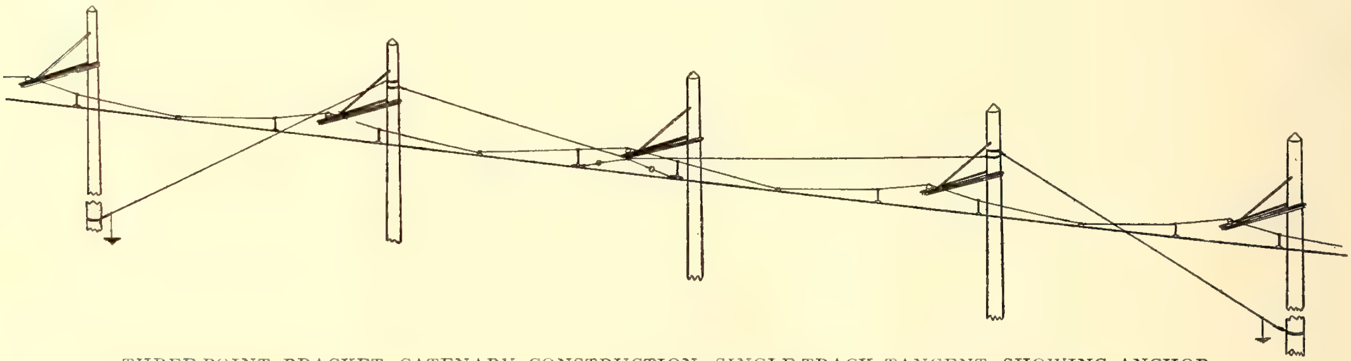
It has been found feasible to increase the distance between poles up to what is now considered a standard dis-

tance of 150 ft. on tangents with shorter distances on curves. The poles are set about 6 ft. to 6 ft. 6 ins. in the ground. With bracket construction they are given an outward rake at the top of about 1 ft. Guys are needed only on curves or where the ground has poor holding qualities, since with bracket supported trolleys the strains tending to bend or displace are only from one-fifth to one-tenth as great as those existing with span construction. The question of doping the poles with tar or protecting them at the ground surface with cement and asphalt is largely a matter of individual taste.

A new element is introduced in the requirements for a bracket with the catenary construction. When the trolley is installed the maintenance will depend largely upon the exact balance of forces on the messenger wire, which means that the deflection for the individual spans should be the same. It is desirable then to have a certain amount of rigidity in the horizontal direction so that the initial dip of the messenger wire may be adjusted to the desired amount. To obtain this stiffness an angle-iron bracket has been designed, consisting of 2-in. x 2½-in. x ¼-in. angles fastened together with suitable spacing blocks at the end over the track and at a point 18 ins. nearer the pole. Through this latter block is passed the stay bolt supporting the bracket though this latter bracket is undesirable from the construction standpoint, as it has no stiffness in the horizontal plane.

For single-track work it is well to raise the outer end of the bracket 2 ins. or 3 ins. so that when loaded with a messenger wire and trolley the pole deflection will make the bracket level.

When the poles and brackets have been put in position and the insulators installed the line is ready for the messenger wire, which for trolley wire up to No. 000 capacity usually consists of a 5-16-in. second grade or high strength seven-strand, double galvanized steel cable having an ultimate strength of about 8100 lbs., or a ⅜-in. Siemens-Martin seven-strand, double galvanized steel cable, having an ultimate strength of about 6800 lbs. The grade first mentioned requires the use of mechanical clamps at the splices, while the softer steel can be made up into the usual cable joint. One or two miles of this messenger wire are usually run out and pulled up to give the required uniform deflection before loading with the trolley wire and fittings. For a 150-ft. span at about 50 to 75 degs. F. the initial deflection of the wire should be about 16 ins. With the messenger wire in place the trolley is run out, pulled tight and clipped in at the center points of the spans. This will change the span deflection at the center from 16 ins. to 24 ins. The



THREE-POINT BRACKET CATENARY CONSTRUCTION, SINGLE-TRACK TANGENT, SHOWING ANCHOR

from the pole top. The angle brackets are shipped unbent, as they are flexible enough to spring out sufficiently to take the pole.

For double-track work longer angle-irons are used, riveted together with suitable spacing blocks at each end. These may be sprung open and slid down over the top of the pole. Where this is impossible, due to wires or other conditions, one end of the bracket is usually bolted. The distance mentioned between the spacing blocks on the bracket is provided to allow an adjustment of the insular position to accommodate alignment of the trolley and provide means to obtain staggering when the bow or pantograph collector is used.

A short iron pin designed with special base and having a bolt passing up between the two angle-irons is used to support a standard type of pole line insulator, which is preferably made in two pieces cemented together. The insulators are cemented to the pins. Cementing is preferred to threading, as it gives the porcelain a more rigid backing and so aids materially in preventing breakage from missiles. It will be seen that any friction due to movement of the messenger wire on the insulators will create a force tending to twist the insulator around the bracket. This is prevented by the pin stud passing between the two angle-irons.

If rigid economy requires a lower cost bracket than the angle-iron, one made of tee-iron would be the next choice, as this possesses a shape to which the insulator pin may be readily attached without danger of twisting around the arm, deflection will be about 28 ins. when the rest of the hangers have been installed with three or more points of suspension. It is well to anchor the trolley while clipped in at the center points only so that any change in the relative position of trolley and messenger wire will not necessitate adjusting the additional suspensions. Both the trolley and messenger wires should be anchored at each end of every curve. The messenger wire deflection given above seems to be about the most satisfactory for 150-ft. spans, as less deflection will cause much more variation in height of the trolley wire due to temperature changes and make the system rigid, while more deflection makes the whole system too flexible in the horizontal plane.

For years the spacing between trolley supports has been in the neighborhood of 100 ft. Many roads are now running satisfactorily with wheel trolleys with this spacing up to speeds of 60 m. p. h. It is probable, therefore, that the direct-current trolley wheel collectors and three-point suspension, bringing the distance between points down to 50 ft., will be entirely satisfactory for any reasonable speed. With sliding contacts of either the bow or pantograph type, having much more inertia than the wheel collectors, a closer spacing of supports is doubtless of advantage, as this makes the difference in level between the supports and center points of spans sufficiently less to enable the heavier collecting device to follow the wire and also lessens the blow at each support. There is nothing to decide just the number of points to give the best results, but it appears that the

stiffness of a No. 0000 trolley is such that the system seems to pass the point of maximum flexibility when the supports are about 15 ft. or 16 ft. apart. If they are closer than this a contact passing under a support not only raises that support but the two adjacent ones, while at this spacing the trolley wire will bend and lift only the support under which the collector is passing. If more than three points of suspension are used the weight of trolley carried by the center point is not very great, and an initial twist in the trolley conductor is liable to cant the center point ear sufficiently to cause it to hit on the moving collector. It is, therefore, desirable to allow a greater distance between the lowest point of the messenger wire and the trolley, so that the weight of the latter will be sufficient to prevent an initial twist canting the center point hangers.

Inertia tests on the pantograph collectors indicate that with a properly installed trolley supported every 20 ft. or 25 ft. there is sufficient activity of the collector to follow up the deflections in the trolley wire, even supposing that these deflections were not actually reduced by the pressure of the collector on the wire at intermediate points between suspensions.

A number of styles of connection have been developed to support the trolley wire from the messenger, but the one which we are recommending most strongly at the present time consists of a sister hook of malleable iron grasping the messenger wire having a flat strip of steel 1/8 in. x 5/8 in. connecting this sister hook with the clamping ear. This ear has been made up in a variety of forms, and the selection of the type is largely a matter of personal choice, as a number of mathematical and screw clamp ears have been developed for this purpose.

With the pantograph collectors a clearance of about 6 ins. vertically 3 ft. away from the trolley wire is required for clearance on curves where the outer rail is elevated, throwing the collector contact surface at an angle with the horizontal. Since the pull-offs must be on the outside of the curves where the clearance space is necessary, a bridle arrangement has been adopted, which consists of 1/4-in. seven-strand cable attached to a special clamping ear with eye on the trolley wire and a special sister hook with an eye on the messenger cable. A rod forms a rigid connection between the sister hook and ear. The strain insulator is inserted in the apex of the triangle formed by this bridle. With curves of large radius, a device known as the "steady brace" is used to push off the trolley wire at a point directly below the bracket. This push-off brace consists of a screw clamp car, to which is attached a gooseneck piece of 5/8-in. threaded steel rod, which in turn is attached to the end of a wooden stick about 2 ins. in diameter. The other end of this stick is fitted into a socket carried, in the case of high-voltage work, by a special porcelain insulator, which is so pivoted at the pole as to allow the motion in a horizontal plane that is required by movements of the trolley wire. In double-track work the principle of the bridle pull-off is used just as the double-curve hanger for direct-current work.

It is well to anchor the trolley about four times to the mile. The anchor is attached to the trolley about 25 ft. either side of the pole anchor bracket, which in turn is anchored to adjacent poles. The change from the center point of span, where the anchor cable would be nearly parallel to the trolley wire, to this location nearer to the bracket is necessitated by the danger of a loose anchor cable catching in a sliding contact. With this type of anchor and a wheel collector the angle between the anchor guy and the trolley is so small that it is not possible to catch a wheel between them.

All of the catenary material is installed suitably either for wheel or bow collectors, with the exception of the frogs, which must be special for each condition.

The strain insulator required for this high-voltage work has been one of the most difficult problems to solve, but a solution has been very well worked out in a special type of insulator made of porcelain, weighing 3½ lbs., and capable of withstanding 10,000 lbs. pull, or, in other words, more pull than any cable used in this sort of construction.

CORRESPONDENCE

THE BOW TROLLEY IN GERMANY

Schenectady, N. Y., Jan. 7, 1907.

Editors Street Railway Journal:

The article on "The Electric Railways of Germany at the Close of 1906," in your issue of Jan. 5, 1907, contains some statements about bow collectors which may give American readers an erroneous impression. The author says that several companies have changed from the wheel to the bow, but none from the bow to the wheel. In most cases this change-over was not based on engineering, but more or less on commercial reasons, such as the merging of railways, part of which were being operated with the bow collector and part were equipped with trolley wheels. The bow collector has the advantage that it runs smoothly on curves of small radius, such as are frequently met with in old European cities, but has the disadvantage that its current-carrying capacity is limited to practically 50 amps. for free running, and 150 amps. when starting.[1]

Where large current-carrying capacity is required, however, the bow collector is at a disadvantage. This is proved by the fact that the Grosse Berliner Strassenbahn, after taking over the railway connecting Berlin with Charlottenburg, was able to run its motor cars over this line with one wheel trolley, which was substituted for the two bow collectors which were formerly necessary.[2] This change contradicts the statement that none of the German companies has changed over from the bow to the wheel. Of course it is a well-known fact to the trade, if not to the general public, that the use of the bow, which was originally brought out by Siemens & Halske, is now free to everybody. The wider employment of the wheel trolley is due, therefore, not to any patent situation, but to its demonstrated greater advantages for heavy electric street railway service. In cases which warrant its use, as on high-tension single-phase roads, the bow trolley is employed by the Allgemeine Electricitäts Gesellschaft.

Another statement to which I would like to take exception is that relative to the car lightning arresters. The facts are that most of the European electric railways are built according to the Thomson-Houston system, and are not equipped with the horn type car lightning arrester, but with the well-known magnetic blow-out lightning arrester, as manufactured in this country by the General Electric Company.

Eugen Eichel.

[1] See letter of Mr. Cremer, engineer of the Siemens-Schuckert Works, Elek. Bahnen u. Betriebe, May 4, 1906, page 244.

[2] See letter of Mr. Dietel, engineer of the Allgemeine Elektr. Gesell., Elektr. B. u., Betr., July 14, 1906, page 384.

PROCEEDINGS OF THE BUFFALO MEETING OF THE STREET RAILWAY ASSOCIATION OF THE STATE OF NEW YORK

The fourth quarterly meeting of the Street Railway Association of the State of New York was held on Friday, Jan. 11, at the Iroquois Hotel, Buffalo, N. Y. The subjects covered were track construction (including bonding and welding), derailing devices and overhead work. There were about seventy-five in attendance, and the live discussions on the topics presented showed how much interest the quarterly meeting idea has created among the street railway men of New York and contiguous territory.

MORNING SESSION

The morning session opened at 10:15 a. m. with President Shannahan in the chair. Mr. Shannahan announced the paper on "Track Construction in Paved Streets," by I. E. Matthews, engineer, maintenance of way, Rochester Railway Company, which will be found on page 99 of this issue.

Following Mr. Matthews' paper the president introduced F. D. Jackson, superintendent of track, International Railway Company, who read the paper on "Concrete Stringers and Concrete Stringers with Ties and Steel Ties," published on page 100.

E. P. Roundey, superintendent of track, Syracuse Rapid Transit Company, then read the paper on "Tie Plates, Braced Tie Plates and Tie Rods," published on page 103.

When these three papers noted had been read, the president announced that the discussion was open.

Mr. Bagg asked whether the estimate given by Mr. Matthews included the cost of paving. Mr. Matthews said it did.

A delegate inquired of Messrs. Matthews and Jackson as to the relative noiselessness of concrete and the old construction with broken stone and regular paving, as compared with concrete and steel ties. He wanted information on this point because the relative noiselessness of different kinds of construction was an important argument with property owners. Mr. Matthews thought there would be some rumbling with the more rigid track construction, but that was naturally to be expected in large cities, where there is always noise from vehicular traffic.

Mr. Roundey asked Mr. Matthews what his object was in using a full-grooved rail in paved streets. Mr. Matthews replied that the city authorities would not permit a regular girder rail, and besides he thought that a full-grooved rail made a better looking pavement. On Mr. Roundey's query whether such a rail would not fill up with dirt, Mr. Matthews said that certain grooves would, but a section which is now being made with a wider groove than usual seems to be very satisfactory. They had some semi-grooved rail in use on the city lines, the Lorain section, 94-313 being the one he had in mind.

Mr. Clark asked Mr. Matthews whether interurban cars entering Rochester experienced any trouble in passing over the girder rail. Mr. Matthews replied that the interurban cars did not have a very deep flange and so had no trouble.

Mr. Clark said that in Cleveland, where the Trilby rail is used, they had a great deal of complaint from the Lake Shore Electric Railway on account of broken wheel flanges —the inside of the flange rubbing against the inside of the Trilby rail flange. This had a tendency to press the wheels outward. The Lake Shore officials wanted his company to grind the rails to suit. He thought that they concluded to widen their gage a trifle. They have had no trouble ever since. The Lake Shore Electric Company uses the standard 1-in. flange.

Mr. Griffin said that the cars of the Rochester & Eastern Rapid Railway in entering Rochester over the tracks of the Rochester Railway had trouble with some Trilby rail which was made for ¾-in. flange. It was necessary to move out the wheels more than ⅛ in. and re-gage all their own track to overcome the difficulty.

Mr. Brown remarked that lack of care in gaging track caused a great trouble, while Mr. Roundey added that cars were frequently found to be of different gages.

Returning to the subject of roadbed construction, Mr. Jackson stated that more noise would be expected from a solid concrete base because it was more rigid, but that it depends upon conditions. On a wet day, when the rail is perfectly clean, the noise is no more than on other construction, but on a dry day when sand and concrete get on the rail there will be more noise because there is less "give" to the structure.

Mr. Wilson, of Toronto, asked if any members had had experience in using sand or coarse gravel instead of broken stone, to make a concrete mixture.

Mr. Clark said that he had built a bridge at Utica with gravel concrete. Mr. Brown remarked that he had put in a large quantity of gravel concrete in Canandaigua, and that it had made an even better concrete than broken stone.

Later, Mr. Clark explained his method of making gravel concrete mixtures by stating that he mixed a small quantity at a time. Good gravel concrete was possible, but there must be no guesswork about the gravel.

Mr. French mentioned a concrete with clay gravel laid by him on Wolf Street, Syracuse, in 1894. A paving contractor who had to dig cross-trenches through it told him it was the toughest he had ever struck. In reply to an inquiry from Mr. Brown, Mr. French said that the clay-gravel concrete seemed to be very dense.

Mr. Penoyer said that his company used crushed stone measured in a box and a proportion of 1-2-6.

Mr. Bragg said that as he understood Mr. Jackson's paper, his new construction consists of a 6-in. sheet of concrete underneath the whole track, that the Carnegie ties are 10 ft. apart and the rails are held with tie-rods. It seemed to him that steel ties placed 10 ft. apart did not have a very important part to play in the track construction after the concrete has set. He wanted to know whether the ordinary yellow pine tie would not have answered as well as steel ties after the concrete had set. Assuming that the steel ties were removed, would not the track stand up as well?

Mr. Jackson replied that it might stand the service almost as well. The steel ties serve to fix the gage during construction and afterward. If the concrete should break a wooden tie would not have the holding power of a steel tie. With the latter there is better holding power against the wet and also underneath the top flange.

Mr. Bagg asked if there would not be some sag.

Mr. Jackson replied that the concrete also extends under the steel tie for 6 ins., so that the steel tie itself is embedded in 12 ins. of concrete. Wooden ties last eight to 12 years;

his company figures that the steel ties should last fifteen years. It seemed to him poor economy to use a wooden tie on construction of such character. He believed they could take out the pavement, remove the rail and place the new rail on the steel ties without interfering with the sub-structure.

Mr. Clark said he was using steel ties every 5 ft. and a 10-in. beam under the rail with tie-rods every 6 ft.

In reply to a question by Mr. French relative to taking up rails on this construction, Mr. Jackson answered that his company had just started to use this construction but he saw no reason why there should be any trouble.

Mr. French said in answer to Mr. Bagg's question that his company had used a few Carnegie steel ties. However, instead of stopping the concrete at the bottom of the rail they brought it up 2 ins. above the base of the rail. In that way they get the whole steel structure in the concrete so there is less liability of moving of the rail. Careful tamping of the concrete under the rail is necessary.

Mr. Roundey said that in Syracuse concrete 4 ins. above the ties would not hold the track to gage. This may be due to the concrete which was put in ten years ago and which may have been a natural cement He did not think that concrete was of much use in holding the track to gage.

Mr. French said it was not his idea to use the concrete for that purpose. He would not lay track without tie-rods.

Mr. Wilson, of Buffalo, took up some of the criticisms made on the new track construction as to the spacing of the ties and rods, etc. The fact was that when his company took up the question last year they found no steel tie designed for electric railway work. They were therefore forced to use steam railroad sections. This year, at his suggestion, the Carnegie Steel Company had rolled a new tie for electric railway use. It was somewhat lighter and cost them $1.40 instead of $1.81. As to concrete, he thought either gravel or broken stone would do, provided the mixture was carefully made and a good cement used. Natural cement is not good for track work. A good Portland cement should be employed even if it is costly.

Mr. Clark asked Mr. Wilson why he adopted a twelve-hole angle-plate. Mr. Wilson replied that he had not yet adopted any standard joint. He was much interested in finding a standard joint. He had used an electrically-welded joint for some years and had gotten tired of replacing broken joints. They could only be replaced in their former condition by the use of the original extensive welding outfit or the thermit weld, which is still experimental.

Mr. Stanley asked if any one knew of failure through the use of concrete in track construction. He knew of a city where a great deal of concrete had been used in track work and every mile laid, whether with wooden or metal ties, had to be rebuilt. That track construction provided for 6 ins. beneath the ties and later for 13 ins. There could be no criticism about the methods used in the construction, as the best material was employed with brace plates or tie-rods on 9-in. and 7-in. rails. The track was in streets with light traffic and single track, and also in streets carrying heavy interurban cars. That experience determined him when deciding upon track reconstruction in New Jersey. They were using broken stone entirely with no concrete whatever beneath the ties, but only between the ties for the support of the pavements. A 2-in. stone is used. This is rolled by a roller and laid to a depth of 6 ins. The ties are laid and tamped and cars are run before the paving is laid. The depth of concrete laid between the ties depends upon the pavement used. The inter-spaces between the paving blocks are filled with cement grout. He was rather surprised to hear so much about the general use of concrete without a single instance of failure, yet here was a large system where it had proved a failure.

In response to a question as to the evidence of failure, Mr. Stanley said it appeared in the rail breaking through the concrete. The metal ties buckled. All sorts of methods were used to overcome this trouble, but they were unsuccessful.

Mr. Peck inquired as to the character of the soil, and Mr. Stanley said it was similar to Cleveland and Buffalo with plenty of sand.

Answering Mr. Brown's question regarding sub-drainage, Mr. Stanley said that tile was laid either through the center or outside of rails.

Mr. Clark said that perhaps Mr. Stanley was referring to the buckling of ties on Michigan Avenue, Detroit. He was there in 1903. He picked up a piece of concrete, struck it on the rail and it went to pieces, so he concluded that it was natural cement concrete which the city demanded. Mr. Stanley said it was true of that street but not of others.

Mr. Clark expressed the opinion that a Carnegie steel tie would not have buckled.

Mr. Stanley further pointed out that where concrete was used the track was idle for seven and in some instances fourteen days..

Mr. French said he believed it must have been poor concrete if it would not stand up as well as loose broken stone, because the concrete is stone with some cement in it, whereas what he is using now is simply loose stone.

Mr. Brown asked Mr. Stanley if he would use coarse broken stone or a rather fine stone for foundation if he did not use concrete. Mr. Stanley replied he would use 1½-in. stone.

Mr. Matthews mentioned an interesting experience which he had had several years ago with concrete construction. A water pipe broke and washed out a large hole 3 ft. in depth beneath the concrete, yet cars were operated over the track for some time before the hole was discovered. Mr Clark said he had had the same experience in Cleveland, where they operated for some time over a hole 6 ft. to 8 ft. wide caused by a broken water pipe.

Mr. Fairchild stated that in Kansas City where much concrete work was done they had some trouble, but overcame it by increasing to 18 ins. the depth of concrete under the rail.

Mr. Jackson asked Mr. Stanley whether he thought broken stone would stand up against the rail as well as concrete which keeps out moisture and prevents the settling of the pavement. In reply Mr. Stanley said that in his territory the teaming was probably as heavy as anywhere else in the United States, still their track had been down for nearly three years and there was not the slightest break in the pavement.

F. A. Heindle, of J. G. White & Company, said he had had some experience with the English type of construction, in which the rails are laid on concrete stringers 9 ins. to 12 ins. deep and 18 ins. wide. They found that in any type of concrete construction if there is a bad foundation and an excess of water or moisture of any kind, the rails eventually will begin to go up and down. This increases until the concrete immediately under the base of the rail is worked up into powder. Of course, American traffic is considerably heavier than that in England, but even there they find that proper concrete construction can be put in only at great cost and care in installation.

At this point the discussion on the first three papers closed. President Shannahan then informed the members that the Central Railway Club extended them a cordial invitation to attend the annual banquet to be held that evening at 7 p. m. in the Iroquois Hotel. Several members signified their intention to be present.

The president then introduced C. Gordon Reel, vice-president and general manager of the Kingston Consolidated Railroad Company, who read a paper on "Standard Rail Sections for Paved Streets." Mr. Reel prefaced his paper by stating that his company proposed laying standard T-rail in the streets of Kingston, and during the last year he had been collecting data to prove his case. He said that when he originally proposed T-rail construction he thought he had a good case, but in looking into it further he felt sure that there could be no successful opposition. He found that T-rail is exclusively used in some of the largest and most progressive cities in the country. This paper will appear in the STREET RAILWAY JOURNAL for Jan. 26.

In connection with his paper Mr. Reel explained from drawings several styles of T-rail construction. The scoria block construction in Montreal he thought was about right. Mr. Reel also read letters received from several city engineers.

Mr. Wilson, of Buffalo, who was now in the chair, opened the discussion on Mr. Reel's paper, which he said was most interesting and admirable. He had taken up the subject with more courage than any one else. To start the discussion he would offer his criticism of this style of construction. As far as the accommodation of the cars was concerned, it was all right; but the fatal point in T-rail construction seemed to him to be the paving. He had occasion about two years ago to examine some track work on Archer Avenue, Chicago. One track was laid with Trilby section and the other with T-rail. He believed that when he examined the track it was about one and one-half years old. The portion which has been built with T-rail had the paving stone worn down next the gage line of the rail. It was not worn evenly, but in ruts, and in his opinion that pavement would have to be reconstructed very shortly This was his objection to the T-rail construction, especially in cities that have a large amount of team travel, heavy drays, etc. In Buffalo they had an illustration of that kind of traffic on North Main Street above Cold Springs. Paving stone which was the best (Medina sandstone) in the vicinity was worn down to the lip of the rail. It did not wear down any further because the lip caught it. On another avenue where they did not lay a new rail, the paving stone next the gage line is all worn out because the lip was not heavy enough to protect it. The lip is also worn down. He thought that was the idea large cities had in mind in designing such large girder sections like the 140-lb. rail in Philadelphia, the lips being made heavier and heavier to take care of team traffic. The new section for Chicago is practically the same as for Philadelphia except that it is 129 lbs. In conclusion, it seemed to him that the greatest objection to T-rail in large cities or congested portions is in the wear of the pavement.

Mr. Danforth said that it seemed to him that the preceding speaker had covered the large city end of the argument in good shape. As he had had occasion to say in previous discussions on this subject, the roads in the Middle West find that the T-rail laid in stone-paved streets is satisfactory except where there is a very heavy traffic. He thought that Mr. Reel was right in saying that T-rail is best for average conditions. Properly laid, it is cheaper for the railway and offers less obstruction to ordinary vehicles; improperly laid, it is worse than any section of girder rail ever laid.

Mr. Bagg said that he might follow up Mr. Danforth by stating that the Fonda, Johnstown & Gloversville Railroad is using T-rail. The pavement is brick, asphalt block and bitulithic, with Medina sandstone on the inside and outside of the rail. The cities traversed have 15,000 to 20,000 inhabitants and the team traffic is not heavy. There is not much wear on the paving inside or outside of the rail. They formerly used a special brick to form a flangeway each side, but the brick broke off and crumbled. This may have been due to poor brick. Lately they have been using a brick placed under the rail and curved over the head on the other side of the rail, thus affording a good flangeway.

Mr. Clark said he had Mr. Wilson's idea on T-rail until he had visited Milwaukee, Minneapolis, St. Paul and other Western cities last March, where T-rail is standard. Milwaukee has a 95-lb. T-rail with 3-in. head. He failed to see any of the difficulties mentioned by Mr. Wilson, and was very much surprised at that fact. In Minneapolis they use a granite block which is chipped to make a groove, and they have no trouble at all with the pavement. In Minneapolis the drays keep out of the car tracks, whereas in Cleveland it is otherwise. Hence he was not so sure that they would not have paving trouble in his city.

Mr. Griffin mentioned a small town (Bellevue, Ohio) where a 70-lb. T-rail was used with concrete sub-grade and brick paving. On examining this track last summer he did not see any ruts. It is true that this town has no heavy teaming, nevertheless, the paving also was light.

Mr. French cited an example in Utica. On Whitesboro Street they have a section laid with 70-lb., 7-in. T-rail and another portion with a 90-lb. Pennsylvania section 201 9-in. girder rail. These have been subjected to the same traffic conditions, that is, the operation of 28-ton interurban and regular double-truck city cars. After operating about four years the girder rail is absolutely worthless, in fact, it should have been taken out long ago, whereas the T-rail is in condition to last four or five years more. This work is paved in with common old-fashioned cobble paving on cinders. Mr. French also said that last year they laid on Genesee Street, Utica, 1800 ft. of double-track 95-lb., 7-in. T-rail with 3-in. head, using the Arthur hump block to form the flangeways. This section was laid with the permission of the city engineer, and his company hopes it will prove a good argument for more T-rail construction in the future.

Mr. Clark related a humorous incident relative to team traffic. It seems that a prominent dump wagon manufacturer wrote to him at Cleveland asking for the exact track gage so that he could build his wagons to suit! Mr. Clark told him to build them 4 ft. 10½ ins. outside to outside of wheels.

In reply to a request from the Chair, Mr. Stanley said that on the system of the Public Service Corporation of New Jersey the Trilby rail was used almost everywhere except in some of the smaller towns, and even there the people were agitating for its installation.

Mr. Wildey remarked that in Peekskill they were using some 7-in. high T-rail, Johnson sections and Trilby sections. They have some steep hills on their lines, and he noted that on the Trilby sections the cars could not be held as well on the grades as where the Johnson and T-rail sections are laid.

Mr. Evans, of J. G. White & Company, said that as he was mainly interested in construction rather than operation he did not have the chance to watch results. From personal

observation, however, he preferred a 7-in. T-rail. In some towns they had succeeded in getting it installed but the paving to go against T-rail must be the very best.

Mr. Reel asked Mr. Evans why he preferred a 7-in. light T-rail to a 5½-in. or 6-in. heavy standard T, since the cost is about the same anyway. Mr. Evans thought that he could get the paving in better and cheaper that way, besides securing a better job.

Mr. Brown said he was advocating a 5½-in., 90-lb. T-rail with beveled brick underneath the head of the rail. From his experience with it there seemed to be less wear than with the grooved brick, and one can turn out of it more easily.

Mr. Clark brought up the track situation in Cleveland, where the city cars are run with 2¼-in. tread and interurbans come in with 3-in. tread. He asked: "Don't you think a wide head rail is not the proper thing; and should it not have a sloping back?"

Mr. Wilson, of Buffalo, said that led up to a very interesting question for him. They are considering the advisability of changing their standard rail. Up to this time they have used the Lorain 94-lb. grooved section 94-313. The head is too narrow to take care of their interurban cars, and also on the prospective freight rolling stock they might figure having in the future. He had a new section designed for use in Chicago, weighing 129 lbs. per yard. This has a 3¼-in. head, the last ¾ in. of which is beveled. A new section designed for San Francisco also appealed to him very much, with the one exception that the lip seemed too light for team traffic. It seemed to him that some of the metal could be transferred from the base to strengthen the lip. Mr. Wilson showed sections of various new rails to illustrate his remarks. The question of a standard rail section was a grave one in any event, besides depending upon city ordinances.

Referring again to the T-rail, Mr. Wilson said he might have been misunderstood when he first spoke. His company uses it in Lockport and finds it very satisfactory, but Lockport has no considerable team traffic. The same construction would be entirely out of place in Main Street, Buffalo, and in the principal streets of other cities like Philadelphia, Cleveland, New York, etc. It appeared to him to be mainly a question as to the locality where the rails were to be laid.

Mr. Reel admitted that there was a chance for an argument between standard and high T sections, but when the question between girder and T-rail came up it seemed to him that if the T-rail had been adopted in Denver, Milwaukee, St. Paul, Minneapolis, Montreal, Indianapolis and elsewhere, he did not see why that form of rail when properly paved against would not give as satisfactory results in Buffalo. If a manager should use a girder section willingly, unless he is positive that the T-rail won't answer, it is a question whether he is doing the best thing by his company and the public. Girder joints cannot be held and the streets must be torn up oftener, making the company lose money and inconveniencing the public. The life of T-rail is one of the principal arguments in its favor.

In reply to a question from Mr. Roundey whether T-rail joints would hold better, as it seemed to him steam railroads also had joint troubles, Mr. Reel mentioned the battered-down condition of the girder rail joints on Broadway, New York, and asked where one would see such conditions on the New York Central or other steam railroads. They do not get battered down to the last two or three inches from the ends as girder rails do.

Mr. Danforth concluded the discussion by remarking that he had seen granite in Chicago which showed considerable wear, while there were Buffalo streets in good condition where Medina sandstone had been down for thirty years.

M. J. French then read an abstract of his paper on "Thermit Welding," published in full in the Street Railway Journal of Jan. 12. He was followed by P. N. Wilson, roadmaster of the Rochester Railway Company, who read the paper on "Electrically-Welded Joints," published on page 103.

At the end of his paper Mr. Wilson put the question: "The cost of putting on step joints, figuring labor and material, is more than by welding over the battered joint; the cost of putting in a 9-in. girder improved mechanical joint is the same as welding. Then why does not the general manager weld?"

Mr. Wilson, of Buffalo, said he was one of the managers who did weld. Probably his company had more electrically-welded track than any other in the country. In the first place "it involved a great deal of trouble to weld." One has to guarantee a certain number of joints per day—he thought it was four per hour, so it can be seen how fast it is necessary to work. He added that they had had breakages every year on the track welded in 1899. These breaks always occur in winter, and it is quite an item of cost to cut them out and repair the damage. They cannot be re-welded with the electric weld, for that requires having the complicated and costly welding apparatus on hand, so of late the Buffalo company has been going away from the electric-welded joint. It is an admirable joint after the welding, but the question of repairs made him question its economy.

He had looked into the thermit joint with interest, and believed there was a great deal in its future. The reason was that it required no train of cars to apply it. The electric weld would make a better joint, too, if it could be applied with a "pot and brush" as it were, but machinery which occupies the track is necessary. On some new track work this year he was seriously considering the Nichols joint, which is of the riveted type used almost exclusively in Philadelphia as a standard since 1901. That city now has about 135 miles of track laid with this joint. It is riveted to the web of the rail and the return is obtained by spelter both on the base and the head. The question of the electrical return of this joint, however, was one point about which he was not entirely satisfied. He would ask Mr. Mack a little later about that. Mechanically he thought the Nichols joint was one of the best joints on the market. He expressed himself as very much interested by the description of a joint used in Cleveland. This is a combination of a bolted joint having on the base of the rail a small thermit weld to secure conductivity. This not only makes the contact but also reinforces the rail at the point where it most needs it. He would like further data on this from Mr. Clark.

Mr. Clark began by saying that without throwing bouquets at himself, he thought that in Cleveland they probably had more experience with joints than any other city. They have the old electric weld, the cast weld, the thermit, continuous, Weber, Atlas and others, not excluding, he said laughingly, the Clark joint. During 1905 they placed about 3500 thermit welds, and in 1906 concluded they would not continue its use. They had to contend with a condition in Cleveland not existing in other cities unless they also become "Johnsonized," namely, if a joint breaks they must get a city permit stating the exact time and pay 46 cents an

hour to an inspector for watching the company carry out the repairs. If only one joint is broken and it takes five hours to do the work, $2.30 is paid for politics alone. So he concluded the thermit weld was not giving satisfaction. There were other reasons why they had so many breaks. He concluded to try a combination of a common joint and thermit. He ordered their rails drilled 2½-6-6 for a twelve-hole common splice bar. The holes are drilled 1 1-16 ins. The holes on the plate are both round holes. In the common fish plate the holes on one side are slotted and sometimes on both sides. He rigged up a car with two No. 2 Christensen compressors with a bank of tanks and an air reamer to ream the holes to 1⅛ ins. He then employed 1⅛-in. machine bolts and nuts with hexagonal heads to make a driving fit. In laying the rails, first two holes were reamed by hand, the common workmen put in two bolts and screwed them up as tight as possible. Then the compressor car comes along carrying the bolts for the rest of the joint. The other holes are reamed and the bolts are inserted, while following workmen tighten them up. After this work is done the men go on to the next job, five or six jobs often going on at the same time. Then the thermit car comes. The thermit is the regular mixture except that the weld is placed across the base of the rail only. First this weld was made ½ in. at the head of the base and ¾ in. at the center. He experimented quite a little, sawing these joints in two to see how much was welded. He found the center was not welded and concluded that this was due to the cooling of the mixture before it got to the rail. So instead of making the collar ¾ in. thick under the web of the rail, it is ¼ in. thick, which allows the steel to flow continuously from side to side. This welds the base of the rail thoroughly and up into the web, greatly increasing the strength of the joint. He estimated the tensile strength at the base of the rail at 120 tons, and figured that the six bolts on each side of the joint would stand safely a shear of 90 tons, hence he did not believe that the rail would ever break at the joint. He added that a hole was left around the joint, the concreting going right on ahead of the welding. The welder then comes along and the hole is filled with concrete after the weld has been made.

This joint has been used since last summer. Some 3000 are now installed and no breaks have appeared. He had an electrical test made on eighty-five 60-ft. lengths of rail in one straight line on Jennings Avenue, and not one showed a leak. As to the cost of the joint: The pure thermit is $1.75, but a mixture of 7 lbs. thermit with ½ lb. steel is used, as the thermit alone would burn the crucible and some would be lost through spluttering; the joint plates are bought by the ton at $37.55 in Cleveland, and bolts are ¾ cent additional per pound on account of being machine bolts; mold, 2 cents for a box 8 ins. x 4 ins.; cost of reaming, placing bolts and welding brings the total to $4.24 or anyway under $4.50. The price of common labor per diem was given as $1.40, and foreman's services $3. If there is a break in this joint it would show up only with a Conant tester or similar device for testing conductivity. Such electrical breaks are repaired by applying a bond which is brazed on the side of the rail.

Mr. Wilson asked whether riveting Mr. Clark's joint would not improve it. Mr. Clark answered that his early work along these lines was more or less experimental; the coming year he expected to rivet, but it meant that another car would be required for riveting.

Here President Shannahan announced that the discussion would be continued in the afternoon session. He informed the members that President Pierce and General Manager Wilson, of the International Railway Company, had provided a splendid luncheon for the members in the adjoining chamber. Before adjournment, however, he would ask Secretary Swenson, of the American Street and Interurban Railway Association, to address the meeting.

After expressing his pleasure at being able to keep in personal touch with the interesting quarterly meetings of the New York Association since they were started, Mr. Swenson pointed out how much good was being accomplished by these little gatherings where mutual experiences could be exchanged more freely than at the larger conventions. He regretted that conditions made it impossible to have similar meetings in the American Association. Mr. Swenson also mentioned the fact that W. Caryl Ely, the former president of the American Association, had been anxious to greet the delegates in his own city, but an imperative business engagement obliged him to be in East Liverpool, Ohio, instead. The secretary then told something about the present condition of the American Association. The annual notices for dues had been sent out and a large number of members had already responded—which was very encouraging, as every secretary knew. The reports of the Columbus convention would be quite voluminous. Each of the four constituent associations would have one, averaging at least 350 pages, which will make about 1400 pages bound in two volumes. One of these volumes will cover the proceedings of the American and Engineering Associations and the other those of the Accountants and Claim Agents. The two latter are strictly company memberships, whereas the others include the associate members. These volumes will be bound in cloth, instead of paper as hitherto. In conclusion Mr. Swenson pointed out the benefits and low cost of association membership in the American Association, and told the delegates that he would never be too busy to go to a State Association meeting.

THE LUNCHEON

During luncheon the delegates were cordially welcomed by Henry J. Pierce, president of the International Railway Company. His speech had both humorous and serious phases, but while the former served to entertain the diners the latter was of such import as to secure their undivided attention. He spoke of the benefit of getting together as shown by the ever-increasing tendency toward the consolidation of like interests in the form of business combinations or simply as an organization for mutual instruction on technical topics, like the New York State Street Railway Association. Throughout the country there has been an increased cost of living and all materials and labor have advanced in price. Unlike other lines of industry, however, the street railway companies can not increase the selling price of their commodity in proportion to the increased cost of labor and material. To-day some 50 per cent of the street railway companies of the United States are unable to pay dividends. Though it sounded like a paradox, the speaker believed that hard times to the industrial world at large presaged good times for the railway companies, since the amount of riding would not be reduced in the same ratio as the prices of material.

Mr. Pierce deplored the tendency manifested by companies whose franchises are expiring to make offers for renewal on a basis lower than compatible with meeting actual cost of operation and fixed charges and providing for depreciation. He recommended that when a street railway company's franchise expired it should offer for renewal

only such terms as would allow it a fair return on the investment. Should a cheap-fare company enter the field—do not oppose it. Sooner or later the newcomer will find it impossible to make both ends meet, and then the old company will be able to pick up the property probably for less than cost. Street railway companies spend millions of dollars toward paving streets and keeping them in repair, and yet have not the right of way.

In conclusion Mr. Pierce pointed out that the duty of the association was to work for the amelioration of the many onerous conditions imposed on street railways by appealing to the State Legislature and the different municipalities. The question of taxes in particular should be definitely settled. He believed that franchise taxes should be levied on gross receipts of the system rather than varying percentages in the different communities served.

After the conclusion of Mr. Pierce's remarks the assembly listened to a short and witty address by Mr. Porter Norton, who has been the attorney of the company for about 25 years.

AFTERNOON SESSION

The afternoon discussion on rail joints was opened by Mr. Stanley, who expressed himself as still doubtful about the proper joint. At present many miles of Trilby rail on the Public Service Corporation's system were used in connection with the continuous joint. A great deal of this property had once been welded with the cast-welded joint, and in almost every instance that joint proved a failure. He had seen many miles of track welded electrically, but after a year or two those who installed the electric welding process were not quite so enthusiastic about it; the same seemed to be true of thermit. In his judgment, at this time he would prefer to use a mechanical joint which he knew would answer the purpose for a reasonable period, and hope that when the renewal period came experience would have demonstrated which of the new methods was the most advantageous. Mr. Clark's joint appealed to him more than any other he had heard about, but he still wanted information very badly.

Mr. Reel said that in their new (T-rail) work at Kingston they were planning to use a thermit joint to come about halfway up to the head of the rail, and will omit the end bolt-hole with which Mr. French had had trouble. The first hole will be 6 ins. or 8 ins. back from the end of the rail. What he wanted to know was whether the head of the rail would be injured by the excessive heat in proximity to it, and whether there would be any deterioration as time goes on.

Mr. Clark said that he had noted no such deterioration in Cleveland during the two years thermit welding had been installed there. Mr. Reel thought that any trouble of that kind if it existed would have shown itself appreciably in two years.

Mr. Clark said he wanted to take up Mr. Stanley's remarks regarding joints. To be sure such joints as the Weber and Continuous are good mechanically, but the bonding or electrical features should also be considered. He had put in plug and solid terminal bonds, but had been unable to get one which after a year had not become oxidized and started to leak. They are now brazing the bond on the head of the rail. Wherever a leak shows the bond is put on.

Mr. French said in answer to Mr. Reel's question about rail deterioration due to thermit welding, they had found that apparently the wear is no more at the joint than anywhere else. If he remembered correctly, the Thermit Company will guarantee that the weld will not injure the rail in that respect.

Mr. Wilson, of Rochester, said he had noticed no bad effects. In thermit welding he thought the heat was so concentrated that it did not affect the head of the rail at all. As to what Mr. Wilson, of Buffalo, had to say about the Nichols Philadelphia joint, while he had not been connected with the Philadelphia Rapid Transit Company he believed the application of this zinc joint required as much machinery as electric welding,—a riveting machine, a zinc machine, sand blaster, etc. He could not see that any mechanical joint is as good as a welded one, nor why it should be preferred when it was possible to have a continuous rail. Besides, no mechanical joint can be considered without bonding.

A delegate asked Mr. French what he thought of thermit on unpaved streets. Mr. French replied he saw no objection to it provided the rail was kept covered to prevent contraction and expansion with changes of temperature.

Mr. Clark said that when the Cleveland authorities got hot-headed recently they tore up some of his company's track on Fulton Road, breaking it at different points. It happened that this track had been electrically welded. When the company was replacing the track on this street Mayor Johnson came along and told Mr. Clark that he would be unable to weld it, whereupon Mr. Clark averred that it would be ready in two days. The Mayor did not believe this, assuming that the Lorain method would be used, which of course requires getting the necessary special cars "Well," said the Mayor, "even if you do weld you will soon find your tracks over there against the lamp post." The result of the argument was a bet between the two involving a new hat. Mr. Clark welded the tracks with thermit and they lay in the hot sun for three or four weeks, simply banked up with dirt. There was no trouble. His present hat he said was bought by Mayor Johnson.

Mr. Reel asked in the event of welded joints being put in unpaved streets, how much of the welded track it would be safe to open up as one wanted to do the paving. Would the buckling be serious?

Mr. French suggested that a record be kept of the temperature when the rails were laid originally and then do the paving under slightly lower temperature. Not more than 200 ft. ought to be exposed.

Mr. Wilson, of Buffalo, said he did not think there would be any trouble on that score, and Mr. Jackson could tell them how long their exposed sections were. Mr. Jackson remembered that once when they had opened up at least 1000 ft. it was out of line during the day but came back at night all right. In reply to a query from Mr. Reel, he said the track did not lift.

Mr. Brown recalled one case where 400 to 500 ft. had been exposed over night. The weather became very cold and five or six joints were found broken next morning. Mr. Wilson, of Rochester, said that in Philadelphia he had seen some 1200 ft. laid open. The track was covered with wet canvas and the buckling went back. Another delegate said that playing on the rail with a water hose would also remedy the trouble, while Mr. Clark gave an instance where 2800 ft. of crawling T-rail on a bridge was straightened by sprinkling it.

President Shannahan announced that, at the suggestion of Charles R. Barnes, expert of the State Railroad Commission, he would call for a discussion on derailing devices.

Mr. Stanley, on being asked to open up this subject, said that in most instances they used only the ordinary hand derail and interlocked with the steam railroads in some cases. They did not use the interlocking system.

Mr. Wilson, of Buffalo, said that at a few places on their interurban lines they had distance signals operated from a tower. The trouble with derailing apparatus is to keep it thoroughly drained. As a rule there is no means of draining the pipes through which the levers run, so in winter the trainmen disconnect and plug them. Putting the derailing duty up to the conductor was a good thing and an accident preventer. The derail ought to be put back a sufficient distance from the rail. One delegate thought 25 ft. a sufficient distance, while another believed it should be located 100 ft. from the first steam railroad track—back far enough to make it impossible to reach the steam track.

Mr. Clark said that in Ohio the law stated the derailing switch must not be further than 70 ft. or closer than 40 ft. If too far it causes a great deal of trouble. They have been contemplating the trial of a new derailer. With the Porter and similar derails, the conductor must go either to or across the track and pull the derail,—sometimes this puts him in such position that he cannot get a clear view up and down the track. They had a case in Cleveland a few weeks ago where a conductor pulled a derail just as a string of cars, which he did not see, was coming down. A collision was avoided by 2 ft. He referred to the Cheatham electric switch, which he wanted to put in, setting the connections so that whether the car has power on or not it will stop as soon as it comes to this switch. Then make it an order that the conductor must go ahead and stand on the track—not get away over and stand behind a string of cars. In the meantime, the motorman must get off the car and throw the switch back. This scheme was suggested by one of their conductors.

President Shannahan told the members that the State Railroad Commissioners had been anxious to have this matter taken up because of the large number of accidents on grade crossings, and in several instances on crossings which were supposed to be protected by some form of derail. These devices had been put in at Mr. Barnes' suggestion, and it was with great surprise that the Commissioners noted that accidents continued to occur at these very crossings. On investigation it was found that the derails had been frozen tight or for other reasons had been disconnected and were out of use. It really seemed to the Commissioners that they were a source of danger rather than of safety. It appeared to him that Mr. Clark's method would obviate this. Two men must do the work and it puts the conductor at a point where he will be hit by the train if he is not vigilant.

Mr. Stanley asked whether the Cheatham switch got out of order. Mr. Clark said that it had given very little trouble. Mr. Stanley thought it better to have it mechanical rather than electrical, but Mr. Clark said in that event it would be necessary to have a switch-throwing equipment on every car. Keeping the switch in order had given them little bother.

Mr. Wilson, of Rochester, said he did not see what would compel the conductor to get off and stand on the track, but Mr. Clark replied it would not take long to discover such neglect of duty.

President Shannahan asked if it would not be possible to locate the switch so as to have it thrown by the conductor instead of the motorman. Mr. Clark, however, said a duty of that kind would be simply mechanical, whereas his judgment is exercised when he is obliged to get on the steam railroad track to watch for trains. Mr. Harvie thought there should be no objection to placing a lever somewhat in the position of a draw signal between or close to the tracks, so the conductor would know the track was clear.

Mr. Eveleth asked if it would not be possible to use a device that would make the conductor hold the derail until the car was over. Mr. Clark believed that the conductor should be sent ahead of the car, but if he had to stand there and pull some switch it would be hard for him to jump on the car as it shot by—it being the rule on his line to run over crossings as quickly as possible after the safety signal is given. They have thirty-five derailing places. The boxes are kept from freezing by putting in salt.

Mr. Wilson, of Rochester, thought a bad feature was the absence of the conductor from the car, as the motorman could not see passengers entering or leaving the car. Mr. Clark answered that their agreements with the steam railroads in Cleveland expressly state that the conductor must go ahead of the car and signal the motorman in advance. They had practically no accidents due to passengers entering or leaving the cars, as very few do this at crossings, and anyway it is second nature for the motorman to look back when he starts his car.

The president then introduced Mr. H. L. Mack, superintendent of line, International Railway Company, who read the paper on "Rail Bonds," printed on page 104.

In the discussion which followed Mr. Mack's paper, Mr. Clark said that in Cleveland they have used all kinds of bonds—pin, soldered, terminal, compressed, etc. The fact was they were discarding bonds anyway. Their electrical engineer had recommended thermit welding on all lines with heavy return currents. What they are doing and have done during the past year is to coat the bonds with some amalgam (plastic alloy) daubing both sides of the bond to keep the air out. They use the Crown bond. Most of their bonding is really around special work. Before using the plastic alloy they coated the bond with white lead.

Mr. Wilson, of Rochester, asked Mr. Clark what he thought of the comparative value of white lead compared with the amalgam. Mr. Clark said he could speak only from what Mr. Cook (their electrical engineer) had told him, namely, that they test about as well.

Mr. Brown asked Mr. Matthews what results he had with plastic bonds.

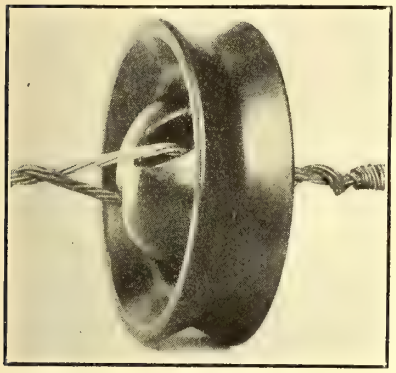
Mr. Matthews said they had occasion in 1903 to go over the track where plastic bonds had been installed nine years. On testing the joints they found no deterioration except of a mechanical nature, such as the loosening of the joint bolts.

Mr. French said he had some sad experiences with soldered bonds, but was not certain that the principle was at fault. In 1905 a small portion of the West Shore (steam) Railroad, between Frankford and Mohawk Junction was electrified and soldered bonds were used on the outside of the rail head on his recommendation. The bond was 500,000 circ. mil capacity and was made up of ribbons running horizontally. The freight traffic on the West Shore was so heavy that the excessive vibration worked the bonds loose because they did not possess sufficient flexibility. Finally they were replaced by 10-in. compression bonds put under the fish plate. If the bond had been constructed with the connecting wires coming from the terminals vertically instead of ribbons laid horizontally, they would have held a great deal better. He had also used the American Steel & Wire Company's twin terminal bond, which appealed to him more than the old compression bond. (This was described in the Nov. 24, 1905, issue of the STREET RAILWAY JOURNAL on page 1021.) Mr. French said

that this bond showed a conductivity equal to a soldered bond of the same capacity. This he thought superior to pression bond except that it must be placed on the outside of the rail where it may be stolen, but so far they had had no trouble in that respect. He thought that the man who tried to steal this bond would be convinced that he could not enough copper to pay for his trouble.

Mr. Wilson, of Toronto, who is also using twin terminal bonds, said he had avoided their being stolen by coating them with a mixture of oil and lampblack. They had many junk men traveling up and down their 30 miles of tracks, but no bonds have been stolen, though they have lost wire.

Following this discussion the subject of electrolysis was taken up in executive session.



G. E. Eveleth, of the General Electric Company, then read the paper on "Span and Catenary Construction," published on page 105.

Following this paper Mr. Eveleth showed the novel form of strain insulator illustrated herewith, and used in catenary construction. He stated that a great deal of attention had been given to this subject by the General Electric Company, and the form illustrated has so far proven very desirable for 6000 and 11,000 volts. It is of porcelain, weighs 3½ lbs., and is capable of withstanding about 10,000 lbs. pull. Its shape is somewhat similar to that of a trolley wheel. The object of the flaring flanges is to lead rain away from the vertical surfaces. The strain wires pass through holes which loop around each other so that the insulating material between them is under pressure and not under tension.

F. A. Bagg, chief engineer of the Fonda, Johnstown & Gloversville Railroad, who had been scheduled to read a paper on "Center Pole Construction," said that in preparing it he had found it was more of an argument for span construction than for center poles, and as the association was going to have a paper on span construction he thought another paper unnecessary. He would, however, give a few of his reasons for preferring span construction. The most important objection to center-pole construction is the manner of supporting the trolley wire at the bracket arm. It is not as flexible as the rest of the trolley wire and therefore the wheel jumps at the higher speeds and there is always sparking at the ear, which hurts the wire and in time brings on breaks at such points. He objected to seeing poles on the devil strip because it was dangerous,— they should be out of the way. There is a saving in grading and ballast in span construction, as the road can be narrowed by about 2 ft. With center-pole construction the tracks should be placed 15 ft. center to center, and with span construction they can be 11 ft. This difference is quite a consideration in first cost and maintenance. He thought span construction would estimate more per mile than the other, but the saving in grading and ballast will be in favor of span work. Catenary construction, of course, brings up new considerations. He had seen span and center-pole construction used indiscriminately in the same territory and on the lines of the same company, but it would seem that one type should have some advantage over the other. He believed that eventually one of the two methods, probably span construction, would win out and the other become obsolete.

Mr. Mayer asker Mr. Eveleth if he considered 15 ft. the minimum distance between hangers for catenary construction with the trolley wheel. He replied that there was nothing to limit the distance between points—it is simply a case of how many are considered necessary. If they had been running for years with 80 ft. to 100 ft. between points, an assumption of 50 ft. between points would be close enough for wheel collector work. Distance less than 50 ft. could be used for the wheel, but less than 15 ft. would make the systems more rigid without obtaining much more value for the greater cost.

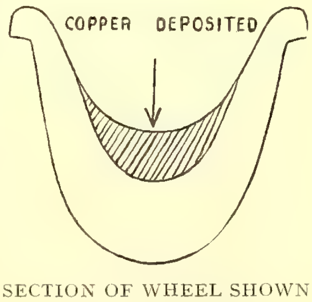
Mr. Reel asked Mr. Eveleth if it would not be practicable and desirable to apply the catenary system to span construction instead of carrying it on long brackets which, as Mr. Bagg had pointed out, have their disadvantages.

Mr. Eveleth said there were a number of roads operating that way and the only difference from the usual cross-suspension is the extra weight of the messenger wire. It is also advisable to allow a little more depth between the points of support on cross-suspension and the connections to the messenger wire than in the ordinary construction. On one catenary line of this kind no one had ever seen a wheel leave the wire on tangents.

Mr. Pardee wanted to ask one question regarding wire breakage. They were using 0000 wire and had five or six breaks inside the splicing sleeve during the last two months. Every time the wire broke 1-in. inside the sleeve. He was anxious to learn of a permanent corrective for this.

Mr. Clark said they should use a mechanical instead of a soldered sleeve. Another delegate suggested that the trouble was probably due to overheating the wire during the soldering process.

Mr. Griffin, who with Mr. Pardee represented the Rochester & Eastern Rapid Railway, said they were using a home-made trolley wheel with a collecting surface of 2¼ ins., as against the 1¾ ins. of the Kalamazoo wheel. This wheel was put on for a two-car train carrying eight 75-hp motors, and after running about 1725 miles copper from the wire was deposited on the wheel in the way shown in the accompanying cut. Other wheels wore out in the usual way after making from 5000 to 6000 miles, and he could not understand why a deposit should have occurred on this particular wheel. The pressure they try to keep is 35 lbs. at the trolley. The wheel increased 5-16 in. in diameter in 1725 miles. The schedule speed is 24 miles per hour.



SECTION OF WHEEL SHOWN BY MR. GRIFFIN

One delegate who had experienced a similar trouble when operating locomotives said it was due to heavy currents at slow speed; if the speeds were increased the trouble would disappear. Mr. Pardee pointed out, however, that this would not be a remedy in their case, for while the schedule speed was 24 miles an hour, the running speeds were often 50 to 60 miles.

The president then read a telegram from Mr. Barnes expressing his regret at being unable to attend the meeting.

The meeting then adjourned after unanimously adopting a vote of thanks to President Pierce and General Manager Wilson, of the International Railway Company, for the many courtesies extended to the delegates.

COPPER WELDING FOR RAIL BONDING

Copper welding as used in connection with rail bonding is now attracting the attention of electric railway men throughout the country. This process for uniting the bonds to the rails has been worked out by the Electric Railway Improvement Company, of Cleveland, and promises both durability and perfect conductivity.

In applying the process a quantity of copper is first brought to a white heat in a crucible placed in a small furnace using hard coal or coke, served with an air blast. The bond is placed on the rail with the strands projecting into a mold made to the shape desired for the head. A portion of the melted copper is poured through a small opening in the mold where the point of contact is desired. The mold extends back along the rail some distance and is hollowed out to form an overflow, so that sufficient of the white-hot copper may be poured in to bring the strands of the bond and the steel up to the welding point. The copper at the same time adheres to the steel and the end of the bond in sufficient quantity to form a solid metal head. The mold is then taken off and the overflow knocked off with a hammer to be used again in the crucible for the next bond. This weld is said to be so perfect that even in breaking off the overflow particles of steel adhere to the copper and portions of the copper remain on the rail.

APPLICATION OF COPPER BEFORE WELDING

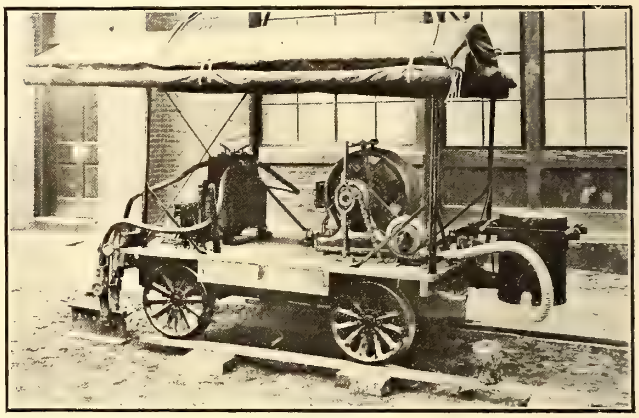
THE BOND IMMEDIATELY AFTER WELDING

THE BOND COMPLETED

On a road under construction where power is not available, the car for carrying the furnaces and other welding apparatus has a 35-hp marine gasoline engine which is also used for operating the blower furnishing the blast for heating the copper. This engine has a chain draft with a friction clutch. Where available the power of course can be taken from the trolley.

The portable furnace added to the welding car made by this company (which, together with the original process, was described in the STREET RAILWAY JOURNAL for Nov. 24, 1906), is mounted in the rear of the car upon removable arms, so when not needed the entire apparatus may be taken off at will. The air blast is furnished by a small blower mounted on the car and operated by the welding generator through a band and friction clutch. When operating the electric welding machine it often happens that there is special work such as welding large cables. The copper welding outfit is of great advantage in this respect in connection with the electric welding machine. Cables as high as 1,500,000 circ. mil may be welded with this process.

The electric welding machines manufactured by the company are provided with rotary converters and step-down transformers for securing the desired voltage at the rail. The current for the weld is regulated through a switch in the primary of the transformer and the desired heat is obtained by a controller and rheostat in series with the armature. In operation, the bond is clamped to the rail and the current turned on, when sufficient heat is developed to melt the brass cap forming the head of the bond. This makes a perfect union between the steel and the copper. Tearing off the bond ruptures either the steel or the copper and it is therefore never breakable at contact.



RAIL-WELDING OUTFIT ON LIGHT CAR

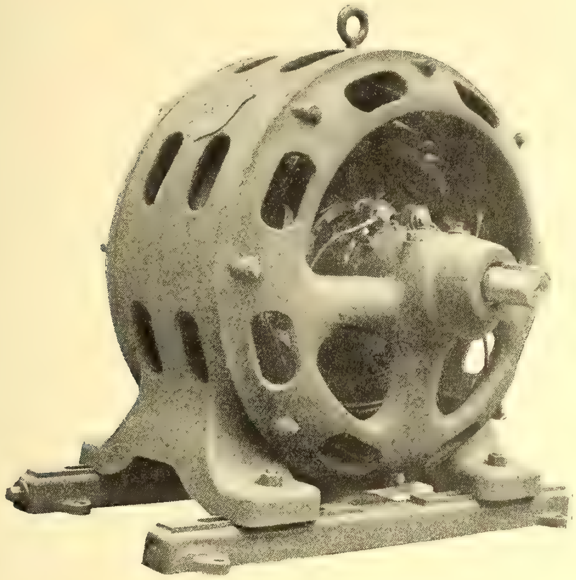
AN ELECTRIC RAILWAY SHOP FOREMEN'S ASSOCIATION FOR GREATER NEW YORK AND VICINITY.

At a meeting held in Newark, N. J., on the evening of Jan. 14, steps were taken by a number of shop foremen connected with the Public Service Corporation of New Jersey to form an association to have meetings from time to time for the discussion of shop questions. It is planned to take in at first the foremen connected with the electric railway companies in New York and vicinity, and later on form branches in more distant cities. At the present time the originators of this idea are perfecting the draft of the constitution and by-laws which will be presented at a meeting to be held Jan. 29, at 8 p. m., in the Wood Building, 122 Market Street, Newark. An invitation to attend this meeting is being sent to all foremen connected with the nearby railway companies, but should any fail to receive it, they are asked to come anyway and get acquainted. This meeting will be devoted to a discussion of the best methods for carrying out the work in a manner most beneficial to all the members. The present idea is to have monthly meetings at which experts from the different manufacturing companies will be invited to give talks on topics connected with the care and maintenance of equipment. Following each lecture there will be an open discussion and smoker.

All correspondence should be addressed to J. R. Case, foreman of South Orange Repair Shop, Public Service Corporation of New Jersey, Newark, N. J.

SELF-CONTAINED BELTED ALTERNATORS

The Allis-Chalmers Company has recently developed a line of small 60-cycle belted alternators known as Type A B. These machines are self-contained and are built for outputs ranging from 50 kw at 1200 r. p. m. to 150 kw at 900 r. p. m., two or three phase. They can also be furnished for single phase in outputs ranging from 37½ kw at 1200 r. p. m. to 110 kw at 900 r. p. m. As shown by the accompanying illustration, the bearings are supported in end housings bolted to the stator yoke so that the whole machine is self-contained and requires no base. The stator yoke rests on slide rails, to which it is bolted.



SELF-CONTAINED ALTERNATOR

These machines are of the revolving field type, the armature being stationary. The stator punchings are of selected steel carefully annealed. They are supported in a cast-iron yoke provided with numerous openings to allow free circulation of air.

All armature coils are form wound. As the slots are open, the coils can be readily removed, thus giving a decided advantage over machines having closed slots, in which the coils are difficult to replace in case of accident. The projecting stator yoke and end housings completely protect the end of the coils where they project beyond the laminated core.

The field poles are built up of steel laminations riveted between end heads and dovetailed and keyed to a spider or hub. The field coils are wound with square wire, which makes a very compact and durable winding. Exciting current is supplied to the field through cast bronze collector rings mounted on the shaft between the field and the outboard bearing. The bearing housing has three arms, as shown in the illustration, thus leaving the space around the collector rings and brushes easily accessible. Each ring is provided with two brushes. The machine illustrated has the shaft extended to receive a pulley for driving a belted exciter; they can, however, be furnished without extended shaft. The bearings are of the ring oiling, self-aligning type, and are of liberal dimensions; both bearings are of the same size.

LARGE SHIPMENT OF SEMI-CONVERTIBLE CARS FOR CLEVELAND

The most noteworthy shipment made by the John Stephenson Company last month consisted of twenty cars of the Brill grooveless-post, semi-convertible type for the Forest City Railway Company, Cleveland. These cars present some interesting features in the interiors, notably the register rod, which runs directly down the center line of the roof instead of along the ventilator rail as is usual, thereby obviating the necessity for the conductor to ring up fares over the heads of seated passengers. The arrangement of the lights on either side of the register rod is also noteworthy. Arc lights are placed at each end of the car on the monitor roof. The finish of the interiors is in cherry, the ceilings are of three-ply birch, and the seats are of the Brill make. Angle-iron bumpers, drawbars, vestibule door controllers, sand boxes and other specialties used on the cars are all of Brill make. The car bodies are mounted on No. 27-G trucks having a wheel base of 4 ft. 6 ins. The weight of the car and trucks with motors is 44,000 lbs. The chief dimensions follow: Length over end panels, 30 ft. 8 ins., and over vestibules, 42 ft. 8 ins.; width over sills, including sheathing, 7 ft. 11½ ins.; size of side sills, 3¾ ins. x 7¾ ins.; end sills, 5¼ ins. x 6⅞ ins.

INTERIOR OF FOREST CITY COMPANY'S CAR

EXTERIOR OF FOREST CITY COMPANY'S CAR

FINANCIAL INTELLIGENCE

The Money Market

WALL STREET, Jan. 16, 1907.

The past week has witnessed a decided improvement in the monetary situation. The heavy inflow of money from all parts of the country has materially strengthened the position of the New York City banks, and all indications point to a continuation of the movement in this direction for some weeks to come. For the week ending Jan. 12 the net gain in cash by the local institutions amounted to nearly $11,000,000, and since that time the cash holdings have been further increased by nearly $7,000,000, as a result of their operations with the Sub-Treasury. These favorable developments were reflected in a general disposition on the part of the large lenders of money to offer with more freedom, and consequently a further easing off in the rates for practically all classes of accommodations followed. Money on call, which last week commanded 15 per cent, was in abundant supply at rates ranging from 6 to 3 per cent, while funds for all fixed periods were readily obtainable at 6 per cent. The demand for time money, however, was largely for the short maturities, and lenders reported considerable difficulty in placing funds for six months and longer at 6 per cent. Mercantile paper was in better demand, but quotations ruled entirely unchanged at 6 and 6½ per cent for the best names. The sterling exchange market was strong at rates well above the gold import point, and this, together with the easier local monetary conditions, were reflected in a decidedly better feeling at all of the principal European centers, and especially at London, where money and open market discount rates have displayed an easier tendency. It is not expected, however, that the governors of the Bank of England will order a reduction in the official discount rate at this time.

At the close of the week the belief prevailed in banking circles that the present easy conditions will continue for some time. It is not expected that rates for day to day money will go materially below those ruling during the week, but it is probable that further concessions will be made in charges for time accommodations. About the only unfavorable factor of the situation is the heavy borrowings by the railroads and other corporations. The announcement of the issue of new securities by the St. Paul, Northern Pacific, Great Northern and other corporations, was followed this week by the announcement that the Pennsylvania contemplates the issuance of $100,000,000 new stock and a like amount of convertible bonds, while the directors of the Chicago & Northwestern have decided to issue $25,000,000 new stock, being part of the $100,000,000 authorized by the stockholders last autumn. Other new issues of stocks and bonds are likely to be announced from time to time, but the financing of them will probably be deferred until such time as the banks are in a better position to stand the strain. The bank statement published on last Saturday made a decidedly favorable exhibit. Loans decreased $858,800 and net deposits increased $8,344,100. The gain in cash was $10,578,900, but as the reserve required was $2,086,025 more than in the preceding week, the surplus was increased by $8,492,875. The surplus now stands at $8,640,700, as compared with $147,825 in the preceding week, $12,808,650 in the corresponding week of last year, $24,459,275 in 1905, $23,181,750 in 1904, $20,217,125 in 1903, $19,061,450 in 1902, $22,398,050 in 1901, and $16,707,350 in 1900.

The Stock Market

In so far as the volume of business is concerned the past week in the stock market has been one of the least important for some time past. This is in a measure accounted for by the revival of active interest in mining stocks dealt in on the curb market, although the tendency on the part of the big railroad corporations to bring out new issues of securities, as manifested by the announcement that the Pennsylvania Railroad would issue $100,000,000 stock and a like amount of bonds, and that the Chicago & Northwestern will shortly put out $25,000,000 additional stock, served as a pronounced deterrent in the taking on of new ventures by the speculative and investing public.

Such highly important factors as a pronounced restoration in the surplus reserves of the New York City banks, decidedly easier conditions in all branches of the local money market, continued enormous earnings by the railroads and further material advances in prices for copper metal, both here and in London, were almost entirely without influence in a stock market sense, although they unquestionably tended to strengthen belief in an ultimately higher ruling for all classes of securities. However, with such an uncertain element hanging over it as the making of new securities by the large railroad corporations, as well as rumors of further impending issues, it is not surprising that the market failed to respond to the favorable factors alluded to. Wall Street still remembers the effects of the last period of "undigested securities," and while it entertains no fear that it is about to run into any such period again, the mere suggestion of any such possibility is sufficient to retard operations for the bull account.

Another matter which has served to temporarily check bullish ardor is the absence of the customary demand for bonds incident upon the January interest and dividend payments. The high rates for money that have prevailed for several weeks past have been too tempting for those having ready cash at their command, and comparatively speaking the investment yield on railroad bonds is at present small, the money received as interest and dividends found its way into the loan market instead of that for bonds. Now, however, that the tension in the money market has apparently relaxed, and conditions promise permanent ease, this money will in all probability find its natural channel and the bond market benefit accordingly. This, of course, will exert a good effect upon the stock market.

There were very few noteworthy movements in individual stocks during the past week, and aside from those immediately concerned in the new issues of securities and those in the Hill-Harriman group, fluctuations as a rule were in keeping with the restricted volume of trading. Pennsylvania & Northwestern at one time suffered severe declines, but subsequently recovered part of their losses. Chesapeake & Ohio, Canadian Pacific and Erie, which companies were specifically mentioned as also considering the advisability of raising money by new security issues, were likewise heavy at intervals, but generally speaking the undertone of the market was steady, and some stocks even manifested rising tendencies. As a group, industrial stocks ruled firmer than the railways, the natural reflection of existing conditions in practically all branches of industry throughout the country, notably in the iron and steel, copper and rubber trades, where conditions are much more favorable than they have ever been at any time in history.

Philadelphia

The local market for traction shares has been comparatively quiet during the past week, and the general trend of values was toward a lower level. Philadelphia Rapid Transit was again the leader of the group, and the price sustained a sharp decline. Opening at 21, the price ran off to 19¼ on the reported serious illness of a prominent director of the company. About 8000 shares changed hands. Union Traction slumped in sympathy with the decline in Philadelphia Rapid Transit, upwards of 5000 shares selling at prices ranging from 59⅛ to 56. Philadelphia Traction sold as low as 94, and Philadelphia common ran off from 48 to 46¾. Other transactions included American Railways at 51, Railways General at 6½, Philadelphia Company common at 48 and 47, Philadelphia Company preferred at 48, and Frankford & Southwark at 425, and Consolidated Traction of New Jersey at 76½ and 77.

Baltimore

The United Railway issues were again the leading features of the Baltimore market, and although dealings in them did not assume large proportions, prices for these issues held decidedly firm. Of the 4 per cent bonds, $50,000 sold at 90 and 89¾, while $45,000 of the income bonds changed hands at 58¾ and 58½. Small amounts of the new funding 5s sold at 86¾ and 86½. The free stock changed hands at 13¼ and 13½

for upwards of 800 shares, and the certificates representing deposited stock sold at 13¾ and 13½. Other transactions included Macon Railway & Light 5s at 96½ and 96, Norfolk Railway & Light 5s at 98, and Lexington Street Railway 5s at 100¼.

Other Traction Securities

Interest in the Boston market centered largely in Massachusetts Electric issues, both of which were unusually active and strong. The common stock, after selling at 18½ early in the week, advanced to 20⅜, and eased off at the close to 19⅞, fully 3000 shares changing hands. The preferred stock rose from 69 to 71½, and then reacted to 70, about 2000 shares changing hands. Boston & Worcester common was easier, about 10,000 shares selling at from 27¾ to 26½. Boston & Suburban sold at 13½, West End common at 92½ and 92, West End preferred at 107, and Boston Elevated at 151. The traction issues at Chicago were practically neglected. Transactions included Chicago Union Traction preferred at 19¼ and 19⅛, Metropolitan Elevated at 27½ and 27¾, Northwestern Elevated preferred at 64½, and West Chicago at 27.

On the Cleveland Stock Exchange the feature of interest the past week has been the advance of Cleveland Electric of about 12 points since last week. This is due, of course, to the prospects of a settlement of the fight in the city. Traders did not ask so much upon what basis the settlement would be made, but whether it would be made soon. For a time after the decision of the United States Supreme Court it seemed that the stock would reach a very low point, but the reaction began with President Andrews' proposition to make a settlement on a fair basis, and the probability that Mayor Johnson would be willing to treat with him in the same spirit.

Security Quotations

The following table shows the present bid quotations for the leading traction stocks, and the active bonds, as compared with last week

	Jan. 9	Jan. 16
American Railways	51	51
Boston Elevated	150	a151
Brooklyn Rapid Transit	81⅞	81
Chicago City	160	160
Chicago Union Traction (common)	5¼	5½
Chicago Union Traction (preferred)	17½	17¼
Cleveland Electric	61⅝	71
Consolidated Traction of New Jersey	*75½	75½
Detroit United	80	80
Interborough-Metropolitan	36½	36¼
Interborough-Metropolitan (preferred)	73¾	73½
International Traction (common)	a63	a62
International Traction (preferred), 4s	82½	82½
Manhattan Railway	143¼	142¾
Massachusetts Electric Cos. (common)	19	19
Massachusetts Electric Cos. (preferred)	68½	69½
Metropolitan Elevated, Chicago (common)	27½	27
Metropolitan Elevated, Chicago (preferred)	69½	70
Metropolitan Street	105	105½
North American	87¾	89
North Jersey Street Railway	40	40
Philadelphia Company (common)	47¾	46¾
Philadelphia Rapid Transit	20⅛	19¼
Philadelphia Traction	95¾	94
Public Service Corporation certificates	67	67
Public Service Corporation 5 per cent notes	96	96
South Side Elevated (Chicago)	89	89
Third Avenue	120	121
Twin City, Minneapolis (common)	107	107½
Union Traction (Philadelphia)	59⅛	55¾

* Ex-dividend. a Asked.

Metals

The "Iron Age" says that the buying movement in pig iron for forward delivery in the Central West has made further progress. It is estimated that during the past week there have been made sales aggregating 100,000 tons in the Chicago district, and other markets like Cleveland and Cincinnati are feeling the movement, the furnaces in the former district having advanced the price to $22. Pittsburg reports that the supply of steel is becoming better so far as the open market is concerned. It is estimated that all of the steel rail mills in the country have on their books orders aggregating 2,500,000 tons in addition to about 250,000 tons carried over from last year.

Copper metal continues firm. Prices for all of the leading grades rule ½c. a pound higher for the week, and the tendency is still upward. Lake is quoted at 24½ and 24¾c., electrolytic at 24¼ and 24½c., and castings at 24 and 24¼c.

EARNINGS OF UNITED RAILROADS OF SAN FRANCISCO FOR YEAR AND STATEMENT FROM PRESIDENT THALMANN

The gross receipts of the United Railroads of San Francisco for 1906 were $5,941,000, a loss of approximately $1,116,000, compared with the year 1905. The gross passenger receipts for December were $556.000.

President Thalmann, of the United Railways Investment Company, which controls the stock of the United Railroads of San Francisco, says: "The officers and directors of the United Railroads are confident that the rebuilding of San Francisco will go forward with continued vigor. They report that the labor situation is steadily improving, and that the company now has no difficulty in obtaining all the labor necessary for the reconstruction of its old cable lines, several of which have been completed, and the entire work of reconstruction will be finished by spring.

"The delivery of the 250 new cars which were ordered by the company has begun, and when they are placed in the service the company should be as well equipped as any street railroad property in America. The new construction has been of the highest order. The officials of the company report a most favorable outlook for this year's business. It is confidently believed that the earnings for 1907 will exceed those of 1905."

AMERICAN RAILWAY INSURANCE COMPANY ORGANIZED

The organization of the American Railway Insurance Company, of Cleveland, Ohio, was completed at a meeting of stockholders, held at the office of Henry H. Staats, Thursday, Jan. 10. The directors of the company are: Horace E. Andrews, of Cleveland; C. L. Allen, of New York; A. E. Akins, of Cleveland; H. L. Clark, of Philadelphia; Alexander Dow, of Detroit; Henry A. Everett, of Cleveland; G. L. Esterbrook, of Philadelphia; C. G. Goodrich, of Minneapolis; J. C. Hutchins, of Detroit; Walter Kernan, of New York; R. E. Sheldon, of Columbus, and J. H. Price, Samuel Scovil and Henry N. Staats, Cleveland. The board organized by the election of officers as follows: Horace E. Andrews, president; Henry N. Staats, vice-president and general manager; H. J. Davies, secretary and treasurer. Horace E. Andrews, Henry A Everett, H. J. Davies and H. N. Staats, all of Cleveland, and J. C. Hutchins, of Detroit, executive committee. H. L. Clark, of Philadelphia; R. E. Sheldon, of Columbus; C. G. Goodrich, of Minneapolis, and E. W. Moore and J. H. Price, of Cleveland, financial committee.

Electric railways and light companies represented at the meeting are as follows: Twin City Traction Company; Cleveland Electric Railway Company; Rochester Railway Company; Syracuse Rapid Transit Company; Utica & Mohawk Valley Railway Company; Schenectady Railway Company; Rochester & Eastern Rapid Railway Company; Rome City Railway Company; Oneida Railway Company; Northern Ohio Traction & Light Company; Toledo Railways & Light Company; Canton-Akron Railway Company; Detroit United Railway Company; Bangor Railway & Light Company; East St. Louis & Suburban Railway Company; Alton, Granite & St. Louis Railway Company; Grand Rapids Railway Company; St. Joseph Railway, Light, Heat & Power Company, Columbus Railway & Light Company; Lake Shore Electric Railway Company; Cleveland & Southwestern Traction Company; Cleveland, Painesville & Eastern Railway Company; Detroit Edison Company, and Cleveland Electric Illuminating Company.

The company is capitalized at $200,000, and has a surplus of $300,000. It is possible that the capitalization and surplus will be increased to $1,000,000 later on. The company will write on electric railway properties and lighting plants exclusively, and from the start will be able to carry pretty large lines. It will be ready to write business within two months. The Traction Mutual, the Electric Mutual and the Asociated Railway Companies' Insurance Company will also be put into operation later on. The office is in the Citizens' Building.

A TRUCE AT CLEVELAND

A thirty-day truce has been declared in the street railway controversy at Cleveland, and, in the meantime, all injunctions will be inoperative and the Municipal Traction Company will operate its cars over the Cleveland Electric's line from its present western terminus to the Square. This agreement was reached between President Horace E. Andrews, of the Cleveland Electric, and President Dupont, of the Municipal Traction Company, as a result of the decision of the United States Supreme Court on the Central Avenue and Quincy Street lines a few days ago. As a duty to the public, these lines must be kept in operation by some means, and this plan was adopted in order that sufficient time might be given to arrive at some conclusion as to a permanent settlement of the question. Of course, the Cleveland Electric was not expected to give up the lines without an opportunity to secure a renewal of its rights in some way. On the other hand, the new companies were anxious to get possession of the streets on the strength of the franchises that were granted after it was declared by the United States Circuit Court that the Cleveland Electric had no right in these thoroughfares by virtue of the renewal of the old franchise at first granted by the City Council.

Immediately after the news of the decision of the Supreme Court reached Cleveland a public meeting of the City Council was called for Thursday afternoon, when the Cleveland Electric Railway Company was asked to present some plan looking to the termination of its occupancy of the streets on which its franchises had expired. Mayor Johnson presided at the meeting. President Horace E. Andrews read the proposition of his company from the clerk's desk. In substance, it said that when the City Council determines the wisest course to be followed, his company desires an opportunity of presenting a proposition for the continued use of the lines on which the franchises have expired. As some time is necessary in arriving at such conclusions, he suggested that the company be allowed to operate the two lines at cost, pending a final determination of the course to pursue. To this end he proposed to operate the lines at a fare of three cents per passenger, with transfers, as at present, and at the termination of the arrangement, if the cost of carrying passengers proves to be less than three cents each, the amount of surplus is to be determined by H. J. Davies, secretary of the Cleveland Electric, and A. B. Dupont, president of the Municipal Traction Company, with the provision that if they cannot reach an agreement a third person shall be chosen by them. As to the other streets on which franchises may have expired, he suggested that if their use as loops and for terminal purposes were forbidden, the public good would not be subserved. At the same time, he said, if it is the will of the Council, they will be abandoned. Mr. Andrews stated that, although the company is not legally bound to compensate the city for the use of Central Avenue and Quincy Street since the expiration of the franchises in 1905, and that a Supreme Court decision on the subject is to the effect that streets used for street railway purposes is highway use, it wishes to meet the question and pay to the city every cent to which it is entitled, eliminating any question of technical law or legal rights. The company at one time offered to make an agreement to the effect that it would account to the city for all profits above 6 per cent on the property used in these streets, in case the courts decided that it had no rights in the streets, but it was refused by the city. However, Mr. Andrews said that the company is now willing to submit the entire matter to the judgment of H. J. Davies and A. B. Dupont, with the stipulation that the amount fixed by them shall not exceed the amount originally offered by the company for the use of the streets. In case they fail to agree they are to call in some third person to settle the differences.

President A. B. Dupont, of the Municipal Traction Company, presented a proposition in writing looking to the lease of the entire system of the Cleveland Electric Railway Company, on the same basis as the Municipal Company, now holds the property of the Forest City Railway Company. On this it is paying 6 per cent on the stock that the company issued at not less than 90 a share, and redeemable at $1.10, the stock representing only the physical and construction value of the property. The Municipal Traction Company is willing to enter into similar contracts with the Cleveland Electric, the rent to be fixed by a careful determination of the physical value of the property and the present worth of the unexpired franchises, adding to that sum one-ninth thereof, and upon the sum so derived, paying at the rate of 6 per cent per annum. The company instructed Mr. Dupont to suggest that he was willing to meet President Andrews, of the Cleveland Electric, and determine with him the valuations. It was also suggested that a stock reorganization might be effected which would allow the stock of the Cleveland Electric to be redeemable at the same figure placed upon the Forest City. In case such a proposition is accepted, the company expressed its willingness to make such changes in the personnel of the company as would be satisfactory to all concerned.

W. A. Greenlund, secretary of the Low Fare Railway Company, presented a proposition to lease or rent the property of the Cleveland Electric Railway Company on Central Avenue and Quincy Street and operate the line on a fare of three cents, giving transfers to any other road in the city that will give transfers to its lines. The conditions are that the property shall be appraised by a commission of three, one chosen by the Low Fare Company, another by the Cleveland Electric and the third by these two, and that 6 per cent interest be paid upon this valuation in the form of rent, payments to be made monthly in advance. Strict account would be kept of the business and full reports made to the City Council. This arrangement was to be maintained as long as perfectly satisfactory to the city and until some more permanent arrangement could be made for the use of the streets. The property, of course, would be adequately maintained. The company also proposed to purchase the property at the values fixed.

The Mayor suggested that the Council meet the next afternoon in executive session to consider the propositions that had been submitted for a settlement of the trouble. When the time came for the meeting, however, the Mayor said it should be an open session. Members of the Council were surprised when the first order of business was announced as a joint communication from President Andrews, of the Cleveland Electric, and President Dupont, of the Municipal Traction Company, and they were more surprised when that communication proved to be a truce declared for thirty days on conditions satisfactory to all parties concerned. Besides agreeing that all injunctions should be suspended for that period, and that no new legal cases should be begun, the Municipal Traction Company agreed to defer all further work on new lines for that period. This indicates that both sides will make an earnest endeavor to arrive at some plan that will mean a settlement of the long fight here satisfactory to the city and the companies. The fact that Mayor Johnson blocked the incorporation of a three-cent clause in one of the resolutions offered at this meeting also indicates that he is not decidedly averse to a settlement that does not call for that exact figure.

On taking up the discussion of the proposition of the Cleveland Electric, made the day before, an attempt was made to inject a thirty-day limit into it. This was opposed by the Mayor and many of the Councilmen. When the vote was taken there were only four against it. The question was put in the form of a resolution, and the chairman of the committee on street railroads was instructed to prepare proper resolutions to be presented at a regular meeting of the Council embodying what had been done. The proposition of the companies to call a truce having already been accepted by resolution, both Messrs. Andrews and Dupont said that the lines would all be in operation Saturday morning, according to the plans agreed upon, which was done.

That the interests affected are ready to consider the matter, was indicated by the fact that President Andrews asked President Dupont to meet him and begin negotiations at once. It was decided, however, that it would be better to delay the matter until the Council had received a communication from the Cleveland Electric that it was willing to enter into such negotiations. President Andrews left for New York Saturday evening and will not return until Wednesday evening, so that the negotiation will necessarily be postponed until the latter part of the week. Mayor Johnson and President Dupont, of the Municipal Traction Company, conferred on Saturday, and, it is said, considered the working out of the details of the plans upon which a holding company could take over the Cleveland Electric property.

Aside from the security to be offered, one of the hard points to determine will be the valuation of the Cleveland Electric's stock. It is surmised that a holding company should not take

the business at a higher valuation than 70, and possibly not that. On the other hand, the owners of the Cleveland Electric stock would probably not be willing to lease on a basis under that figure, and they would probably want more. The stock has gone up about five points within the past few days, and shows an inclination to go still higher. At one time when Mayor Johnson broached the subject of a holding company, he stated that he would be willing to accept a lease on the basis of 85, but of late he has placed a lower valuation on the stock, perhaps because he believes the company is not in as strong a position as it was at that time.

On Wednesday Judge William A. Babcock, of the Common Pleas Court, decided that the franchise of the Low Fare Railway Company on Sumner Avenue is not invalid because it was not published a second time before the ordinance granting it was passed by the Council. This, of course, was only a partial victory, as the Cleveland Electric still had the financial interest contention to interpose; but the following day the attorneys for the Cleveland Electric announced that they would not continue the case, and the restraining order was dissolved. The Forest City Railway Company at once put a force of men to work on the road, and on Friday evening they had used all the material at hand and the tracks had not yet reached East Ninth Street. Just what course the Forest City will pursue now is problematical. It is included in the agreement made with the Cleveland Electric, and cannot consistently continue the construction of the Low Fare Company's road, although the latter is free to do as it chooses, according to Secretary Colver.

The hearing of the financial interest case against the Forest City Railway Company was taken up early last week, and Randolph Clitz, sales agent of the Lorain Steel Company, was put on the stand. He testified to the guarantee that Mayor Johnson gave his company for the rails furnished the Forest City Company. The court, in deference to the wishes of the contending companies, however, suspended the operation of all injunctions, and nothing more will be done with these cases until the expiration of the agreed thirty days. The Cooper injunctions on Superior Street cases were also suspended for that time, and the Forest City cars were in operation regularly over the tracks of the Cleveland Electric Saturday. They go to the Public Square and return. The agreement provides that the low fare companies shall not operate, or attempt to operate, cars east of the Square.

The City Council has accepted the proposition of President Andrews, of the Cleveland Electric Railway Company, regarding the manner of arriving at the amount of compensation for the use of the streets since the franchises expired, and the agreement on a truce between the contending companies has also been approved. In a communication to the City Council, read Monday evening, Jan. 14, the Cleveland Electric indicates its willingness to treat with the city and the other companies on a holding company plan, but states frankly that the officers believe their proposition to give seven tickets for a quarter and universal transfers will be more satisfactory to the people. The letter states in detail the reasons for this belief, and also that, from their experience, the officers think a road cannot be operated on a 3-cent fare. They fear a failure of the plan, although the company will, under the ideas advanced, be protected in case of such a failure.

TRANSIT MATTERS IN NEW YORK

Chas. Buckley Hubbell, Harry W. Alden and Warren Leslie, commissioners appointed by the Appellate Division of the Supreme Court to consider the advisability of four subway routes, presented their report Monday, Jan. 14. They approve three of the routes.

The first route approved is the bridge loop railway. It extends from the Manhattan terminus of the Williamsburg Bridge, through Delancey Street to Center Street, and thence to a "suitable point under the proposed terminal of the Brooklyn Bridge." It has three spurs; the first from Center Street, under Grand and Desbrosses Streets to West Street; the second from Center Street, under Canal Street to the Manhattan terminal of the Manhattan Bridge, now under construction; the third from the southern terminus of the loop under William Street to Beekman Street.

The second route recommended is the Beekman Street Railway. It will connect with the present Subway at the City Hall, and local trains will run from the Subway through it under the East River to a point in its center, where it will join a tunnel now under construction. From there the trains will run under Cranberry and Fulton Streets, Brooklyn, to Joralemon Street.

The Maiden Lane route is the third which has been approved. It is a link in the Fourteenth Street section, which is to pass through Fourteenth Street, come down the west side to Liberty Street, and run east to Maiden Lane. From there it will run to the East River and will meet the proposed tunnel to Brooklyn in the center of that stream.

The commission, however, decides against the William Street route upon the question of the nature of the ground through which it would have to be built. The suggestion is that it begin at Beekman and William Streets, the end of the southerly spur of the Bridge loop, and pass under William Street and Old Slip to the tunnel to Brooklyn, making the same connection with the Brooklyn subways as the Beekman Street and Maiden Lane routes.

The routes were laid down by the Board of Rapid Transit and have passed the Board of Estimate and Apportionment. As the abutting property owners did not consent, the Appellate Division named the commission. If it approves of their findings, it will consent to the construction of the lines. As several schemes for effecting the same object—the relief of transportation conditions—are under consideration by different commissions, the approval of this report by the court will not take from the Board of Rapid Transit Commissioners the ultimate decision as to what subways shall be constructed. The board will still have the power to build all or none of those approved by the court. The next step in the proceedings will be the hearing of a motion to confirm the report before the Appellate Division.

The Interborough Rapid Transit Company completed one of the last links of its Broadway subway line Monday, Jan. 14, and one minute after midnight Tuesday morning the first train was run over the Ship Canal Bridge to the 225th Street station. The opening of the new station is of great importance to residents of Kingsbridge, Marble Hill, and points as far as Yonkers. Up to this time passengers in that locality have had to walk acros the Ship Canal Bridge to 221st Street to get subway trains. The subway, by the opening of the new station, will connect directly with the trolley for Yonkers, which has a terminal at this point. The station is also only about 200 ft. from the Kingsbridge station of the Putnam Railroad.

The plan for a speedy relief of traffic conditions at the Manhattan terminal of the Brooklyn Bridge, for which the Board of Estimate and Apportionment on Friday, Jan. 11, authorized the appropriation of $3,000,000, embraces, among other things, a temporary rearrangement of all the tracks, both elevated and surface, running into the present terminal and the diversion of the traffic to a sub-surface station between Park Row and Center Street.

STREET RAILWAY RESULTS IN CONNECTICUT FOR YEAR ENDED JUNE 30, 1906

The fifty-fourth annual report of the Connecticut Railroad Commissioners to the Governor for the year ended June 30, 1906, has just been made. In the part of the report which deals with street railways the commission refers to what has been done during the year in building lines and extending those already built and says that the growth in the traffic and earnings of the street railways is a "surprising revelation."

Below are given extracts from the street railway part of the report:

The total capital stock of the street railway companies outstanding is $29,107,500, representing 739,931 miles of main tracks owned, computed as single track, including, in some cases, gas and electric lighting properties. This amount is $1,347,488 less than the amount reported one year ago, principally caused by the consolidation of various companies since that time. If the whole amount of stock reported is considered applicable to street railways (which is not the case), and is divided by the miles of main track owned, viz., 739,931, it would show $39,338.13 capital stock issued per mile.

The total bonded debt of the street railway companies is $48,251,592.88, an increase of $11,715,000 over the previous year.

The floating indebtedness of the companies is $823,299.16, a decrease of $233,652.28 since the previous year. The total stock,

bonds and floating indebtedness of the companies is $78,182,392.04, an increase of $10,133,859.72 over that of last year.

The cost of construction and equipment reported is $64,394,736.42, including the cost of the street railways and certain gas and electric lighting properties. This amount divided by the number of miles of main track owned, viz., 739,931, giving $87,028.03 as the cost per mile including gas and electric lighting properties.

The gross earnings of the companies for the past year were $6,349,202.31, an increase of $925,585.88, or 17 per cent over the earnings of the previous year. The gross earnings per mile operated were $7,989.36, being $813.55 more per mile than last year, and per mile run $0.2432. The gross earnings per car-hour were reported as $2.319.

The operating expenses for the year were $3,795,694.11, being $416,064.04 more than for the previous year, amounting to $4,776.21 per mile operated and $0.1454 per mile run.

The net earnings for the year were $2,558,602.14, compared with $2,043,986.30 for the previous year, an increase of $514,615.78, or an increase of about 20 per cent, and were $3,213.15 per mile operated, and $0.0978 per mile run.

Dividends amounting to $453,935.54 have been paid upon $16,900,000 of capital stock, while no dividends are reported paid on $12,207,500 capital stock.

The amount of taxes paid to the State by the various companies was $295,892.53.

The number of miles run was 26,096,310; gross earnings per mile, $0.2432; operating expenses, $0.1454, and net earnings, $0.0978. The number of miles run increased 2,107,195 over the previous year, an increase of about 13 per cent, and the gross earnings, operating expenses and net earnings per mile run show a slight increase.

The number of fare passengers carried was 121,322,906, an increase of 18,428,746, or 18 per cent over the number carried last year, compared with 70,536,271, carried by the steam railroads.

The number of employees was 3815, an increase of 208, averaging about 4.8 per mile operated.

CHICAGO TRACTION ORDINANCES RECOMMENDED TO THE CITY COUNCIL

The Chicago traction ordinances have been completed and have been recommended by the Council committee on local transportation to the City Council. The action was in accordance with the vote of the Council a week ago, declaring itself in favor of immediate settlement of the traction question rather than to delay until a referendum vote could be taken in April. This action of the Council evicted a strong protest from Mayor Dunne, who favors a referendum, and as a compromise provisions for a referendum were incorporated in the resolution of the committee recommending the adoption of the ordinances. The resolution as passed read:

Resolved, That the committee recommend the adoption of the pending ordinance as reported by the committee unless a petition signed by the number of bona fide voters required by law requesting the submission to the electors of the city at the election to be held on April 2, 1907, of the question of the adoption of said ordinances as reported by the committee shall be filed with the Board of Election Commissioners of Cook County not less than sixty days before said election.

And that in the event of the filing of such a petition, the ordinances be passed after their amendment by the addition of a section providing that said ordinances shall not take effect unless a majority of the votes cast upon the question shall be in favor of the adoption of the ordinances.

The committee's action, which was taken after the end of a 14-hour session, is regarded as a definite step towards the settlement of the traction difficulties. If the Council passes the ordinances as is generally expected, and a referendum is not desired by the people, relief from the present inadequate transportation facilities will be in sight.

The traction ordinance for the lines of the present Union Traction Company is left blank. A provision is made in the ordinance for the organization of a holding company to take over the properties of the Union Traction Company. Special Traction Counsel Fisher has announced that a board of five trustees has been selected for the new incorporation to succeed the Union Traction Company. This board, as announced, is made up of Charles Gates Dawes, president of the Central Trust Company of Illinois; A. A. Sprague, of Sprague, Warner & Company; Chauncey Keep, capitalist and one of the executors of the Marshall Field estate; Charles H. Hulburd, president of the Elgin Watch Company; A. C. Bartlett, of Hibbard, Spencer, Bartlett & Company.

MORE BOSTON-PROVIDENCE INTERURBAN PLANS FILED

The Gaston-Shaw-Stone & Webster plans for an interurban electric railway have been filed with the Massachusetts Railroad Commission, with a petition asking the board to certify that public exigency requires the construction of its line. A hearing will shortly be assigned upon the matter. The petitioners are: J. L. Richards, H. H. Newton, F. S. Pratt, Russell Robb and L. E. Snow, directors of the Boston and Providence Interurban Electric Railroad Company.

The estimated cost of construction and equipment of the new line, which will be about 40 miles long, is $4,730,819. Among the items which are included in this total are: Right of way, $473,058; steel rails, 8203 tons, $278,140; track laying and surfacing, $82,498; clearing and grubbing, 270 acres, $18,630; twenty-eight overhead crossings, $253,000; twenty-one underneath crossings, $136,500; changing channel of Neponset River, $12,000; bridging and trestle work in Boston, $55,676; power station and equipment, $774,000; fifty-two 50-ft. passenger and combination cars, $565,000; two freight locomotives and two express cars, $61,000; ten coal and freight cars, $24,000. The route begins in Hyde Park Avenue about 1200 ft. south of Forest Hills Square.

PENSION SYSTEM IN WASHINGTON

The Washington Railway & Electric Company and its allied companies have established a new pension system, which went into effect Jan. 1. Employees who have attained the age of seventy years, those who have worked continuously for twenty years or more in the service of the company, and those who become physically disqualified by reason of injuries received in the line of duty will be benefited by the system. The railway company has appropriated the sum of $5,000 annually to defray the expense incurred in paying these pensions. It is announced that a board will be named whose main duty will be to consider and pass upon all matters pertaining to the pension system. The number of members of this board has been fixed at not less than five and not more than seven, and they will be appointed by the president of the company to serve as long as he deems best.

Any employee in the service of the company who is a member of the Washington Railway Relief Association, or who shall become a member of that association before June 30, 1907, is eligible, it is stated, for a pension allowance, provided he remains a member until his retirement or has been declared ineligible to membership by the officers of the association. The employees benefited are those who are employed by or in connection with any of the railroads operated by the Washington Railway & Electric Company, or its allied lines, and also the Potomac Electric Power Company, so that the service of any such employee shall be considered as continuous from the date upon which he has been employed upon or in connection with such railways or companies. Arrangements have been made whereby the board shall appoint one or more physicians, who will examine the member making application for a pension. The allowances paid the employees after all formalities have been complied with, are as follows:

If service in the company's employment shall have been continuous for thirty-five years or more, 40 per cent per annum, in equal monthly instalments, of the average annual wages for the ten years next previous to the retirement.

If the service has been continuous for thirty and less than thirty-five years, 30 per cent per annum, in equal monthly instalments, of the average annual wages for the ten years next previous to retirement.

If the service has been continuous for twenty-five and less than thirty years, 25 per cent per annum, in equal monthly instalments, of the average annual wages for the ten years next previous to retirement.

If the service has been continuous for twenty and less than twenty-five years, 20 per cent per annum, in equal monthly instalments, of the average annual wages for ten years next previous to retirement.

The same basis of payment to apply to all employees who are retired at the discretion of the pension board.

Pension allowances may be revoked by the board upon conclusive proof that the recipient has been guilty of misconduct, of which the board shall be the sole judge.

PRESIDENTIAL ADDRESS OF B. J. ARNOLD BEFORE WESTERN SOCIETY OF ENGINEERS

The presidential address of Bion J. Arnold at the annual dinner of the Western Society of Engineers, on Jan. 8, was devoted to the subject of heavy electrification. Mr. Arnold gave a brief summary of the electric railway plans of the New York Central & Hudson River Railroad Company; the Pennsylvania Railroad Company's New York terminal; the Long Island Railroad Company; the Hudson Companies; the New York, New Haven & Hartford Railroad; the St. Clair tunnel of the Grand Trunk Railroad; the Erie Railroad; the West Jersey & Seashore branch of the Pennsylvania Railroad; the West Shore Railroad between Utica and Syracuse; the Spokane & Inland Railway; the Simplon Tunnel, and the Southern Pacific Railway, near San Francisco. According to Mr. Arnold, these propositions involved an expenditure of approximately $100,000,000 for electrical equipment and a collateral investment of some $300,000,000 more. He also referred to the proposed electrical equipment of the Cascade division of the Great Northern Railway, for a distance of about 100 miles, and a division of the Southern Pacific Railway through the Sierra Nevada Mountains, both of which are for the purpose of eliminating the difficulties due to tunnel operation.

WORCESTER RAILWAYS & INVESTMENT REPORT FOR YEAR ENDED DEC. 31

The Worcester Railways & Investment Company, which is controlled by the New Haven, has issued its pamphlet report for the year ended Dec. 31, 1906. The company itself is a voluntary association, owning all the stock of the Worcester Consolidated Street Railway Company and other miscellaneous street railway securities. The income account for the year compares as follows:

	1906	1905
Gross receipts	$283,318	$237,282
Balance income acct. previous year	23,142	149,761
Total	$306,461	$387,043
Expenses	4,692	4,411
Balance	$301,769	$382,632
Dividends	292,284	359,490
Surplus	$9,485	$23,142

In his report to the shareholders, President Bullock says:

"A large amount has been expended the past year in reconstruction and repairs of the various properties owned by this company and all properties are in excellent condition.

"During the year the Marlboro & Westboro Street Railway has been purchased. Two lines are thus established between Worcester and Marlboro, so that cars can be run alternately and give a half-hour service between the two places. One line runs by the way of Shrewsbury and Northboro, the other by the way of North Grafton and Westboro.

"On Dec. 18 the new line, practically an air line, between Worcester and Leominster was opened. It is located for the most part for about 10 miles on private land, which enables the company to reduce the running time between the above mentioned places from 2 hours to about 1 hour, and it takes only 1½ hours to go from Worcester to Fitchburg by this route.

"As it passes through West Boylston, Sterling Junction and Sterling, towns that never have had the advantage of street railway connections, the local traffic is expected to add considerably to the through business, especially in the summer, when a large number of persons go to Sterling Junction.

"The floating debt of the Worcester Consolidated on Sept. 30, 1906, was $1,978,000, an increase of $275,500 over the previous year, the greater part of which increase was expended in connection with the new line to Leominster."

The principal change in the investments of the company are the acquisition of 1585 shares of the capital stock and $80,600 notes of the Marlboro & Westboro Street Railway Company.

OPERATING RESULTS IN MASSACHUSETTS FOR YEAR ENDED SEPT. 30

From the reports of the street railway companies of Massachusetts for the year ended Sept. 30, on file with the Railroad Commissioners, have been compiled figures giving in outline the general results for the year. The record of the ninety-two companies shows a total of 572,128,730 passengers carried. Gross earnings were $33,955,447, an increase of $6,914,156 over the previous year, while net earnings, $8,199,561, showed a decrease of $572,471. Dividends amounting to $2,159,321 were paid by only twenty-nine companies out of a total of ninety-two. On their railways, land, buildings and equipment, the railways place a book value of $133,357,315, of which the cost of railways represents $75,261,295; equipment, $34,927,226, and land and buildings, $23,168,795. The capital stock of all of the ninety-two railways amounted to $72,187,200, an increase over 1905 of $1,860,215. The number of car miles run was 113,205,945. The number of miles of railway operated was 3,307.2 miles. A total of 7318 cars were operated, while aggregate number of employees was 17,134 Only three persons were killed out of an enormous total of 572,128,730 persons who used the trolleys, while 5156 persons were injured. The following table shows the more important operations of the Massachusetts street railways for the years ended Sept. 30, 1906, 1905:

	1906	1905
Gross earnings	$33,955,447	$27,041,291
Net earnings	8,199,561	8,772,032
Dividends	2,819,404	3,174,505
Capital stock	72,187,200	70,326,985
Number passengers carried	572,128,730	532,731,013
Car miles run	113,205,945	109,258,739
Miles operated	3,307.2	2,668.5
Persons employed	17,134	16,479

CONSTRUCTION OF SAN FRANCISCO, VALLEJO & VACA VALLEY RAILWAY BEGUN

Work has been started on the grading of the San Francisco, Vallejo & Vaca Valley Electric Railway from Vallejo, Cal., to Benicia. This road is the one which was promoted by the late Col. L. W. Hartzell. He sold his franchises to Col. Stock, who, in turn, secured the money for the building of the road in France. The company will first build its road from the Maine Street wharf in Vallejo, where it will connect with the steamers of the Monticello Steamship Company running to San Francisco. It will extend along Maine, Alamedá and Pennsylvania Streets and Solano Avenue, in Vallejo, to the county road to Benicia. Along this road a franchise has been secured to the tannery city. Where the road is not straight, private rights of way will be secured by purchase or condemnation proceedings. The route of the road will pass within a half mile of the big oil refinery to be built at Dillon's Point, four miles east of Vallejo, on Carquinez Straits, and a branch road will be run to the oil works. From Benicia north, the road will connect with Suisun, Vacaville, Winters and Dixon, and later with Sacramento. This has been definitely announced. What means will be used to reach Marysville, to connect there with Stock's Marysville & Great Eastern road to Downieville, is not known, but already a conference has been held with the Northern Electric officials for the use of its tracks from Sacramento to Marysville. Vallejo is now connected with Benicia, the second largest town in the county, by a stage line which gives fairly good service, but an electric road will pay big returns from the start, as Vallejo is off of the main line of the Southern Pacific road, and a branch electric line will cause all of the Vallejo traffic to Sacramento, Oregon and eastern points to pass over the electric road to the steam road's main line at Benicia and will benefit that town immensely. The grading work will start at the city limits of Vallejo and extend eastward. No work will be done in town until nearly all of the outside line has been finished. May 1 is the date set for the opening of the road between Vallejo and Benicia.

PUBLICITY THE TOPIC AT MASSACHUSETTS ASSOCIATION DINNER

At the monthly dinner of the Massachusetts Street Railway Association, at Young's Hotel, Boston, on Tuesday, Jan. 8, Thomas F. Anderson, of the Boston Publicity Bureau, was the chief guest. President Francis H. Dewey, of Worcester, presided. There was a large attendance of members. Mr. Anderson spoke informally upon the relations that exist between the transportation companies and the press. He referred to the present policy of railroads and street railway companies in the matter of furnishing to the newspapers information concerning these companies that is of interest to the public. He said that a number of the big railroads of the country have established press or publicity bureaus during the last ten or fifteen years, and some of the important street railway companies have followed the example.

MANY APPLICATIONS FOR CHARTERS IN PENNSYLVANIA

The probability of the present Pennsylvania Legislature exacting legislation favorable to the electric railway companies of the State, including the authority to carry freight and the right of eminent domain, has greatly accelerated the movement toward establishing new lines, as evidenced by the number of applications for charters filed in the office of the Secretary of the Commonwealth. A number of these lines will traverse populated districts now without steam or electric connections. Among the companies recently granted charters are the following:

Big Valley Street Railway Company.—Capital, $162,000; length of line 27 miles, extending from Mill Creek, Huntingdon County, to Lewistown, Airy Dale, Allenville, Belleville and Reedsville. Of this line 11 miles will be in Huntingdon County and 16 miles in Mifflin County. It will be a single-track line. R. W. Jacobs, of Huntingdon, is president, and the other directors are: F. Blair Isenberg, H. E. Steel, George C. Wilson and Wallace Wilson.

Juniata Valley Electric Railway Company.—Capital, $84,000; length of line 14 miles; extending from Third and Washington Streets, Huntingdon, through Ardenheim, Mill Creek, Long Hollow and over certain streets in Mount Union and Huntingdon. The directorate is the same as for the Big Valley Electric Railway.

Caledonia Street Railway Company.—Capital, $200,000; length of line 13 miles, extending from the present eastern terminus of the extension of the Chambersburg & Gettysburg Electric Railway at Graffenburg, thence over the Chambersburg Turnpike and Gettysburg and Petersburg Turnpike through Franklin and Cumberland Townships, Adams County to Gettysburg, to a terminus at Washington and Chambersburg Streets. The charter sets forth that the line is to be operated by either electric power or motors driven by gas, gasoline or oil. The president is H. C. Kennedy, president of the Cumberland Valley Railroad Company, and the other directors are: H. A. Riddle, C. Davidson, Thomas B. Kennedy, Thomas J. Brereton, J. H. Tonge, all of Chambersburg. All these gentlemen are officials connected with the Cumberland Valley Railroad Company, which interests are also in control of the Chambersburg & Gettysburg Electric Railway Company. The new line will give the Cumberland Valley Railroad Company an electric railway entrance into Gettysburg, which was lost to the company when the Philadelphia & Reading Railway Company purchased the Gettysburg & Harrisburg Railway, from Carlisle to Gettysburg, some years ago and made it a part of its system west of the Susquehanna River.

Coraopolis Street Railway Company.—Capital, $24,000; length of line 2 miles; extending from Groveton Station, Allegheny County, to Coraopolis, to the line of the Pittsburg, Neville Island & Coraopolis Railway Company. The line will cross Montour Creek near Coraopolis. The president is J. W. Arras, and the other directors are: C. B. Ferguson, W. J. Dithrich, M. A. Ross and W. J. Tredway, all of Coraopolis.

Jefferson & Wilson Street Railway Company.—Capital, $8,000; length of line 1 1-3 miles; extending along the River Road leading from Dravosburg to West Elizabeth, Allegheny County, to Peters Creek; the entire line being in Jefferson Township, Allegheny County. The president is Hugh Miller, of Dravosburg, and the other directors are: L. E. King, John Herron, H. A. Ward, C. M. Clarkson.

Selin's Grove & Freeburg Electric Railway Company.—Capital, $30,000; length of line 5 miles; extending from Market and Pleasant Streets, Selin's Grove, along the public road and Middle Creek to Kautz Village and Freeburg, Snyder County. The directors are: E. M. Leader, Shamokin; F. P. Llewllyn, T. H. Hutchinson, H. N. Harter, George W. Wagonseller.

Shannopin Electric Railway Company.—Capital, $36,000; length of line 6 miles; extending from Shannopin, Beaver County, through New Sheffield, the entire line being in Beaver County. The directors are: S. H. Dugan, Coraopolis, president; R. Burgher, James A. Newell, J. E. Wilson and D. G. Dugan.

Shenango Street Railway Company.—Capital, $12,000; length of line 2 miles; extending from Greenville, Mercer County, and crossing the Shenango River to Third Avenue, covering a number of streets in Greenville. The consent of the Greenville Electric Railway Company to the use of certain portions of its system by the new company has been secured. Edwin Ripley, of Sherman, N. Y., is president, and the other directors are: C. G. Glatzan, E. C. Emery, W. M. Waugh and E. A. Henry.

Friendship Avenue Street Railway Company.—Capital, $15,000; length of line 2½ miles; extending from Liberty Avenue and Denny Streets, Pittsburg, and passing over Denny, Mifflin, Fortieth, Main, Carroll, Edmund, Friendship, St. Clair and Baum Streets and Avenues. The directors are: Moulton J. Hosack, Pittsburg, president; Roger Knox, James M. Magee, Chas. K. Robinson and W. D. McBryan.

Linden Street Railway Company.—Capital, $27,000; length of line 4½ miles; extending from Neville and Bayard Streets, Pittsburg, and over Amberson, Westminster, Pitcairn, Fifth, Wilkins, Beechwood Boulevard, Linden, Thomas, Braddock, Susquehanna and Dunbar Streets and Avenues to the line dividing Pittsburg and Wilkinsburg. The directors are the same as those of the Friendship Avenue Street Railway Company.

Beaver Falls & New Castle Street Railway Company.— Capital, $60,000; length of line 10 miles; extending from Morado Park, College Hill, Beaver County, to Homewood, and Kopple, Hoytdale, Wampum, with a branch from Hoytdale to Ellwood City. The directors are: U. B. Duncan, president; Jordan Johnston, W. Bliss Dewey and George B. Nye.

Wampum Electric Railway Company.—Capital, $36,000; length of line 2 miles; extending from Main Street, in Wampum, and over various streets in Wampum. The directors are: H. W. Hartman, of Ellwood City, president; C. Carland, C. A. Glaser, J. R. Atwood and S. B. Depney.

Wampum & New Castle Electric Railway Company.—Capital, $42,000; length of line 7 miles; extending from Wampum to Newport, thence to Moravia and Mahoningtown (New Castle). The directors are the same as for the Beaver Falls & New Castle Electric Railway Company.

NEW PHILADELPHIA & WESTERN SYNDICATE PROPOSED

It is reported in New York that it is proposed to form a syndicate to retire all funded and other outstanding obligations of the Philadelphia & Western Railroad, which is building an interurban line out of Philadelphia. At present the subscribers of cash will be given certificates of syndicate participation, and after the road is opened and the earnings of the property demonstrated the certificates will be convertible into common and preferred stocks and bonds on what is considered a favorable basis. It is believed the road will earn $500,000 per annum, and that it can be operated at 50 per cent of the gross receipts. The road will, as now projected, run through West Chester, Lancaster and to Harrisburg. It is also proposed to build to York and in Southeastern Pennsylvania.

STREET RAILWAY PATENTS

[This department is conducted by Rosenbaum & Stockbridge, patent attorneys, 140 Nassau Street, New York.]

UNITED STATES PATENTS ISSUED JAN. 8, 1907

840,619. Pivoted Car Step; Gust Hagberg, Warren, Pa. App. filed Sept. 26, 1906. Provides a pivoted step for cars which may be swung up in elevated position while the car is in transit to prevent any one from boarding or alighting from the car while the same is in motion.

840,649. Trolley Pole Connection; Jacob M. Olinger, Spring-

field, Ohio. App. filed April 28, 1906. Provides a trolley pole readily removable from its socket or support, and consists of a support having a pair of hooks which are engaged by a specially constructed latch, spring impelled into position so as to prevent dislodgement of the pole by vibration or other accidental cause.

840,697. Railway Frog; Edwin S. Hippey, York, Pa. App. filed Oct. 12, 1906. Consists in the provision of two intersecting grooves formed in the upper face of the frog and extending parallel with the direction of extension of the two crossing rails and in alignment with and adapted to receive the blind flange of a worn car wheel as it passes over the frog.

840,733. Derailment Guard; August Anderson, Birmingham, Ala. App. filed Oct. 29, 1906. A derailment guard connected and movable with the axles and wheels and with respect to the truck and having depending arms standing in alignment with the flanges of the wheels, the outer sides of the depending arms being beveled at their forward and rear edges.

840,801. Elevated Railway System; Daniel M. Pfautz, Germantown, Pa. App. filed May 23, 1906. Details of construction of an elevated structure from which cars are suspended.

840,865. Electrically Propelled Vehicle; Mathias Pfatischer, Philadelphia, Pa. App. filed Nov. 25, 1906. Relates to electric trucks provided with a trolley pole and shoes to contact with track rails, so that the vehicle can proceed along an electric roadway when available. At other times the vehicle runs by storage battery.

840,866. Electrically Propelled Vehicle; Mathias Pfatischer, Philadelphia, Pa. App. filed Nov. 29, 1905. Relates to modifications of the above.

840,950. Railway Rail and Chair Therefor; Robert Morgan, St. Paul, Minn. App. filed Aug. 29, 1906. The rail is provided with two heads, so that it may be reversed to present a new head when one of the heads has become unfit for further use. The chair is made of one piece and is slipped on over the end of the rail and the jaws thereof wedged to the web of the rail.

840,988. Combined Tie and Rail Fastener; Erick P. Bergman, Concordia, Kan. App. filed Sept. 14, 1906. A metal tie having an integral rail engaging shoulder on one side and a locking plate attached to the rail on the other side of the rail.

840,991. Beamless Brake for Car Trucks; Edward S. Coffman, Clifton Forge, Va. App. filed April 13, 1906. Two brake levers, each pivoted intermediate of its ends as a brake head, and each having its long arm offset from the plane of the wheel, and means for connecting the long arm with a brake rod.

841,046. Railway Signal; William M. Ralston, Fostoria, Ohio. App. filed Sept. 21, 1906. A plurality of spaced tappets pivotally mounted in the roadbed, and adapted to be actuated by the car wheels to display a danger signal at a semaphore arm when the train is traveling in one direction, and to effect no actuation of the signal when traveling in the opposite direction.

841,084. Fare Register; Charles E. Gierding, Newark, N. J. App. filed Sept. 28, 1906. The object of the invention is to adapt the transmitting mechanism of the numeral wheels to form effective zero stops for the units-wheel, and such other numeral wheels as may have a wheel of higher value to the left of them.

PERSONAL MENTION

MR. HARRY WHERLAND has resigned as superintendent of transportation of the Spokane Traction Company, of Spokane, Wash.

MR. FRED D. POTVIN, of Grand Rapids, Mich., has been appointed manager of the Citizens' Railway & Light Company, of Muscatine, Ia., to succeed Mr. A. L. Lindner, resigned.

MR. MARSHALL E. SAMPSELL has resigned as clerk of the United States Circuit Court, in order that he may devote all of his time to his duties as receiver of the Chicago Union Traction Company and to the practice of law.

MR. GEO. A. ILER has been appointed superintendent and electrical engineer of the Las Vegas Railway & Power Company, of Las Vegas, N. Mex. Mr. Iler formerly was connected with the Western Maryland Railroad as electrical engineer and superintendent of machinery.

MR. J. E. SEWELL, who was recently appointed to continue as general manager of the properties embraced in the system of the Connecticut Railway & Lighting Company, of Waterbury, Conn., taken over by the Consolidated Railway Company, acting for the New York, New Haven & Hartford Railroad, has resigned from the company.

MR. THOMAS N. McCARTER, president of the Public Service Corporation, retired from the directorate of the Prudential Insurance Company, Monday, Jan. 14, and Mr. John K. Gore, for many years actuary of the company, was elected in his stead. Mr. McCarter was not a candidate for re-election, for the reason that he desires to devote his entire time to the Public Service Corporation.

MR. C. C. BENSON, assistant manager of the Santa Clara Interurban Railroad Company and also assistant manager of the San Jose & Santa Clara County Railroad Company, writes that he has not left the services of those companies as stated in a note in this department in the issue of Dec. 15. It is a pleasure to make this correction. Mr. Benson is well known in the East, as for a number of years he was superintendent of the Citizens' Street Railway Company, of Newburyport, Mass. He was also for some time connected with the early electrical work on the West End Railway, of Boston, and later with the contracting firm of Woodbridge & Turner. In 1902 Mr. Benson accepted the position of manager of the San Juan Light & Transit Company, of Porto Rico, where he remained two years. Upon his return he went to California, where he has been engaged in engineering and railroad work.

MR. F. R. SLATER, consulting electrical engineer, announces that he has formed a partnership with Mr. H. N. Latey, under the firm name of Latey & Slater, for the general practice of engineering, with offices at 100 Broadway, New York. Both Mr. Latey and Mr. Slater have been closely identified with the electrical work on the New York Subway, Mr. Latey having been principal assistant engineer on the electrical equipment of the subway during construction, and for the past three years electrical engineer of the Interborough Rapid Transit Company, while Mr. Slater was assistant engineer in charge of the construction of the direct-current distribution system and later principal assistant engineer, succeeding Mr. Latey. Mr. Latey is a graduate of Massachusetts Institute of Technology in electrical engineering, and is a member of the American Society of Civil Engineers, and an associate member of the American Institute of Electrical Engineers. Upon graduation in 1893 he entered the shops of the Westinghouse Electric & Manufacturing Company, at Pittsburg, and was subsequently engineer in charge of erection in the St. Louis district. In 1898 he became principal assistant to the consulting engineer of the Manhattan Elevated Railway Company, in New York, on extension work and estimates and calculation for electrification, and from 1899 to 1901 was connected with the electrical construction department of this road on equipment work. In 1901 he became principal assistant engineer of the Rapid Transit Subway Construction Company, in connection with electrical equipment, where he remained until the completion of the subway. Mr. Slater is a graduate of Cornell University in 1894. After completing his course in electrical and mechanical engineering he was engaged for a short time in the design of the power station of Columbia University, after which he entered the designing department of the Otis Elevator Company. On the outbreak of the recent war with Spain he decided to engage in military service, and served as adjutant in the First United States Volunteer Engineers. After the close of the war he joined the forces of the Manhattan Railway Company, of New York, which was then converting its elevated lines from steam to electricity, and remained with this company until he joined the engineering forces in the building of the New York Subway. He is an associate member of the Amercan Institute of Electrical Engineers and an associate member of the American Society of Mechanical Engineers.

TABLE OF STATISTICS OF NEW YORK STATE

The accompanying table gives the capital stock, funded debt. receipts, operating expenses, charges, dividends and surplus of the different companies of New York State for the year ending June 30, 1906. This table is made up from reports rendered by the different companies for the year mentioned to the Railroad Commissioners of the State, and will appear in detailed form in the full report of the Commission, which is usually issued some time in March. Through the courtesy of the Commission, however, the figures are reproduced on the following page:

TABLE SHOWING CAPITALIZATION AND OPERATING STATISTICS OF NEW YORK STATE STREET RAILWAY COMPANIES.

NAME OF COMPANY.	On June 30, 1906.		Year Ending June 30, 1906.					Surplus for Year.
	Capital Stock.	Funded Debt.	Total Receipts, All Sources.	Operating Expenses.	Charges on Earnings.	Dividend Paid. Amount.	Dividend Paid. P. C.	
Interborough Rapid Transit Co.	$35,000,000	$15,000,000	$20,411,097	$8,400,823	$8,841,383	$2,887,500	8¼	$281,391
New York City Ry. Co.	9,361,500	1,761,000	19,092,385	9,576,511	12,802,189	......	..	Def. 2,286,315
Brooklyn Rapid Transit Co.	45,929,759	78,690,680	18,473,328	10,441,377	5,612,934	......	..	2,162,609
Brooklyn Heights Railroad Company	200,000	250,000	13,329,864	7,294,747	4,701,575	......	..	1,333,542
Nassau Electric Railroad Company	15 000,000	15,000,040	3,414,654	1,922,271	1,008,333	390,000	6	94,050
Rochester Railway Company	6,000,000	4,557,000	2,105,421	1,204,903	556,952	270,000	4 and 5	73,566
International Traction Company (all systems)	19,269,500	13,852,000	4,766,393	2,755,623	1,152,130	652,820	4	205,819
United Traction Company	4,999,600	5,141,000	1,785,113	1,116,037	347,071	249,980	5	72,025
Coney Island & Brooklyn Railroad	2,000,000	3,500,000	1,663,279	1,193,824	307,961	160,000	8	1,494
Union Railway Company, New York City	2,000,000	2,000,000	1,521,182	1,060,637	285,308	......	..	174,237
Brooklyn, Queens County & Suburban	2,000,000	3,500,000	1,520,345	776,139	448,158	......	..	296,048
Syracuse Rapid Transit Railway Company	4,000,000	3,861,000	1,027,340	579,268	258,812	......	..	189,260
42d St., Manhattanville & St. Nicholas Av. Ry. Co.	2,500,000	2,800,000	1,004,103	700,814	395,227	......	..	Def. 91,938
Utica & Mohawk Valley Railway Company	6,250,000	2,957,000	902,321	523,291	180,090	......	..	198,940
Schenectady Railway Company	600,000	2,000,000	882,206	559,448	211,096	......	..	111,662
New York & Queens County Railway Company	3,235,000	3,000,000	852,193	564,346	203,987	......	..	83,860
Fonda, Johnstown & Gloversville Railroad	2,500,000	6,537,000	776,885	374,360	357,144	......	..	45,381
Hudson Valley Railway Company	3,000,000	7,845,000	570,689	327,354	265,975	......	..	Def. 22,640
Thirty-Fourth Street Crosstown Railway	1,000,000	1,000,000	553,417	208,033	70,557	......	..	214,826
Dry Dock, East Broadway & Battery Railroad	1,200,000	2,050,000	477,863	344,620	180,438	......	..	Def. 47.195
Yonkers Railroad Company	1,000,000	1,000,000	341,258	239,074	110,593	......	..	Def. 8,409
Westchester Electric Railroad Company	500,000	500,000	332,273	277,546	103,169	......	..	Def. 48,442
Auburn & Syracuse Electric Railroad Company	1,750,000	1,050,000	311,109	183,355	75,831	23,750	..	28,173
Binghampton Railway Company	964,749	1,671,000	291,943	150,889	87,791	24,049	..	29,214
Albany & Hudson Railroad Company	1,750,000	1,750,000	265,671	168,960	92,804	......	..	3,907
Richmond Light & Railroad Company	2,875,750	2,200,000	264,539	225,959	115,786	......	.	Def. 77,206
Rochester & Eastern Rapid Railway	1,500,000	1,500,000	237,905	144,947	85,010	......	..	7,948
New York & Long Island Traction Company	1,000,000	1,000,000	207,301	102,998	52,903	......	..	51,400
Elmira Water, Light & Railroad Company	1,000,000	2,861,000	206,570	155,892	49,514	......	..	1,164
Staten Island Midland Railroad	1,000,000	1,000,000	196,266	144,259	57,787	......	..	Def. 5,780
Long Island Electric Railway Company	600,000	600,000	184,808	129,132	37,962	......	..	17,714
Twenty-Eighth & Twenty-Ninth St. Crosstown R.R	1,500,000	1,500,000	162,037	129,442	87,415	......	..	Def. 54,820
Jamestown Street Railway Company	100,000	300,000	157,794	104,296	33,431	......	..	20,067
Niagara Gorge Railroad Company	1,000,000	1,000,000	143,272	72,730	52,993	......	..	17,549
New York & Stamford Railway Company	500,000	426,000	137,477	83,973	24,895	......	..	28,609
Kingston Consolidated Railroad Company	400,000	700,000	131,144	74,797	39,600	......	..	8,747
Orange County Traction Company	325,000	425,000	129,991	86,792	31,423	......	..	11,776
Tarrytown, White Plains & Mamaroneck R.R. Co.	300,000	300,000	128,548	113,445	31,686	......	..	Def. 16,583
Western New York & Pennsylvania Traction Co.	300,000	413,500	128,465	63,607	32,182	......	..	32,676
Hamburg Railway Company	350,000	300,000	126,696	80,785	17,961	......	..	27,950
*Oneonta, Cooperstown & Richfield Springs Ry	1,464,000	1,364,000	116,767	154,631	4,133	......	..	Def. 41,990
Ithaca Street Railway Company	325,000	315,000	110,944	74,539	21,370	17,875	..	Def. 2,848
Poughkeepsie City & Wappingers Falls Electric Railway Company	750,000	370,000	107,152	85,180	18,474	......	..	3,498
Syracuse Suburban Railroad Company	400,000	550,000	106,078	61,318	33,942	......	.	10,819
Peekskill Lighting & Railroad Company	650,000	575,000	100,699	33,493	33,857	7,200	6	33,349
Geneva, Waterloo, Seneca Falls & Cayuga Lake Traction Company	450,000	450,000	90,755	54,766	22,078	......	..	13,911
Kingsbridge Railway Company	8,600	......	88,120	73,573	86,960	......	..	Def. 72,413
Black River Traction Company	45,000	55,000	84,918	79,338	5,262	......	..	318
Syracuse, Lake Shore & Northern Railroad	500,000	......	75,883	53,973	2,758	......	..	19,152
Rochester & Suburban Railway Company	420,000	450,000	74,388	38.560	70,939	......	..	Def. 35,111
Waverly, Sayre & Athens Traction Company	200,000	150,000	72,738	46,831	10,628	......	..	15,279
Chautauqua Traction Company	500,000	126,000	70,750	39,156	10,357	......	..	21,237
Dunkirk & Fredonia Railroad	173,250	100,000	64,945	48,539	7,260	......	..	9,146
Cortland County Traction Company	320,000	500,000	59,143	35,473	13.129	......	..	10,541
Van Brunt Street & Erie Basin Railroad	200.000	65,000	57,541	38,552	4,869	10,000	5	4,120
Cohoes Railway Company	120,000	84,000	55,063	44,353	6,890	......	..	3,820
Oswego Traction Company	300,000	288,000	54,501	34,347	13,487	......	..	6,667
Ocean Electric Railway Company	35.000	20,000	54,281	58,937	2,383	......	..	Def. 7,039
Wallkill Transit Company	350,000	300,000	54,255	37,264	16,218	......	..	773
Corning & Painted Post Street Railway	100,000	100,000	48,157	26,248	7,516	4,000	..	10,393
Coney Island & Gravesend Railway	35,400	......	48,028	26,042	1,009	......	..	20,977
Benington & Hoosick Valley Railway	200,000	182,000	47,332	32 410	11,457	......	..	3,465
Fishkill Electric Railway Company	50,000	50,000	47,303	30,329	11,710	......	..	5,264
Southern Boulevard Railroad Company	250,000	250,000	46,785	44,317	19,166	......	..	Def. 16.698
Buffalo Southern Railway Company	547,200	300,000	44,266	34,632	1,053	......	..	8,581
Eastern New York Railroad Company	300,000	300,000	39,258	27,231	15,030	......	..	Def. 3,003
Buffalo & Williamsville Electric Railway Company	75,000	117,500	33,872	21,288	7,223	......	..	5,361
Troy & New England Railroad Company	180,000	183,725	32,958	20,191	6,009	......	...	6,916
Fulton Street Railroad Company	500,000	500,000	30,931	28,880	21,298	......	..	Def. 19,247
Ogdensburg Street Railway Company	150,000	150,000	30,655	18,536	14,829	......	..	Def. 2,710
Penn Yan, Keuka Park & Branchport Railway	94,000	100,000	26,195	17,248	6,555	......	..	2,392
Hornellsville & Canisteo Railway Company	50,000	80,000	25,689	12,235	4,078	......	..	9,376
Rome City Street Railway Company	150,000	200,000	24,922	17,445	10,867	......	..	Def. 3,390
Plattsburg Traction Company	100,000	80,000	24,034	15,525	6,449	......	..	2,060
Rochester, Charlotte & Manitou Railroad	97,500	81,250	22,493	18,839	5,068	......	..	Def. 1,414
New Paltz, Highlands & Poughkeepsie Trac. Co.	100,000	100,000	21,372	13,693	4,883	......	..	2,796
Lake Erie Traction Company	500,000	400,000	20,921	19,111	20,351	......	..	Def. 18,541
Hornellsville Electric Railway Company	50,000	70,000	20,645	17,416	3,793	......	..	Def. 364
Keesville, Ausable Chasm & Lake Champlain Railroad Company	60,000	150,000	19,218	17,171	3,830	......	..	Def. 1,783
Marcellus & Otisco Lake Railway Company	200,000	200,000	19,116	13,648	6,833	......	..	Def. 1,365
Catskill Electric Railway Company	138,000	132,000	17,383	16,087	7,487	.....	..	Def. 6,191
Huntington Railroad Company	30,000	26,000	17,360	11,918	1,941	......	..	3,501
Westchester Traction Company	300,000	600,000	15,944	22,600	8,460	......	..	Def. 15,116
Oneida Railway Company	15,000	10,000	14,012	13,379	1,260	......	..	Def. 627
Elmira & Seneca Lake Railway	300,000	300,000	13,130	14,850	3,924	......	..	Def. 5,644
Buffalo & Depew Railway Company	305,000	350,000	12,496	27,153	18,695	......	..	Def. 33,352
Port Jervis Elec. Lt., Pwr., Gas & R.R. Co.	150,000	95,000	12,249	14,930	5,692	......	..	Def. 8,373
Buffalo, Dunkirk & Western Railroad	3,500,000	750,000	11,342	8,904	39,697	......	..	Def. 37,259
Pelham Park Railroad Company	50,000	27,750	10,703	11,159	1,123	......	..	Def. 1,579
City Island Railroad	50,000	27,873	10,231	7,975	1,774	......	..	481
Lima, Honeoye Electric Light & Railroad Co.	Private	ownership.	9,890	10,443	187	......	..	Def. 740
Nassau County Railway Company	35,000	......	9,499	9,625	667	......	..	Def. 793
Northport Traction Company	45,000	......	8,340	8,437	239	......	..	Def. 336
†Glen Cove Railroad Company	10,000	......	8,089	8,862	......	......	..	Def. 773

* July 1, 1905, to May 9, 1906. † November 16, 1905, to June 30, 1906.

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During 1906 *the Street Railway Journal printed and circulated* 426,950 *copies, an average of* 8210 *copies per week. Of this issue* 8000 *copies are printed.*

Using Passenger Cars as Work and Freight Cars

On small electric railway systems the mistake is sometimes made of not having a work car or a car for rough service, and in such instances extra passenger cars must frequently be put into heavy service for which they were not intended. Occasionally they are used to carry rails or other track or line material from one portion of the system to another, but more often they are employed in pulling heavily loaded freight cars. Such service cannot help but result in considerable harm to the car. It is an exceptional track or line gang that will not injure the car body when loading or unloading heavy material. If perchance glass or seat castings are not broken, paint will be scraped off and the car will be filled with dirt to such an extent as to give it a shabby appearance in a very short time.

Usually the draft rigging of passenger cars and other parts of the body are not built with the intention of standing the heavy strains that will be thrown upon them if the car is used in switching heavily loaded work or freight cars, and when put into such service, even if something does not give way, there is great liability of the body being racked and loosened. If it is felt that the company cannot afford to purchase work cars for the small amount of service required of them, instead of using passenger car bodies the suggestion is made to build cheap work car bodies for the passenger car trucks. Then when a work car is needed, it would not require much time to run the trucks with motors out from under an extra passenger car and put them under the work car. The work car body need be nothing more than a flat car with a mast for the trolley, and should not cost more than, say, $200. It would, however, be necessary to wire it and provide it with a controller and rheostats, and this would entail the greater portion of the expense of the duplicate equipment. Such a car body, it is true, would necessitate an outlay of several hundred dollars, but compensation for a part of this expenditure would come through the time saved in loading and unloading and the greater adaptability of the car to the work in general. A considerable cost would also be offset by the lessened maintenance expense on the passenger equipment.

The Rear of the Switchboard

Switchboard details are so seldom designed by the operating electric railway force, that it would be a waste of time to dwell upon the subject if it were not for the actual working results which every switchboard layout creates. Just as in the modern telephone organization, the traffic department states the operating necessities to the engineers and leaves the latter to scheme out the minute particulars of jack sizes, relay resistances and signal locations, so should the electrical department of the railway system make known its wants in the way of switching flexibility and protection to the manufacturer through suitable broad specifications. Unless the operating and the construction

forces unite in the suggestion and execution of the design, trouble is liable to come.

The back of the switchboard needs as much intelligent consideration from the purchaser as the front of the panels. This is particularly the case with the growing use of alternating current in one branch or another of electric railway service. The mere statement of the switching, measuring and regulating functions desired on the front of the panels is not a complete solution of the problem from the operating end. Of course, hard and fast specifications in regard to minute details of switchboard wiring are unwise in many cases—at least until a conference has been held with the factory engineers. Closer co-operation will result in better satisfaction all around. Unless the man who designs the switchboard in detail can be given the local conditions in the plant where the board is to be installed, he cannot be expected to meet all present and future requirements at one and the same time.

Switchboard wiring has been vastly improved during the past few years, in both its mechanical strength and its electrical intelligibility—if such a term can be used. The front of a 600-volt d. c. railway board resembles the older designs quite closely, but behind the scenes much more care is used to separate and insulate conductors of opposite potentials. Bulky field rheostats are often relegated to the basement ceiling, instrument wiring is run in heavily insulated covering or even in armored piping, with 90-deg. bends and straight, horizontal or perpendicular runs. Curves and slants are being avoided as much as possible, and it is much easier to understand the main wiring behind many boards than in earlier days. Instrument leads, potential and current transformers, special fuses and lightning arresters, oil switch relay connections and synchronizing wires are the really complex elements in the a. c. board, and in the arrangement of these there is ample scope for conferences in specific operating problems between the purchasing company and the manufacturers. It is still not uncommon to find too little space behind the switchboard for convenient working, and in a recent installation which defied criticism in almost every other particular, three bare-knife 2300-volt line switches and a grounded bus projected from the rear of the switchboard and paralleled the adjacent wall, respectively, leaving a gap of but 15 ins. in which to work,—a construction too dangerous to be tolerated, and yet one which might have been avoided by co-operation between the purchaser and the designer. In another case a set of 6600-volt knife switches was installed against the station wall within a foot of the floor. Compactness is sometimes led to defeat its own ends, and while it is a desirable feature of all switchboard layouts, it is worthy of more cautious application in more than a few cases.

Steam Railroad Delays

It is perhaps more than a coincidence that the State Boards of Railroad Commissioners of the two neighboring States of New York and Massachusetts should have been investigating recently with a great deal of care the delays to passenger traffic on steam railroads. The work of the New York Commission has been local, that is, related to the service into the New York terminal of the New York Central & Hudson River Railroad, where the interruptions to the schedule owing to the work of electrification have been general. The Massachusetts inquiry has been broader in that it has covered the service of practically all of the principal steam lines in that State. For this reason the report issued a week or two ago is of general interest, even to electric railway companies, although trolley service is not referred to in any way in the text. Steam and electric railways have many points of common interest in these days, and it is not seldom the practice of one type of road is full of significance to the other, although the conditions of operation are necessarily at variance.

Without going too much into detail, the Massachusetts report attributes the extraordinary delays of railroad service in the State this winter to eight principal causes: heavy business, unfavorable weather, delayed through trains, overcrowded terminals, bad coal, insufficient coal, lack of motive power and false economy in the maintenance of equipment. The results have been vexatious delays in the movement of trains, and the board does not hesitate to criticise our steam railroad brethren at considerable length for their failure to maintain better schedules.

It is not easy to suppress one's satisfaction that, during this period of overstrained steam schedules, the trolley lines in both New York and Massachusetts have been giving excellent and reliable service, with the result that the fire of hostile criticism has been almost entirely turned in other directions. Of course, the electric roads have not had the complications of an enormous freight traffic to contend against, and there have not been foreign cars on limited schedules to handle on through routes from points 500 or 1000 miles away; but the same weather has been experienced by the trolley lines; the same questions of proper maintenance expenses have been considered; the fuel question has had to be solved in the face of the winter's business; the crowded city street has had to be negotiated no less than the intricate and easily upset terminal station, and sufficient motors have had to be purchased to take care of anticipated increases in traffic. The traffic on the street railways has reflected the general prosperity of the country in no small degree in the past year, and there is no question that the rush-hour peaks of the electric lines have been much harder to handle than the extra morning and night suburban service of the steam railroads. In the light of recent experience, it is clear that the boasted advantage of the steam locomotive's independence of a power station is not as great as some people are disposed to assert, and there is no escaping the conclusion that a well managed electric line is capable of giving better passenger service than a poorly operated or crippled steam road.

There is a note of warning in the foregoing list of train delay causes, however, which ought not to be overlooked. Like accidents, some train (and car) delays are, humanly speaking, unpreventable. In heavy storms and fogs safety in operation imperatively demands cautious running, and if time tables are made up on a fair weather basis, departure from schedules is inescapable. But modern demands for transportation will not tolerate slow-running, stormy-

weather schedules in days of sunshine. We prefer to make allowances the other way. Then there are increases of traffic which no one can fully foresee, and delays in the delivery of equipment from factories swamped with orders which cannot be completed within the guaranteed time limits. Forecasts of coming conditions cannot be made with absolute certainty, even in times of high prosperity like the present. Relief from congestion, due to overcrowded tracks, cannot be instantly obtained by a stroke of the president's pen, no matter how large a check he authorizes the treasurer to sign to cover the new construction.

On the other hand, and here is where the electric railway manager needs to avoid trouble, there is little excuse for delays due to faulty fuel or to too great zeal for dividends at the expense of proper maintenance of the property. Fuel can be accurately tested by chemical analysis or calorimetric measurement before a ton is accepted, and the cost of such determinations by a competent chemist or engineer is a mere bagatelle in proportion to the value of the test. As for that great sin of omission—stinginess in maintenance of equipment—it is good to note the ever-widening appreciation of its false economy in electric railway circles. In the older days of the industry repairs were not regarded with the interested eye and ear of the present manager, and chances were taken which the higher speeds and heavier rolling stock of 1907 would not for a moment justify. With the lesson of the Massachusetts report before one—and false economy was given as the root of the whole trouble—no thoughtful electric railway man can fail to appreciate anew the immense importance of adequate equipment maintenance in the performance of a profitable and satisfactory public service by his property.

Steam vs. Electricity for Suburban Service

It was Rochefoucauld, we believe, who was the author of the sinister aphorism, "There is something even in the misfortunes of our best friends not altogether unpleasing to us." It is not without a certain feeling of this kind that we have regarded the failures of steam suburban traffic out of Boston and New York mentioned above. The difficulties on the New York Central Railroad already referred to can be excused, as that road is engaged in the herculean task of at once introducing an entirely new system of motive power and of completely changing its terminal station. Its patrons have the satisfaction of looking forward to better conditions soon to come. The same is not true, however, with the suburban lines which serve New York from Jersey City and with the Boston lines referred to. This is the season of the year when one is always forcefully reminded of the claim of the steam railroad operator that a purely passenger business is unprofitable, and the suburban systems of many of our steam roads seem to be run on this principle. In fact, matters have come to such a pass in the Boston instance that petitions have been circulated and bills introduced in the General Court of Massachusetts looking to the cancellation of the lease under which the Boston & Albany road operates its so-called Albany Circuit which serves the towns to the southwest of that city. We have neither occasion nor desire to sit in judgment on the merits of its controversy, and we merely state the demands of the patrons of the road in question.

For some years past there has been a great deal of talk about the conversion to electricity of this line. In fact, at the time when the South Station was built, special provision was made for the circuit trains, and it was then generally believed that some step would be taken toward electrification of this particular line. There has also been considerable talk about the equipment of the trans-Hudson roads. All of these lines are peculiarly well situated for conversion into electric roads. They run through well-populated and rapidly growing suburbs, and furnish traffic which needs only the stimulant of a proper electric service to grow into exceptionally remunerative density. All of them also touch tidewater, so that there are admirable opportunities for building power stations on sites particularly favorable for cheap power. If the alternating current motor system were to be adopted a single power station would be ample for any of the systems. If it were desired to adhere to the older direct current then at most a few sub-stations only would be necessary, and in the Boston case a single one would undoubtedly suffice. Yet with all these advantages year after year has gone by, and the electric system has been admirably developed elsewhere, but these steam suburban systems have remained under the old regime, with their timetables little altered as the years have gone by. The suburbanites, who ten years ago disturbed the last act in most of the New York and Boston theaters by their hurried exits trainwards, still bolt at the same inopportune period to catch the last opportunity for getting home.

There seem to have been no serious efforts made by the companies interested toward the much-talked-of conversion to electricity. The Erie suburban plans are said to have been abandoned, at least for the present; the more vague proposals of the Lackawanna seem no nearer completion, and last of all comes a suggestion that the Boston & Albany Road, including the Circuit under consideration, is to move bodily out of the South Station, which was supposed to have been prepared for its convenience, and is to seek terminal facilities of its own. This would give to Boston three independent stations between which passengers who do not wish to stop permanently in the Hub must seek such transportation as they may find. The moral which this story teaches is somewhat as follows: "It is easy to drive a steam railroad to the current but exceedingly difficult to make it drink,"—as in the case of the traditional horse.

It seems to be much easier and cheaper to drag along in the same old way, giving the same old service and turning the same old deaf and unresponsive ear to complaints than it is to go ahead and do the thing which any enterprising street railway management is doing and is glad to do all the time. If these suburban systems had been owned by the electric railway corporations in the districts affected it is safe to say that they would long ago have been electrified and would be building traffic for themselves at a surprising rate, a fact which teaches the lesson that if a community seeks suburban rapid transit it should turn over the facilities for getting it to those who know best how to utilize them.

THE LAS VEGAS RAILWAY & POWER COMPANY

Las Vegas, New Mexico, although having hardly over 11,000 inhabitants, is of much more importance than its size would lead the stranger to suppose. It is of industrial importance as the center of a district from which great quantities of limestone, gypsum and wool are exported, and in recent years it has become a great health resort. The mild, dry climate of this part of New Mexico has brought thousands of health seekers to and near Las Vegas, besides others who have come to aid in the great development of the Southwest.

THE STARTING POINT OF THE LAS VEGAS RAILWAY, FROM THE LAS VEGAS DEPOT OF THE SANTA FE RAILWAY, OPPOSITE CASTANEDA

Clear evidence of the progressiveness of this bustling town is afforded by the success of the Las Vegas Railway & Power Company, which is giving Las Vegas its electric railway, light and power service. Previous to the organization of this company the street railway was operated by the Las Vegas & Hot Springs Electric Railway, Light & Power Company, and the electric light and power business by the Las Vegas Light & Fuel Company. Upon the organization of the Las Vegas Railway Company, the two functions were combined and a new power plant was constructed on a site well adapted both for the railway and the electric light and power business.

THE ROUTE

The railway line starts in Las Vegas from the Santa Fe station, and within a few minutes has left the town to traverse one of the most picturesque routes in the country. The vicinity of Las Vegas has several great health resorts. Among those reached by the railway are the territorial hospital for the insane, the hospital owned by the employees of the Santa Fe Railway, and the Montezuma Hotel. Here there are some hot springs which, together with the hotel, have not been exploited for the last two years, despite the fact that the location is very healthful and the springs are considered to be among the best in the country. There appears to be little question among Las Vegans that this could be built up into a great health and pleasure resort by a good hotel man. Before reaching the Montezuma the line passes by one of the finest race tracks in the Southwest and along Gallinas Park, a well-cared-for grove full of shady paths, rustic seats, hidden springs and an artificial lake. The great charm of the ride, however, is afforded by the more rugged beauties of Nature, which come into view after leaving the Montezuma, when the line turns abruptly through the cañon made by the Gallinas River. Here the tracks follow the now rapid stream through deep clefts and yawning gorges in the shadow of rocky cliffs hundreds of feet high.

On the right, the passenger may look at the broad scenic highway clinging in its tortuous course to the mountain side, while on the left the narrow stream is seen to broaden now and then to lakes with steep wooded shores. In fact, the southern slopes are so high that in winter the lake surfaces are not warmed by the direct rays of the sun, so that a thick coat of ice is formed. It is a unique yet frequent picture here to see skaters dashing on the ice under the shadow of the cliffs while in the warm sunshine on the northern banks boys are running barefoot. A view of one of these skating parties is shown in one of the accompanying illustrations of scenes along this route.

After leaving these picturesque lakes the railway terminates at a large ice house within sight of the Sangre de Cristo range.

FREIGHT BUSINESS AND PROBABLE EXTENSIONS

In the Gallinas cañon there are all told nine large dams and as many ice houses. The so-called ice harvest takes place the latter part of December and in January and February. During this ice harvest the company handles about fifty cars of ice per day. These dams are from 6 to 8 miles from the city of Las Vegas, and the average grade on the run is about 3 per cent, and in some cases, at the upper end of the cañon from 4 per cent to 6 per cent. The electric locomotive operated by the company usually hauls from fifteen to twenty empty freight cars per day. During the ice harvest the company is compelled to hire a steam locomotive from the Atchison, Topeka & Santa Fe Railroad to help bring up the balance of the empties needed. Coming down no assistance is needed, the electric locomotive taking thirty-five to forty cars in one string, loaded with ice. This ice is distributed by the Santa Fe along its various icing stations, as far east as Dodge City, Kan., and west as far as Phoenix, Arizona.

ICE SKATING ON ONE OF THE LAKES ALONG THE LINE OF THE LAS VEGAS RAILWAY & POWER COMPANY

Another interesting feature is the fact that there is some very valuable farm country and timber as well as coal lands from 35 to 40 miles from Las Vegas, anxiously waiting to be entered by some railroad. The inhabitants in these localities as well as those of Las Vegas have been so urgent in their demands for a railroad in that country that the company

ONE OF THE DAMS OF THE GALLINAS RIVER, WHERE ICE IS CUT FOR TRANSPORTATION BY THE LAS VEGAS ELECTRIC RAILWAY

has practically made up its mind to tap this valuable part of New Mexico by extending its electric line some 40 to 50 miles. New plans have not yet been definitely decided on, but will be very shortly. The new line will also cover one of the finest scenic routes in the United States.

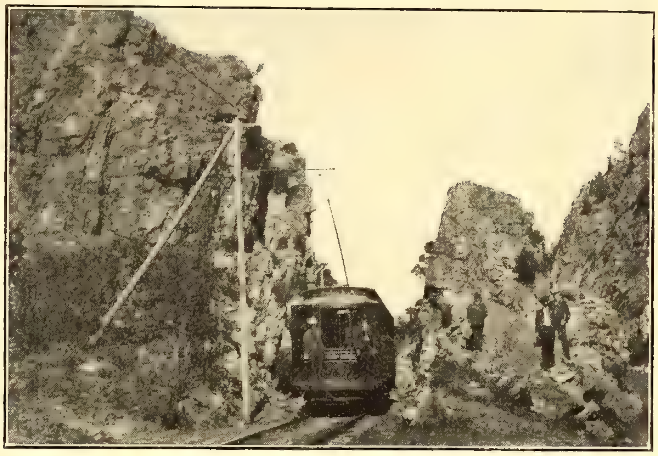
TRACK AND ROLLING STOCK

The Las Vegas Railway & Power Company has approxi-

BRIDGE STREET, LAS VEGAS, NEW MEXICO, SHOWING CAR CROSSING THE STEEL BRIDGE ACROSS THE GALLINAS RIVER. ONE OF THE RAILWAY COMPANY'S COMBINATION PASSENGER CARS MAY BE SEEN ON THE RIGHT, AND ITS ELECTRIC LOCOMOTIVE ON THE LEFT OF THE ROADWAY

mately 3 miles of track in the city limits and 9 miles outside. Practically all of this track is of recent construction. Sixty-lb. T-rail is used throughout, with No. 0000 copper bonds placed between the angle-bar and the rail.

The new rolling stock purchased consists of three complete car equipments, each car being 35 ft. 4 ins. over all, 25 ft. 4 ins. over the corner posts and equipped with double trucks. Each car has two electric motors of the GE-800 type, and a Westinghouse air-brake equipment. The sides are of long leaf yellow pine reinforced with steel plates extending the full length of the car body, and all the body



A TYPICAL VIEW ALONG THE LINE OF THE LAS VEGAS ELECTRIC RAILWAY, SHOWING THE RUGGED NATURE OF THE SCENERY

framing is of dry and well-seasoned white ash. The interiors have space for advertising cards, push buttons, signal bells, and other features of modern cars. The cars are equipped with electric headlights. The Las Vegas Company has also purchased two cars 38 ft. 6 ins. long over the platforms, with bodies 28 ft. 6 ins. long, of the same general type as those described above. Each of these cars is equipped with four GE-54 motors and with Westinghouse air brakes. All of the above cars were furnished by the St. Louis Car Company, St. Louis, Mo.

The company has, in addition to the rolling stock mentioned, one small electric locomotive for use in delivering freight, and one open car of the double-truck type. Both of these cars are equipped with Westinghouse motors and air

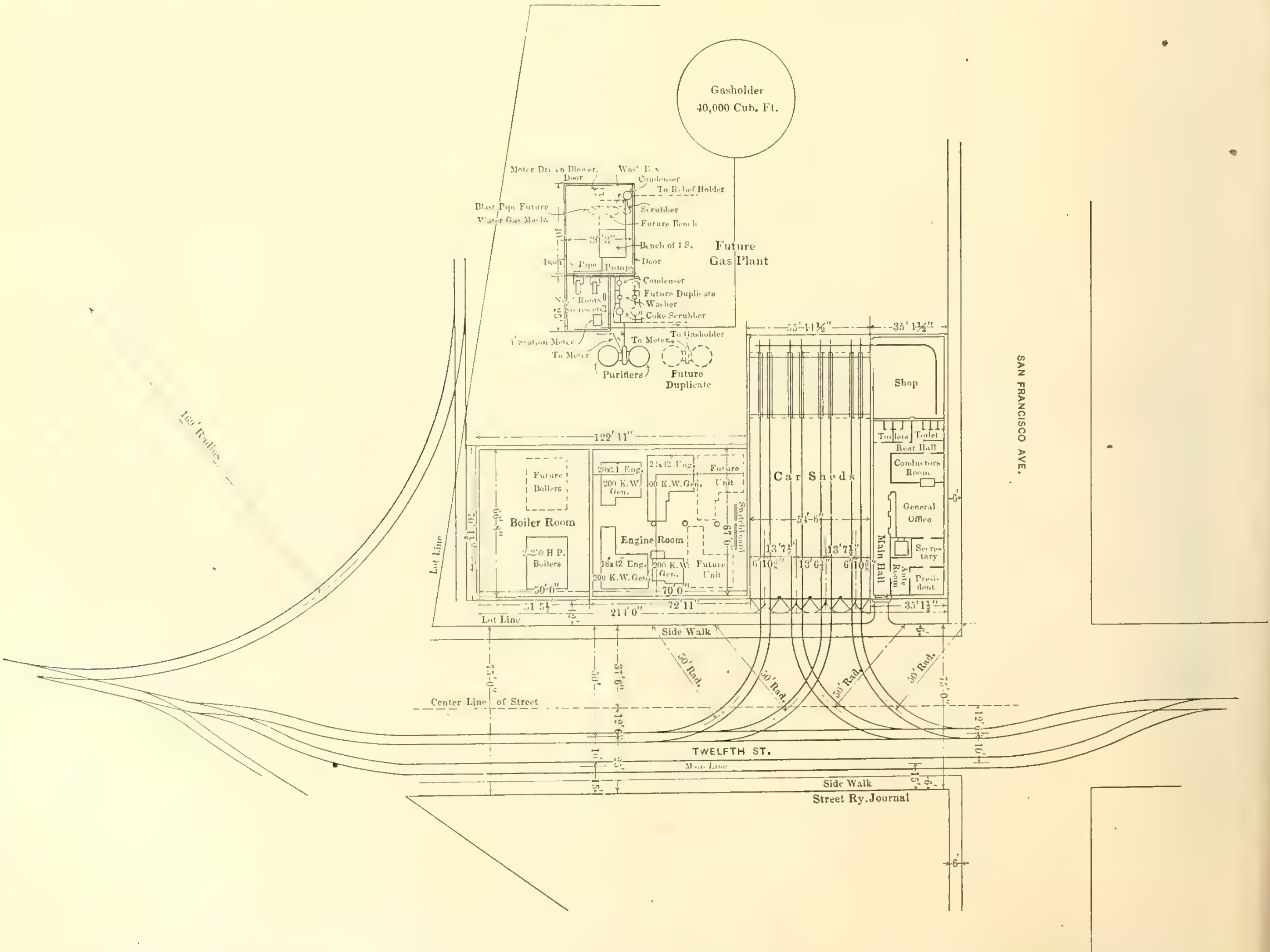
brakes. These last two cars were furnished by the American Car Company, of St. Louis.

The car sheds, as shown in the plan, are between the main office and the engine room of the public service building described later. They comprise a total width of 55 ft. 11½ ins. and have four tracks in all spaced 13 ft. 6¼ ins. and 13 ft. 7½ ins. centers. As the walls are solid no openings were left except in the front and the rear of the car sheds, so the only additional cost for constructing car sheds was that for the roof. A repair pit in the rear of the car sheds extends the entire width of the building under all the tracks.

THE PUBLIC SERVICE BUILDING OF THE LAS VEGAS RAILWAY & POWER COMPANY, LAS VEGAS, NEW MEXICO

PUBLIC SERVICE BUILDING

The handsome stone structure shown in one of the accompanying illustrations was built by Wallace & Davis, of Las Vegas, as a combination service building for the Las Vegas Railway & Power Company. It is located at the intersection of Twelfth Street and San Francisco Avenue. The section set aside for the power station runs parallel with Twelfth Street



GENERAL PLAN OF THE PUBLIC SERVICE BUILDING OF THE LAS VEGAS RAILWAY & POWER COMPANY, THE TRACK ARRANGEMENT LEADING TO THE CAR STORAGE THEREIN, LAYOUT OF THE POWER GENERATING EQUIPMENT, FUTURE GAS POWER PLANT, OFFICES, ETC.

and is alongside the car sheds. That part of the building parallel with San Francisco Avenue used for offices and a show room for electrical fixtures is two stories high, while the one-story division is used for the shops.

THE POWER PLANT

Practically none of the equipment of either the old railway plant or of the new plant of the Las Vegas Railway & Power Company was retained, all of the machinery and equipment being new and installed to conform with present requirements. The Las Vegas company has approximately twenty-five railway motors, aggregating some 200 hp., on the day service, and a peak load for lighting of about 230 kw. Arrangements have been made for the extension of the property both for additional boilers and machinery for light and power, and also extensions of the street railway equipment. The plans for the entire installation were prepared by Ruebel & Wells, St. Louis, Mo.

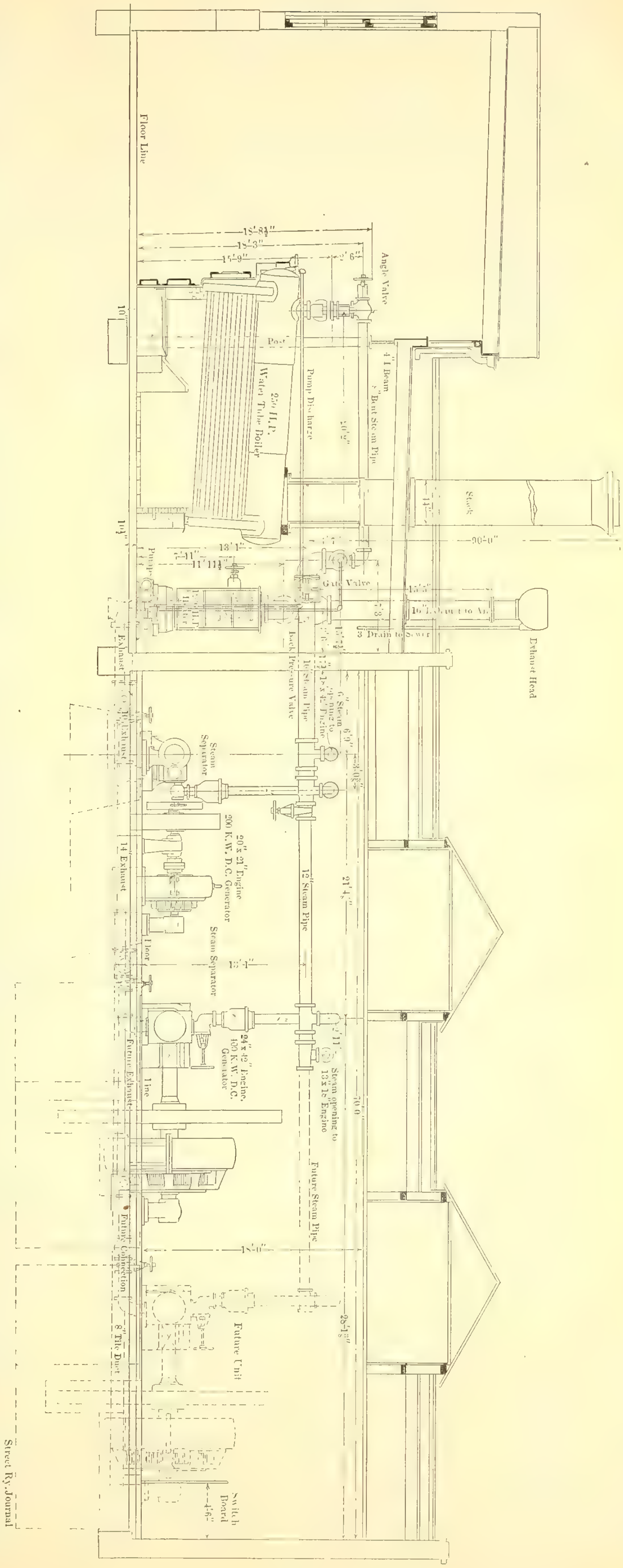
In purchasing the property, sufficient space was provided for the erection of a coal gas plant to be installed at some future time. The proposed location of this gas plant and holder is shown on the plan drawing on the opposite page.

The steam generating equipment is located in a room 50 ft. wide by 66 ft. 8 ins. long, and consists of two boilers of the inclined water-tube type. Each boiler is rated at 250 hp, designed on the basis of 10 sq. ft. of heating surface per horsepower; contains 140 mild steel tubes, 3½ ins. diameter by 18 ft. long; and is guaranteed for a working pressure of 150 lbs. per sq. in. and a test pressure of 225 lbs. per sq. in. The boilers are suspended in front by I-beam supports and are each connected with a stack 90 ft. high and 44 ins. in diameter, built of No. 8 and No. 10 steel. The boilers were furnished by the John O'Brien Boiler Works, of St. Louis.

The steam piping is of heavy wrought-iron pipe with extra heavy fittings throughout and all large valves arranged with by-pass. Connections between the steam heater and the engines are made by pipe bends. The piping of the main header has been designed for the ultimate capacity of the plant, as is also the case with the exhaust piping.

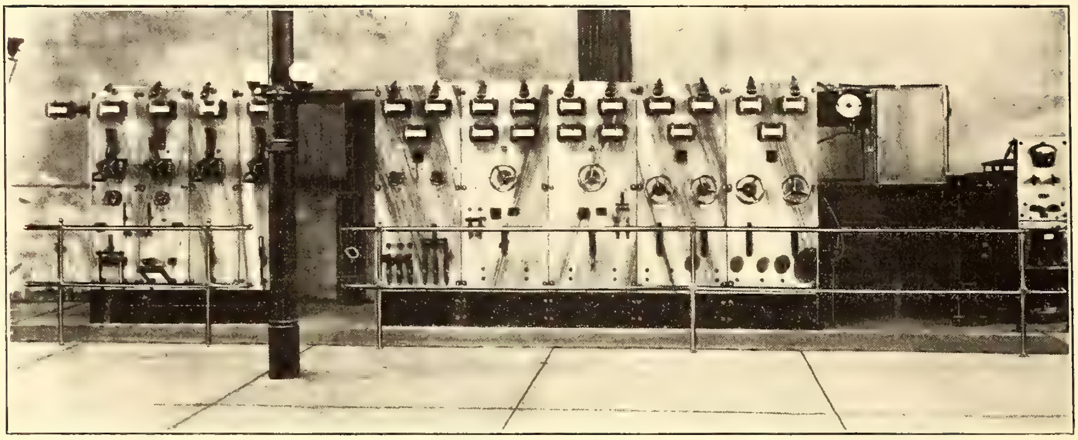
The feed-water heater, which was furnished by John E. Angell & Company, of St. Louis, Mo., is of 1200-hp capacity and of the receiver type, arranged so that the exhaust steam can be taken from the heater for heating the entire building and offices of the company. Traps are furnished for draining the separators for the different engines and also for draining the heater. There are two boiler feed pumps, each of sufficient capacity for the entire plant. They are of the Blake outside-packed plunger type with bronze plungers.

The engine room is 70 ft. long and 66 ft. 8 ins. wide. It contains four steam engines, each direct-connected to a generator. There are two generating sets for the electric light and power service. One set consists of a Filer & Stowell heavy-duty Corliss engine, 18 ins. x 42 ins., operating at 100 r. p. m., direct connected to



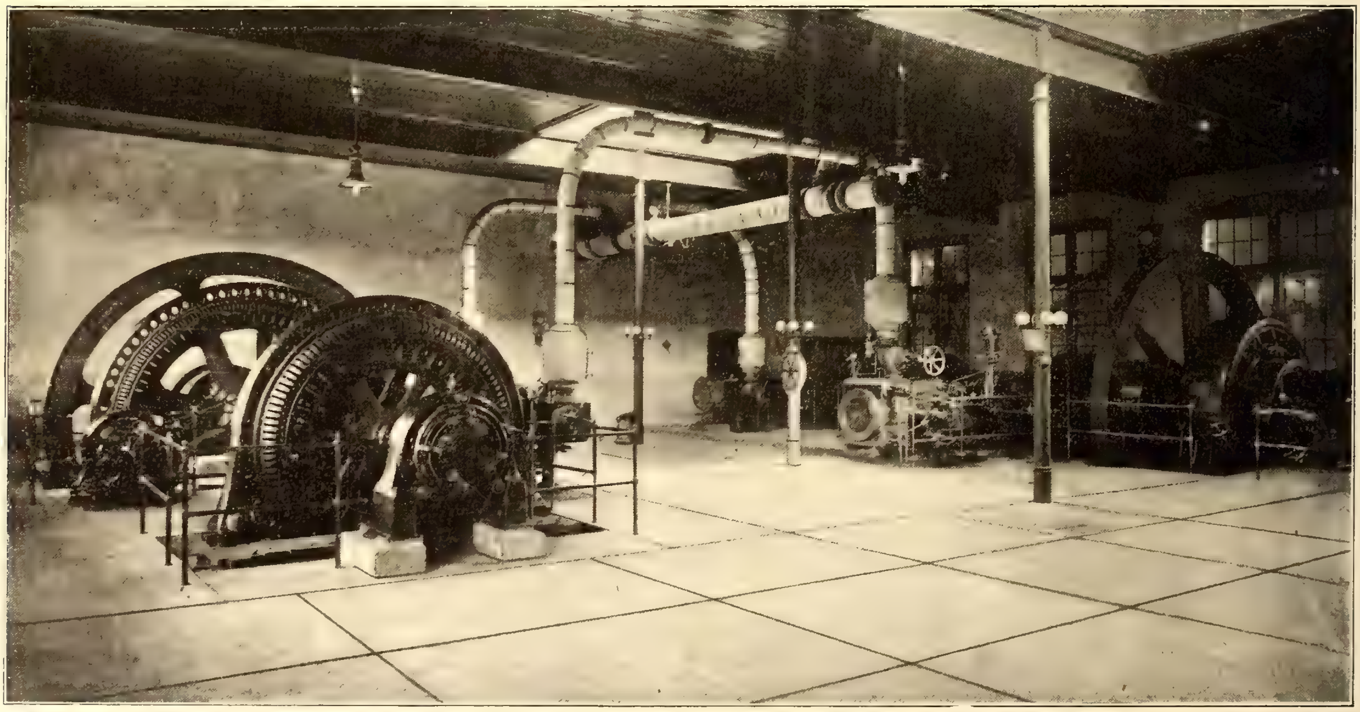
CROSS SECTION OF LAS VEGAS RAILWAY & POWER COMPANY'S POWER PLANT, SHOWING THE ARRANGEMENT OF BOILERS, STEAM AUXILIARIES, GENERATING MACHINERY AND SWITCHBOARD

two 60-cycle, 2200-volt, two-phase, revolving field Allis-Chalmers generators with a 22½-km, 125-volt, 525-r.-p.-m. exciter driven from the engine shaft by a Renold silent chain. The other set consists of a Buckeye simple 13-in. x 18-in. engine and a 125-kw Allis-Chalmers generator of the same type as the other, operating at 225 r. p. m. and having a 12-kw exciter direct-connected to the engine shaft.



THE LAS VEGAS SWITCHBOARD, ONE SECTION CONTROLLING THE DIRECT-CURRENT RAILWAY CIRCUITS, AND THE OTHER THE ONE AND TWO-PHASE LIGHT AND POWER CIRCUITS

For street railway service there is one Filer & Stowell heavy-duty, simple Corliss engine, size 24 ins. x 42 ins., operating at 100 r. p. m. in connection with a 400-kw, 550-volt, 100-r.-p.-m. Westinghouse d. c. generator, and also one 20-in. x 21-in. Buckeye engine operating at a speed of 200 r. p. m., connected to a 550-volt, 200 r.-p.-m. Sprague direct-current generator. As noted in the plan of the power house, space has been provided for two additional units, one for railway service and one for lighting service.



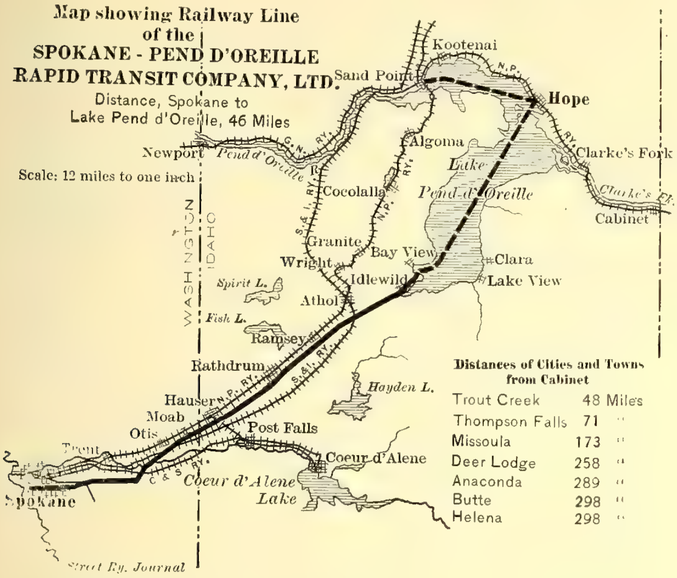
GENERAL VIEW OF THE INTERIOR OF THE LAS VEGAS POWER STATION, SHOWING THE ALTERNATING-CURRENT LIGHTING AND POWER GENERATORS IN THE FOREGROUND, AND THE DIRECT-CURRENT RAILWAY MACHINERY IN THE BACKGROUND

The switchboard has two sections, one for controlling the railway circuits and the other for the light and power wiring. Both parts are equipped with instruments made by the Wagner Electric Manufacturing Company, St. Louis, Mo., but the board was furnished and erected by the Frank Adam Electric Company, St. Louis, Mo. The light and power panel is arranged to control two-phase generators for single-phase distribution, there being four single-phase circuits. Each circuit is connected with a hand regulator controlling through a range of 15 per cent the light operated independently on each circuit. The company furnishes a twenty-four-hour service. All cables connecting the switchboard with the generators are insulated with rubber and lead sheathing and are run under the floor line through ducts between the switchboard and the dynamos. The board is also furnished with the necessary devices for synchronizing the alternating-current generators and for paralleling the direct-current dynamos.

The State Railroad Commission has issued a rule requiring that all electric cars on lines crossing steam roads at grade shall be stopped at such crossings not closer than 10 ft. to the steam road and not further away than 50 ft., and that some one in the employ of the road, the conductor if the car has one, shall go ahead and see that the track is clear and safe for the passage of the electric car. The utmost vigilance is required of the employee who undertakes this work that accidents may not occur. The car is in no case to proceed until signaled to do so by the person who has gone ahead and ascertained that the way is clear. A copy of the rule is to be posted up in each car.

THE SPOKANE-PEND D'OREILLE RAPID TRANSIT COMPANY

Probably no other section of the United States has been growing so rapidly in wealth and population as the territory popularly known as the "Great Northwest" or "Inland Empire." The latter title is well deserved, for it would be difficult to find elsewhere an area of equal extent possessing



ROUTE OF THE SPOKANE-PEND D'OREILLE LINE

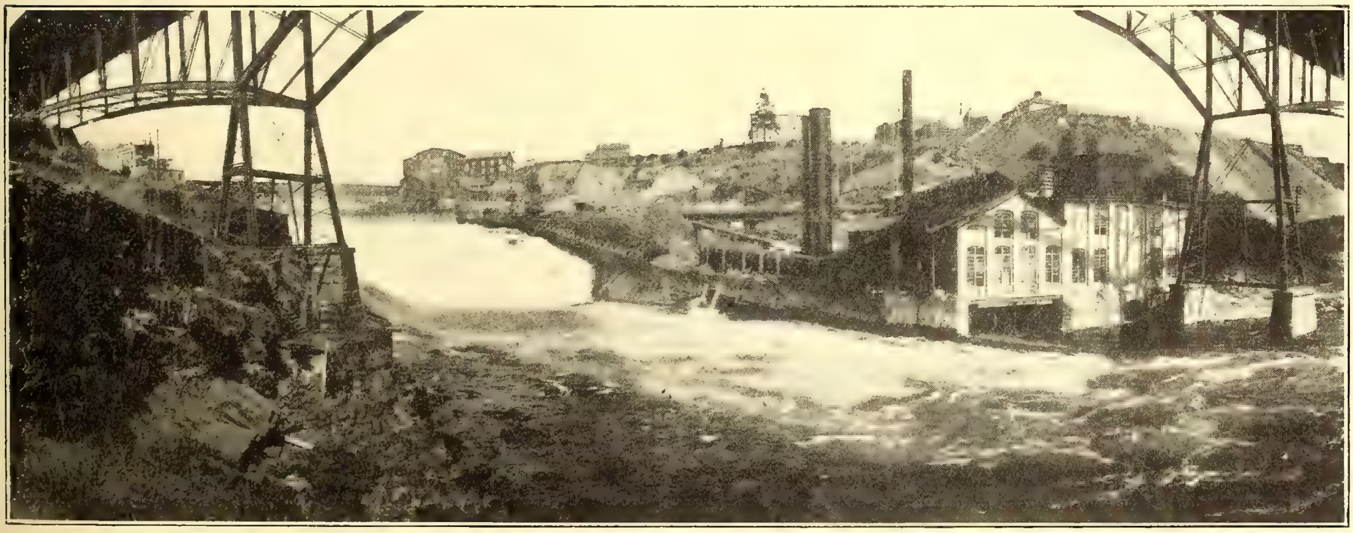
such varied resources in minerals, timber and agriculture. Within a 200-mile radius of Spokane are located the Coeur d'Alene silver and lead mines; the rich copper deposits in the Boundary and Roseland districts of British Columbia; the Palouse wheat and fruit belt, and the Big Bend country with its stock and agricultural regions. This territory is also believed to contain more timber than any other part of the country. To cap these advantages, Spokane, the center of all this promising development, has within its borders the famous falls of the Spokane River—the principal water power of the State. The city has grown in population from 36,800 in 1900 to 86,400 in 1906—an increase of over 134 per cent in six years.

The increase in the population and productions of the "Inland Empire" has long outstripped the facilities of the steam railroads serving it, thus opening up a promising field for electric railways. Among the projects now under way to give electric service to this territory that of the Spokane-Pend d'Oreille Rapid Transit Company, Ltd., may be taken as typical, on account of the length of the line to be built, the district it will serve and the character of the service.

The Spokane-Pend d'Oreille Rapid Transit Company's line, which is to be of the high-speed interurban type, is now under construction from Spokane through the irrigated Spokane Valley to Lake Pend d'Oreille, a large intermountain sea surrounded by the most tempting scenery. The Spokane Valley extends eastward from the city for a length of 46 miles and a width varying from 5 to 15 miles. Much of this valley is level as a floor, and with the tributary Spirit and Hoodoo valleys covers nearly 500 square miles. The Spokane River runs through this district for 35 miles.

Along the borders of this valley are nine mountain lakes most of which are popular summer camps for Spokane citizens. At present the only means of reaching these lakes is by vehicle from railroad stations several miles distant. Five of these lakes are now used as reservoirs for irrigating the Spokane Valley, and a further supply is to be taken from the Spokane River at Post Falls.

The total population along the new line comprises the 86,400 people at the Spokane terminal, the suburban population of 4800 tributary in Washington (taking only one-half of Green Acres), and the Idaho population of 10,200 around Lake Pend d'Oreille. The lake is at a convenient stage in the journey between Spokane and the thriving mountain towns of Montana whose close business connections with Spokane cause considerable railway travel. Among the towns within easy reach are Anaconda, Butte, Helena and Missoula. The population of the Montana copper district is now estimated to exceed 150,000. As the trip via boat and the electric railway will be 16 miles shorter than the steam railroad course around the north bend of the lake, it is believed that the electric railway will attract most of the Montana-Spokane travel. Pleasure riding is expected to prove quite a factor, as the lake is already renowned as an outing resort, while the trip through the orchards of the Spokane Valley ought to induce such travel on that portion of the line.



HYDRO-ELECTRIC PLANT OF THE WASHINGTON WATER-POWER COMPANY AT SPOKANE FALLS, SPOKANE

The Spokane-Pend d'Oreille Rapid Transit Company, Ltd., has now completed all preliminary work and surveys of definite location. Franchises have been secured in Spokane and Rathdrum—in the latter place for fifty years.

Practically all the right of way has been secured and property purchased for terminals in Spokane and on Lake Pend d'Oreille. Grading is under way for several miles and rails have already been laid in Spokane.

The total length of the route is 42 miles. Owing to the flat character of the Spokane Valley the cost of the grading including rock work, is estimated at the extremely low figure of $2,000 per mile. In all there are the following grades: One 300 ft. long, 3.5 per cent; one 1000 ft. long, 1.5 per cent; 1 per cent maximum in the valley in two or three places; 1.4 per cent maximum down to the lake. There are three 10-mile tangents and less than 3 per cent of the line has curves greater than 8 to 10 degs.

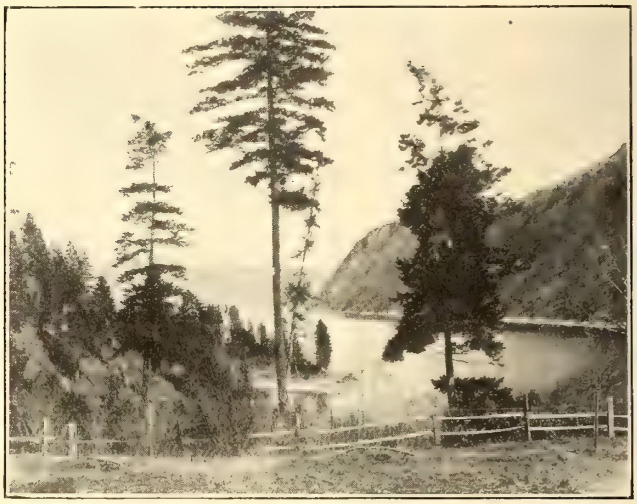
The track work will be of the usual interurban type, using a 70-lb. T-rail. At the great lake terminal the track will be arranged in herring-bone fashion, the sidings branching from a main track and with a circle around the freight house. Between sidings there will be a space of 22 ft. for teams and trackage for storage cars.

The Spokane terminal provides for a double-track loop; its area is 142 ft. x 200 ft. It is proposed to erect on this plot, which is within one block of the business center, an eight-story building for the offices, waiting rooms and special conveniences for patrons shopping in the city. The company has applied for a franchise covering a 2000-ft. loop around four blocks to secure abundant storage room.

Power is to be purchased from the Washington Water Power Company and transmitted at 3 phase, 60 cycles to three sub-stations. The price for the 2300-volt current delivered at the power company's switchboard in Post Falls, Idaho, will be $20 per annum calculated upon 75 per cent of the maximum amperes recorded at any time during each month. The present contract contemplates the use of about 1000 hp. The trolley line will be of catenary construction.

The rolling stock to be adopted is quite extensive both for passenger and freight service. There will be six seating 72 passengers and furnished with a 10-ft. baggage and a 12-ft. smoking compartment. These cars will be 60 ft. long, 8 ft. 3 ins. wide, 13 ft. 3 ins. high. They will be furnished with rattan seats. The ten trail cars are of the same dimensions but are upholstered in plush and have no compartments. For freight service there will be two express cars (with Westinghouse No. 121 motors) similar to those furnished by the J. G. Brill Company to the Washington Water Power Company. These will be 39 ft. 4 ins. long, 11 ft. 11 ins. high, with arched roof and hood covered with canvas. They will be furnished with an enclosed vestibule for the motorman. These cars will be used to haul twenty box cars and forty flat cars equipped with air brakes.

It is apparent from the foregoing statements with reference to terminal facilities and freight rolling stock that the company expects to do a large freight business. In fact, following the plan of the other Pacific Coast electric lines, special attention will be given to fruit and produce trade. The tonnage to Spokane from cordwood alone will be a heavy factor for the next ten or fifteen years, while the agricultural products must increase from year to year as the valley is developed further. Track connections for freight traffic are to be made with the Northern Pacific, the Canadian Pacific and the Union Pacific (the Oregon Railway & Navigation Company) systems.



ECHO BAY, AT THE SOUTH END OF LAKE PEND D'OREILLE

The officers of the Spokane-Pend d'Oreille Rapid Transit Company are: President, C. H. Reeves, partner of the Hercules mine in Cœur d'Alene, Idaho; first vice-president, J. J. Browne, president of the Cœur d'Alene Bank & Trust Company, the Columbia Valley Bank, of Wenatchee, Wash., and an officer of two other banks; second vice-president, D. K. McDonald, manager of the Oregon Mortgage Company, Portland, Ore.; treasurer, J. Grier Long, vice-president and manager of the Washington Trust Company, of Spokane; manager, R. A. Hutchinson, president of the Modern Irrigation Company; secretary, Mark F. Mendenhall, attorney and stockholder in the Spokane Canal Company.

A VIEW OF SQUAW BAY, LAKE PEND D'OREILLE, WHERE THE LARGE TERMINAL IS BEING LAID OUT

CORRESPONDENCE

ENTRANCE INTO BALTIMORE

Washington, Baltimore & Annapolis Electric Railway Company
Baltimore, Md., Jan. 21, 1907.

Editors Street Railway Journal:

In your issue of Jan. 12 you kindly refer to progress of the work on our line which is to connect the cities of Baltimore, Washington and Annapolis, but I wish to correct the statement in the last paragraph of the article which states that arrangements have been made for an entrance into Baltimore over the tracks of the United Railways & Electric Company. The Baltimore Terminal Company, which is owned by the Washington, Baltimore & Annapolis Electric Railway Company, has an independent franchise and entrance into the heart of the city of Baltimore and is not dependent for it upon the United Railways & Electric Company. With the exception of the latter company, ours is the only one having similar rights in the city of Baltimore.

George T. Bishop, President.

ANNUAL CONVENTION OF THE INDIANA ENGINEERING SOCIETY

The twenty-seventh annual convention of the Indiana Engineering Society was held in the Commercial Club rooms, Indianapolis, Jan. 17, 18 and 19. The meeting was well attended, there being 122 of the 165 active members present. Much interest was shown during all the sessions of the convention. C. C. Brown, secretary of the society, made a very encouraging report, showing the society to be in a most prosperous condition and that the membership had increased materially during the past year.

Robert P. Woods, president of the association, delivered his annual address, in which he congratulated the society upon the good showing, progress and growth, increased interest and results, and then presented the interesting paper on "Engineering of Interurban Railway Construction," published elsewhere in this issue. Mr. Woods' paper was highly commended in the discussion that followed.

The report of the committee on electric railroads was presented by J. P. Moore, chairman. The report stated that very few people realized the rapid development that was being made in electric railroads in Indiana. There are now 1650 miles in operation, 273.95 miles were constructed during the past year, and 533.33 miles are now under construction, while 573 miles are projected. The report set out the companies, number of miles of each line, and named the principal cities connected and to be connected; also dealt in figures relative to expenditures and earnings. The report aroused hearty applause and astonished many of the engineers present.

"Paving Between Street Car Tracks" was the subject assigned to B. J. T. Jeup, who described in a very interesting manner what he considered the best pavement for street car tracks. He exhibited drawings and material to illustrate his talk, declaring that his experience convinced him that with the advent of the heavy interurban cars the T-rail was the best, and concrete foundation and brick for paving between the rails the most durable and satisfactory roadbed for many reasons, principally because they were easily removed to make repairs on the rails, replace ties, etc. He said neither wooden blocks nor asphalt was as durable nor as easily and cheaply repaired as brick pavement between the track. Mr. Jeup exhibited a grooved brick to be placed next to the rail to admit the deep flanges of interurban cars. Mr. Jeup's paper brought out quite a discussion, which left the impression that there was considerable difference of opinion as to the best between-rail paving material.

"The Work of the Railroad Commission" was presented by Union B. Hunt, president of the commission. Mr. Hunt addressed the meeting at length and earnestly advocated the necessity for certain changes in the law limiting the power of the commission. He related what the commission had accomplished by persuasion because it lacked the power to compel or penalize railroad companies for their wrongdoing. He said the commission was asking the Legislature to give it power to regulate and adjust crossings of steam and interurban line tracks, to compel the use of safety devices at crossings and otherwise to assume jurisdiction of all railroads for the betterment and safety of life and limb. "We are asking the Legislature to give us power to require the railroads of the State to report any accident within five days after its occurrence, that the commission may determine its cause, and if possible to provide a preventative against a similar accident in future. We are asking for power to appoint inspectors to keep the commission advised as to whether the railroads of the State are maintaining their roadbeds and equipment in proper condition and repair for the security of the employees and the public, and the providing of adequate stations, properly lighted and heated and in sanitary condition." Mr. Hunt also said that the commission was asking for power to deal more effectively with railroads that suffer blockades or refuse to furnish cars to shippers and to compel the moving of freight at least 50 miles per day.

"Track Elevation Plans for Indianapolis" was presented by Mr. Jeup and Mr. Stearns. They described in an interesting way what had been accomplished, and gave interesting account of the engineering features of the work. An astonishing revelation was brought out in the fact that in the work thus far completed the elevation over the streets was not high enough to admit interurban cars several of the new roads are now building.

The report of the committee on materials of construction and paper on "Unit Stresses for Designing Timber Structure," by Prof. Hatt, of Purdue University, were listened to with interest and profit.

Prof. Plumb, of Purdue University, read an interesting paper on "Electric Car Braking." This paper was illustrated with stereopticon views and proved to be an instructive and technical illustration of the principles of effective car braking. Prof. Plumb said he did not expect to present anything new, but to explain the best he could the improvements made and the results obtained by the use of the best type of brakes now in use.

An enjoyable banquet was held on Thursday evening at the Denison House, and 122 members participated in the feast of viands and flow of oratory. Prof. W. K. Hatt, of Purdue University, was elected president; Daniel Luten, of Indianapolis, vice-president, and C. C. Brown, re-elected secretary.

It is announced that the steel cars for the Hudson Companies' tunnels will contain a number of novel features. Posts extending from floor to roof will be used instead of straps and the cars will have double doors at the center as well as end doors. The center doors will be operated pneumatically. The floors will be of cement in which will be embedded carborundum to prevent slipping. The station at Cortlandt Street will contain five tracks and separate platforms will be used for receiving and discharging passengers.

STANDARD RAIL SECTIONS FOR PAVED STREETS*

BY C. GORDON REEL,
Vice-President and General Manager, Kingston Consolidated Railroad Co.

Before enumerating the many advantages of standard rail sections for paved city streets it will be instructive to consider for a moment the history of the so-called girder rail, which, by the way, is now happily obsolescent.

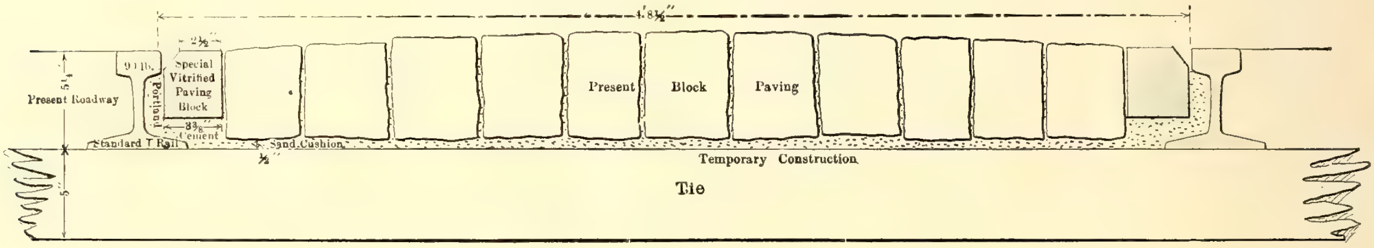
In the horse-car days strap rails were used and were spiked directly to wooden stringers, these in turn being carried on cross-ties. The shape of the strap rail then used was very similar to the top of the girder rail, and inasmuch as this strap was supported throughout its entire width the design did not violate any fundamental principle of mechanics. These principles were immediately violated, however, when the web and base were added to the strap rail, thus producing the girder rail, because the web was placed beneath the middle of the top, which brought it directly under the gage line. The general result is that these rails have the following bad features:

1. By reason of the unscientific arrangement of the metal in the rail section the head is shallow, resulting in short life, and the flangeway is necessarily shallow, which is very objectionable as regards the operation of interurban cars; furthermore, the projecting wagon tread makes the rail difficult to spike. It is safe to assume that fully 50 per cent more metal is required in such a section than is required in a standard section for a rail of equal carrying power and life.

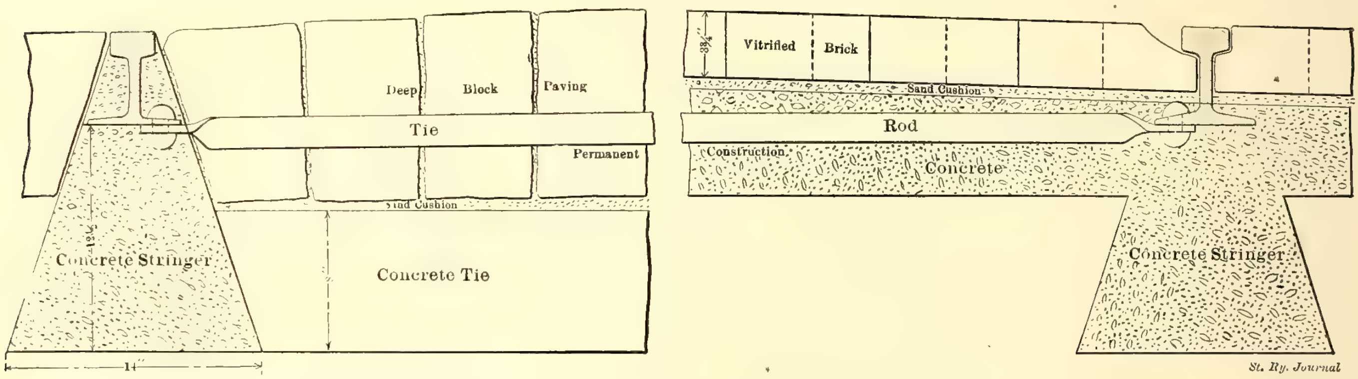
2. As the web is at one side of the head the weight is carried on a sort of projecting cantilever, which results in an absolute inability to maintain joints. There is not a railroad man here who does not know that it is impossible to hold girder rail joints, however heavy the rails may be, or however elaborate the system of splice bars and bolts. Every large city system which has used heavy girder rail has demonstrated this fact beyond the possibility of contradiction.

3. The wheel load being carried over to one side of the web causes the rail to tend to move out from the center of the track when the load is on it. The only way this tendency can be overcome is to use numerous tie rods and thus hold the rail bodily from moving sideways. Correct engineering would require a section with no such tendency to lateral movement. The effect of this lateral movement is that the tracks get wide to gage and the pavement is loosened up generally.

4. When a heavy wheel load is impressed upon the head of a girder rail there is an inevitable bending moment which must be overcome in the structure of the web. No amount of tie rods can prevent this stress in the web, and in fact the greater the number of tie rods the weaker the web becomes, and just where it should be strongest. Similarly, when a heavy truck wheel bears down on the end of the projecting flangeway the bending moment is in the opposite direction. Where traffic is heavy these alternate stresses have so "fatigued" the metal that longitudinal cracks have appeared along the middle of the web.



PROPOSED TRACK CONSTRUCTION WITH 90-LB. A. S. C. E. RAIL, AND PRESENT PAVING BLOCK IN KINGSTON



PROPOSED TRACK CONSTRUCTION WITH 90-LB. A. S. C. E. RAIL WITH 10½-IN. PAVING BLOCK AND VITRIFIED BRICK, IN KINGSTON

ADVANTAGES OF T-RAIL SECTIONS

All of the foregoing difficulties evaporate into thin air upon the introduction of T-rail sections. The advantages of using T-rails are without number. The T-rail is simply the substitution of a correct design for an incorrect design, an intelligent section for a clumsy section which can only carry present wheel loads when weights per yard run up to almost 150 lbs., whereas the very heaviest steam railroad equipment is easily carried on standard rail sections weighing less than 100 lbs. to the yard. A few of the principal advantages of the T-rail might be summarized as follows:

1. Its symmetrical section, the load coming directly over the center of the rail; its full deep head, insuring long life, and the unlimited flangeway; also the fact that it is easily spiked to the ties.

2. The long angle-bar joint with T-rail sections is practically perfect.

3. The load being symmetrical there is no tendency for

* Paper presented at quarterly meeting at Buffalo of New York State Street Railway Association, Jan. 11, 1907.

the tracks to get wide to gage or to move around in the street, and therefore no tendency for the pavement to become loose along the tracks. It is clear that the construction which requires least repairs is best for the company as well as the community which it serves.

4. The flangeway being gritty a vehicle turns out of the tracks with the greatest ease.

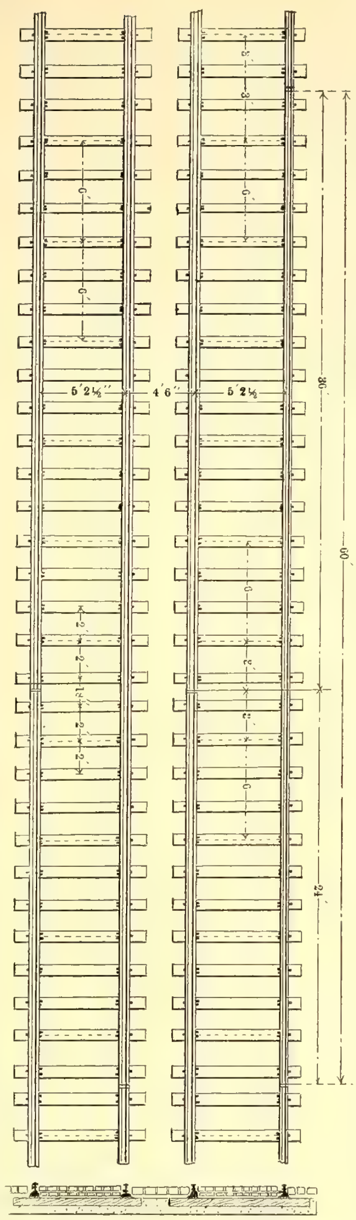
5. T-rail tracks are less noisy. In Montreal the residents have insisted on T-rail for this reason.

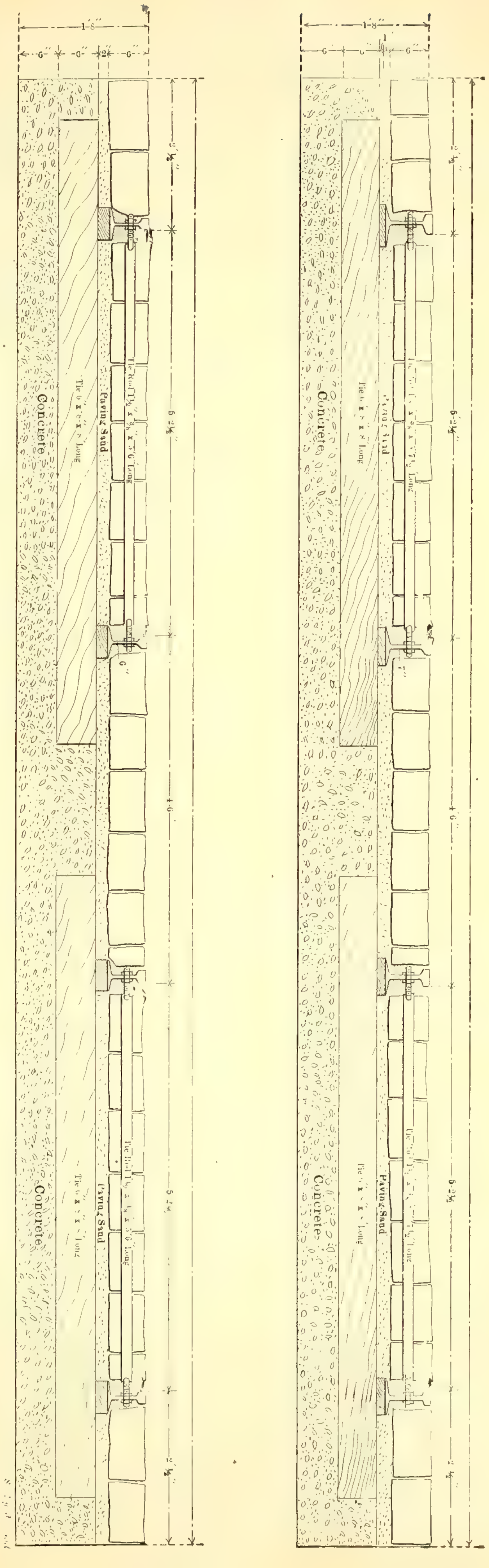
From the foregoing it is evident that there can be no question as to the great advantage of T-rails over girder rails. We will now consider for a moment the still further advantages which the standard rail sections possess over the high T sections:

1. The standard sections are more substantial in every way. They have a larger head, a thicker web and a wider base; and as has been demonstrated by years of service, they realize the maximum efficiency in rail design.

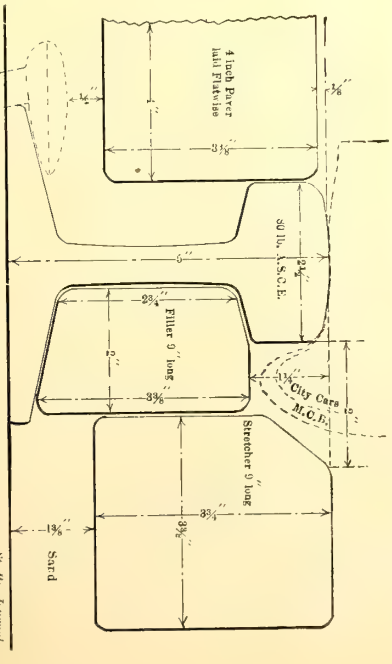
2. The all-important question of joints; for, after all, the life of any construction in a street is measured by the life of the joints and is solved to the best advantage with the standard sections.

3. Some city engineers, while approving the high T sections, have objected to the standard sections on the theory that these latter are not sufficiently deep for paving, but, as we all know, there is nothing in this objection, because there is no reason why the pavement cannot extend down below the base of the rail. We are all familiar with such construction, it is standard in many cities where deep block pavement is used. With brick or asphalt pavement of course, the objec-





SECTIONS AND PLAN OF STANDARD 6-IN. AND 7-IN. T-RAIL TRACK CONSTRUCTION, CINCINNATI TRACTION COMPANY

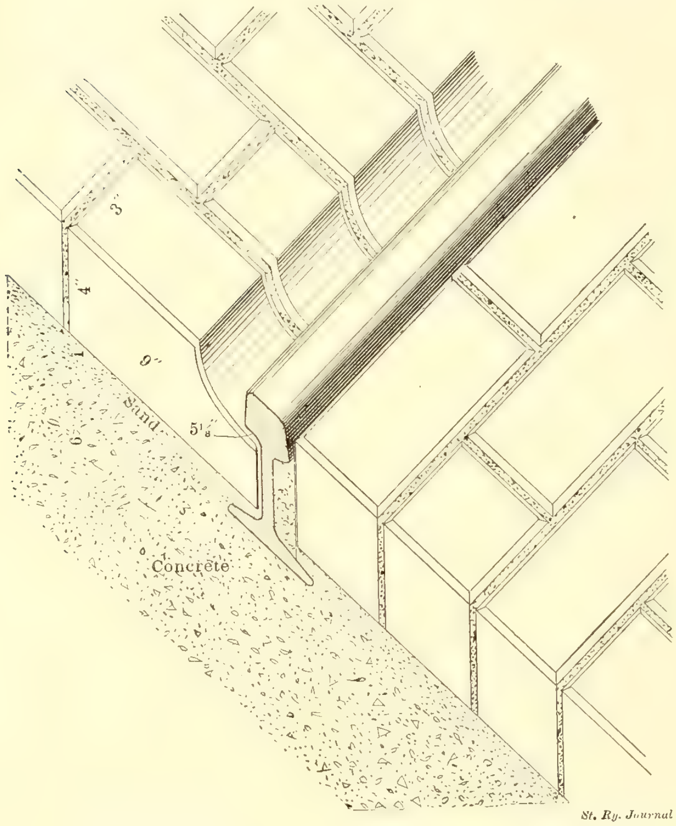


SECTION OF SPECIAL FILLER AND STRETCHER BRICK FOR 80-LB. RAIL AND 4-IN. PAVING, CINCINNATI NORTHERN TRACTION COMPANY

tion with reference to insufficient height cannot be raised.

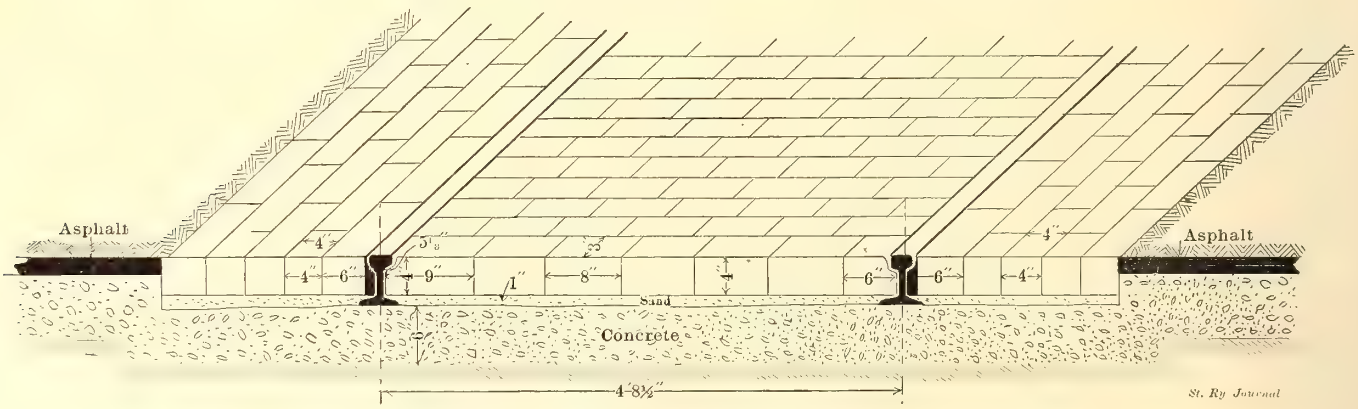
4. The standard sections not being so slim and topheavy have a way of staying where they are put to a much greater extent than the high T's.

5. From the standpoint of economy—since the mills are able to produce standard T sections at a considerably less cost per ton than the high T sections in a ratio of 28 to 36



SECTION SHOWING T-RAIL AND SCORIA BLOCK CONSTRUCTION IN MONTREAL

we are enabled to buy a 90-lb. standard section for the same price as a 70-lb. high T section, and by using the standard section get a track which will outlive the high T twice



ISOMETRIC DRAWING, SHOWING T-RAIL CONSTRUCTION IN MONTREAL

over. If we now assume that a 90-lb. T-rail is equivalent to a girder rail of 50 per cent more weight (which assumption is by no means extravagant when we consider the question of eccentric loading as compared with symmetrical loading, and the impossibility of maintaining the joints of girder rails as compared with the practically perfect joint of the standard rail) and then apply the ratio of cost per ton, we find that a better result is obtained with a standard section than with a girder section costing something like 93 per cent more than the standard. This money might better be spent some other way than literally sunk in the ground.

When a company proposes to lay T-rail to replace girder it is apt to meet with some opposition on the theory that ruts will wear along the rails. This objection seems reasonable on the face of it, but the fact is that in spite of all predictions of ruts they fail to appear. There seems to be no greater tendency for a rut to form along the rail than along the outside edges of a girder rail.

The best argument in favor of T-rail construction is that there is not a single instance on record, when it has been properly laid, that it has not proven satisfactory to the city authorities. On the contrary, wherever tried it has been adopted, as the accompanying letters from city engineers of large cities and other authorities throughout the country prove.

DATA RELATIVE TO T-RAIL CONSTRUCTION

Amsterdam, N. Y.: F. E. Crane, city engineer, under date of June 29, 1906, says: "We have in this city brick block pavement laid along 70-lb. T-rail. This pavement is laid on a concrete foundation with a thin layer of sand. It has been laid since 1900 and is on the street of our heaviest traffic. This pavement shows no tendency to wear in ruts.

Battle Creek, Mich.: E. N. Hunt, city engineer, under date of April 23, 1906, states that most of the track in that city is 7-in. T, although they have considerable 6-in. T. In Mr. Hunt's opinion rails should be at least 5 ins. high.

Brooklyn, N. Y.: J. F. Calderwood, vice-president and general manager of the Brooklyn Rapid Transit Company, under date of May 1, 1906, says that while they have no T-rail construction in his system, there is no serious objection to the use of T-rail in paved streets, since it is much easier to maintain. He says high T-rail is very objectionable in that it is very high compared with the base, therefore the track easily gets out of gage, and there is no reason for making a high T-rail because the ordinary 80 lb. or 90-lb. rail is of ample depth.

Brunswick, Me.: E. D. Reed, engineer of the Lewiston, Brunswick & Bath Street Railway Company, under date of April 30, 1906, says that where Belgian block pavement is required he would lay T-rail in a concrete stringer 14 ins. deep and 12 ins. wide, holding the rail to gage every 5 ft. with tie straps.

Buffalo, N. Y.: T. W. Wilson, general manager of the International Traction Company, under date of April 10, 1906, says that T-rail is used exclusively in several Western States, prominent among which is Milwaukee, where the municipal authorities will not permit anything but T-rail to be laid.

Cincinnati, Ohio: In Cincinnati a 6-in. and also a 7-in.

T-rail are laid on blocks which rest on sawed ties spaced 3 ft. centers and laid in concrete. This construction is used with ordinary block paving and the paving blocks go down below the level of the base of the rail.

The Cincinnati Northern Traction Company uses a standard 80-lb. T-rail laid on ties and paved against with vitrified brick, a filler brick being used next to the web of the rail.

Dayton, Ohio: Robert E. Kline, city civil engineer, under date of Nov. 12, 1906, says: In the past five years T-rail has been adopted and used on all track construction where street paving is contemplated or used in this city. The construction of same has been found to be satisfactory in every respect.

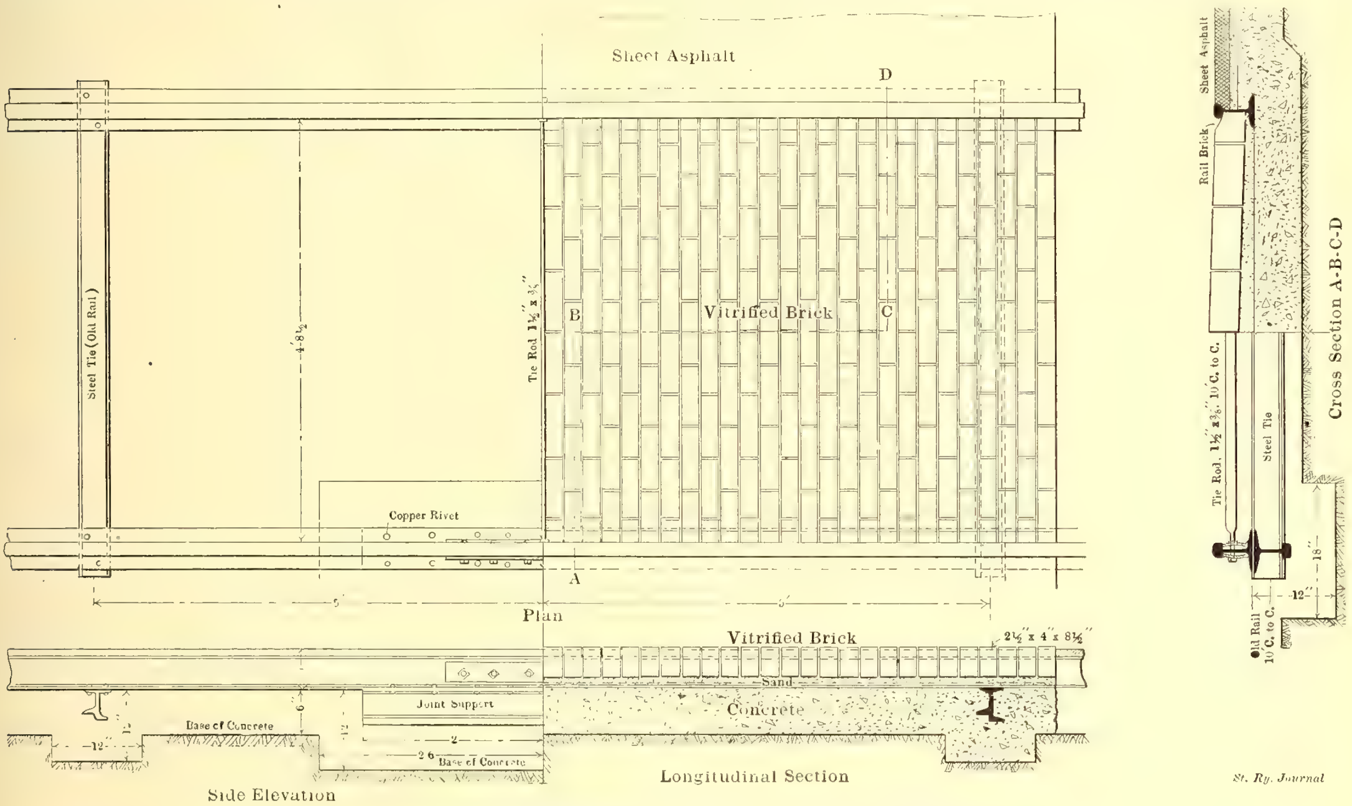
Davenport, Iowa: The ordinances prevented the use of T-rail, but the street railway company obtained permission from the City Council to lay 800 ft. of double track with T-rail in paved streets, choosing the location where traffic was heaviest. After this trial section of track had been in use for a few months, and after frequent inspections had been made by the members of the Council, permission was granted to use T-rail in all of the new track work in Davenport. (STREET RAILWAY JOURNAL, Jan. 5, 1907, page 5.)

Delaware, Ohio: J. S. Dike, city engineer, under date of May 10, 1906, says that they use a 4-in. T-rail raised on a 1-in. block, and special paving block made by the Nelsonville Sewer Pipe Company to form the necessary flangeway, with a special filler brick next to the web of the rail. He expresses himself as greatly pleased with this style of paving, and says: "We like this construction better than grooved rail and have never had any trouble except with a car or two which had a very narrow tread which broke a few of the stretcher brick."

Denver, Col.: John A. Beeler, vice-president and general manager of the Denver Tramway Company, under date of May 10, 1906, says that he uses a 6-in., 72-lb. T-rail laid in concrete which is standard in all paved streets. The rail is in 60-ft. lengths and laid on ties 24 in. centers and ballasted in gravel to a depth of 8 ins. below the ties. A double row of toothing blocks is used on the outside of the rail of each track, and on the inside a single row of beveled blocks going under the ball of the rail. This construction is found to stand the wear and tear of street traffic and the practice of washing the streets has no effect upon the pavement. The above blocks are made from basalt trap rock 5 ins. in height. I quote from his letter: "We do not favor the 7-in., 70-lb. rail, as it is too light in flange and web and does not hold its line well."

Erie, Pa.: B. E. Briggs, city engineer, under date of Dec. 28, 1906, says that he recommended 80-lb. T-rail seven or eight years ago. Although the adoption of the T-rail was opposed by some of the older heads of the city it has proven and is now acknowledged by all to be entirely satisfactory. Mr. Briggs explains that there are strong arguments in favor of T-rail as used from the standpoint of the street car systems which, however, he had not considered in the foregoing.

Glens Falls, N. Y.: D. E. Van Wirt, chief engineer of the Hudson Valley Railway Company, under date of April 11, 1906, says: "As you are aware, nearly three years ago we paved in Sandy Hill against a 5-in. T-rail, using A. S. C. E. section standard T-rail. At that time I designed a special rail block for the work. We have found it very satisfactory from an operating standpoint, giving us ample room for the various flanges we have been running over our road, and also that it affords vehicles a much better crossing than the girder rail commonly used in paving. The only opinion I have ever heard of this work from residents of Sandy Hill has been favorable."



T-RAIL CONSTRUCTION FOR PAVED STREETS IN SCRANTON

Hamilton, Ohio: E. H. Berry, engineer of roadways, of Cincinnati, under date of May 3, 1906, says that several miles of standard A. S. C. E. rail have been laid in Hamilton with good results.

Indianapolis, Ind.: Blaine H. Miller, city engineer, under date of April 17, 1906, states that when the new franchise was made with the Indianapolis Traction and Terminal Company, of that city, tests were made to ascertain which rail was best for all purposes. The result of the test was that the 90-lb. T-rail combined the good qualities of the old grooved and girder rails. These rails were not used except in unpaved streets for some time after the new rail was adopted, but now the use of special grooved vitrified brick has made it possible to use heavy 90-lb. T-rail in permanently improved streets with quite a saving in repairs, especially since the heavier interurban cars have entered the city. This rail is being substituted for the old grooved and girder rails, and is a vast improvement in every respect.

Kansas City, Mo.: The STREET RAILWAY JOURNAL under date of Dec. 9, 1905, says: "The Kansas City Railway & Light Company has adopted 80-lb. standard A. S. C. E. section

T-rail for brick paved streets, and is using that rail on track laid in such streets this year. No more girder rail will be used in the city. A special shape of brick is used for the flangeway. The track is laid on broken stones with concrete around, but not under the ties. The paving brick is laid directly in the concrete without any sand cushion."

Kingston, N. Y.: At a hearing on Mr. Chamberlain's bill No. 1653 E. B. Codwise, city engineer of Kingston, N. Y., spoke as follows: "In the matter of T-rails for railroads, there are things to be said in favor and against them. If T-rail is high enough I do not see any great objection to using it, because it can be paved against. My objection would be to a low T-rail."

Mauch Chunk, Pa.: Franz Mackl, city engineer, under date of May 16, 1906, says they use 70-lb. standard T-rail, paving inside with special beveled bricks in streets paved with Warren bithulithic paving block.

Memphis, Tenn.: J. A. Omberg, city engineer, under date of May 2, 1906, says: "It is my opinion that you can use your 90-lb. T-rail with the special blocks you mention and get very satisfactory results. I am sure that the construction you would get in this way would be greatly better than the old-fashioned tram rail."

Milwaukee, Wis.: C. J. Poetsch, city engineer, under date of April 16, says: "We use T-rail on all streets."

Minneapolis, Minn.: Andrew Rinker, city engineer, under date of April 16, 1906, says: "The street railway company of this city now uses T-rail exclusively. It is the best rail for the purpose and the public interests are better subserved by its use." In a general statement Mr. Rinker has the following to say: "The latest type of rail used is the T-rail weighing 80 lbs. to the yard. These rails are spiked to wooden ties bedded in concrete. The rail is a continuous one with cast joints. This makes a very rigid and substantial rail, and as far as our experience goes is perfectly satisfactory. We find that T-rail is not objectionable to the public travel, as the street railway company paves generally with granite close to the rail on the inside and we lay our pavement in contact with the rails on the outside. The general supposition here is that in order to give good service for rapid transit to the much larger percentage of the public that such construction is advisable. While our method of construction does not prevent teams from crossing the tracks or even following the tracks lengthwise, we believe that it is better policy to permit the railway company to use the space occupied by them (15 ft. in width for double tracks) unhampered by teams, and that the millions of people who are carried annually by the street railway lines get better service than they would if the teamsters were permited to use the rails and obstruct the street railway travel to th extent that they usually do where flange rails are laid."

Montreal, Canada: John R. Barlo , city surveyor, under date of April 25, 1906, states that by the use of T-rail properly paved the vibration is considerably reduced and cars run much more smoothly than otherwise. The rail used is 86-lb. standard railroad rail. This rail is 5⅛ ins. high and is laid on a bed of concrete without ties.

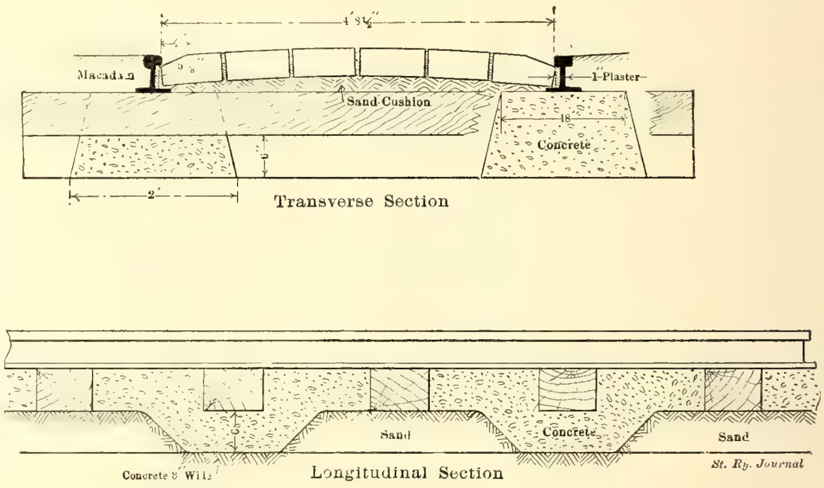
New Haven, Conn.: Calvert Townley, first vice-president of the Consolidated Railway Company, under date of April 17, 1906, says: "We have T-rail on the greater part of our tracks and use it exclusively for new work all over Connecticut except in the city of Hartford, where an old contract between the city and a previous management obliges the railroad company to use a different type. We hope to convince the city authorities of the advantages of T-rail, which the State Railroad Commissioners have indorsed, and thus secure a modification to the contract."

Ottawa, Canada: Newton J. Ker, city engineer, under date of May 14, 1906, says they use a 7-in., 80-lb. T-rail laid on ties 8 ft. centers without tie-rods, and use Nepean sandstone blocks for paving, running grout in and around the same. These blocks are 5 ins. deep and raised on a 6-in. bed of concrete with a 1-in. sand cushion intervening.

Under date of May 10, 1906, Mr. Ker states that all of their tracks are laid with T-rail. "In recent years the old rails have been replaced with the 90-lb. standard T-rail in 62-ft. and 64-ft. lengths, and have proved very satisfactory. Wherever we lay permanent pavements these rails are laid on 6 ins. of concrete. The ties spiked 8 ft. apart and embedded in concrete. The paving blocks are specially cut to fit under the rail and to allow the flange of the wheel to run freely."

Rochester, N. Y.: Richard E. Danforth, general manager of the Rochester Railway Company, under date of April 9, 1906, says: "I fought this question to a finish with the Common Council of the city of Sandusky, at the time we were obtaining a renewal of franchise, and the Council finally specified standard T-rail, weighing not less than 70 lbs. to the yard, as the rail to be thereafter laid in all the streets of the city."

Under date of April 14, 1906, Mr. Danforth says: "In reply to your favor of the 12th, would say that I am pleased to note that your city engineer is coming around to feel more favorably inclined toward the use of T-rail. He is mistaken if he thinks that a standard American Society T-rail cannot be used with brick pavement to the satisfaction of the people. Everything depends, in this regard, upon the kind of work done. As I told you the other day, I put in T-rail in the city of Sandusky, Ohio, after having persuaded the Common Council to specify in our franchise that standard American Society T-rail should be used. In a letter received recently



LONGITUDINAL AND CROSS-SECTION OF T-RAIL CONSTRUCTION, WITH SPECIAL PAVING BRICK, IN UNION AVENUE, SCHENECTADY

from the general manager of the Lake Shore Electric Railway, F. J. Stout, he refers to the work in Sandusky, and states that it is in perfect condition. He says that recently he attempted to lay some girder rail which he has had in stock for the past five years, and the city authorities stopped him. They would have none of it, and he was obliged to buy T-rail for the purpose. The height of the rail necessary to be used in paved streets depends upon the character of the pavement, and where standard forms of vitrified brick are used a 5-in. rail will be found to give perfect satisfaction. It is a mistake to use—in paving around tracks—a sand cushion under brick pavement over three-quarters of an inch deep, and I have found that a cushion of one-half inch is sufficient. I would recommend that a brick abutting rail on either side be set in Portland cement mortar, and that if possible a special header brick be used on gage side. In cities where tram-head girder rail is commonly used, the people will be perfectly satisfied with T construction in brick or stone pavement, if the brick on the gage side is depressed so that the top of the brick goes under the head of the rail and the brick at gage line is connected so that the center is about on a level with the rail. This is the practice now followed in the city of Milwaukee, where they are now engaged in removing a considerable quantity of tram-head girder rail laid a great many years ago, and installing in its place T-rail of the same height. They have been using T-rail in Milwaukee for quite a number of years, and adopted it as a standard rail, I believe, about eight years ago. Rather than give in on the point made by the city

engineer; you would be justified in paying his expenses to Grand Rapids, or even to Indianapolis or Minneapolis, to talk with the local authorities."

Schenectady, N. Y.: J. Leland Fitzgerald, city engineer, under date of April 16, 1906, approves of T-rail for the following reasons: "With the modern smooth pavement the tendency of traffic is to avoid the use of the railroad tracks on account of the greater speed and frequency of the cars, and there is no advantage from easier traction for this reason, there is no use for the iron wheel tread for vehicles. We also had much difficulty in paving under the wide flange of the girder rail, as there was a space that could not be properly filled, but paving against T-rail with the molded brick makes possible a solid construction throughout. There appears to be no excessive wear on the brick at the point of contact. Mr. Peck, general manager of the Schenectady Railway Company, now has about 500 ft. of experimental track in which he uses standard 85-lb. rail."

Schenectady: B. Penoyer, engineer maintenance of way of the Schenectady Railway Company, under date of April 25, 1906, writes: "We are sending you herewith plan showing our T-rail construction with special paving brick. This section of track was laid in October, 1905, in Union and Wendall Avenues; length, 560 ft."

Scranton, Pa.: Henry Jifkins, chief engineer of the city of Scranton, under date of April 23, 1906, writes: "Mr. Codwise is not quite correct in saying that 'Nothing but girder rail is used in the central part of Scranton.' While a good deal is used, it is old, but has not yet outlived its usefulness. When that time arrives it will be relaid, but its place will be taken by T-rail. Furthermore, a ride of two minutes in most any direction from the central city will bring you to the T-rail construction. We do advocate and have adopted the 7-in. high T-rail, but we have many miles of 5-in. and 6-in. T-rail, and I have no hesitation in saying that a 5⅜-in., 90-lb. rail, properly laid and with a properly beveled brick between the rails to form a sufficient groove for the wheel flanges, is infinitely superior to any girder rail and almost practically as good as high T."

St. Paul, Minn.: L. W. Rundlett, engineer of public works, under date of April 28, 1906, states that T-rail is used exclusively in St. Paul on paved streets, the street car company paving with granite between their tracks, having a special cut block with a groove for the flange. These blocks are set on a concrete foundation. Mr. Rundlett states that, in his opinion, they have better track construction in St. Paul than in any city he has visited.

Tacoma: Frank L. Davis, city engineer, under date of May 1, 1906, says: "Our street car company uses 6-in. T-rail on all paved streets. We use no girder rail. So far as I know rails are similar to rails used on railroads and, of course, all right. We find them satisfactory. All rails recently laid are 60 ft. in length."

Toledo, Ohio: F. J. Consaul, city engineer, under date of April 16, 1906, says: "I believe heavy T-rail construction with special rail blocks properly fitted superior to girder rails." Under date of April 18 Mr. Consaul says: "For many years we thought that the girder rail or flange rail, as it is sometimes called, a better construction for paved streets on account of being better adapted to make good joints with the pavement. However, with the special rail blocks that are now made this objection is eliminated. I consider the heavy T-rail the better construction, as it is more desirable and rigid than the girder, thus causing less frequent tearing up of the pavement to make repairs."

Article from STREET RAILWAY JOURNAL of April 21, 1906:

"The development of interurban roads has called renewed attention to the desirability of the use of T-rails in paved streets. In response to a recent request for information, B. V. Swenson, secretary of the American Street & Interurban Railway Association, prepared a short report on this subject. Some of the reasons why T-rails are superior to girder rails in paved streets are given in the report as follows: (1) The paving can be maintained in far better condition with T-rail than with girder rail. (2) The wear on the paving is reduced, owing to the fact that the vehicular traffic will distribute itself over a larger surface of the street instead of attempting to make use of the area adjoining the electric railway tracks. (3) As vehicles will not make so general use of tracks laid with T-rail, the number of accidents due to collision of cars and other vehicles is materially reduced. (4) With T-rails there will be a material reduction of broken wheels and axles on wagons and other vehicles, due to the wrenching of wheels by reason of the groove in grooved girder rails. (5) T-rails have all the advantages of grooved rails, with none of their disadvantages. (6) The T sections give a stronger structure with less metal than the girder sections. This is an important feature in eliminating, in so far as possible, a foreign element in the make-up or construction of the pavement. (7) The joint troubles are materially reduced by reason of the physical construction and form of T-rails as compared with girder rails. Hence T-rails give an easier riding track and insures greater comfort to the passengers than when the cars are run upon girder rails. (8) Actual experiments have demonstrated that cars passing over T-rails do not make nearly as much noise as when passing over girder rails, and T-rail construction will therefore reduce the noise incident to electric railway operation. (9) The T-rail entirely eliminates the delays and annoyance caused by snow, ice and dirt filling the grooves of girder rails. T-rail construction will, therefore, facilitate car movements and permit a more regular service. (10) It is the recognized law of economics that that which accomplishes the same result for less capital, outlay or investment reacts to the general good, weal and welfare of the people or public as a whole.

"After stating that these arguments had been suggested by W. E. Harrington, of J. G. White & Company, the report refers to the benefits to villages and cities afforded by modern electric interurban railways, and the necessity of providing a rail on which they can enter the terminal cities. In the present stage of the art, nothing will accommodate satisfactorily the wide tread and deeper flange of wheel required by these cars except a T-rail section. A refusal to permit T-rail to be laid in city streets, therefore, will act as a direct obstacle to electric railway development and consequently as a serious check to the progress and welfare of the community. Examples of communities, among many in which T-rail has been laid and is now in use with the entire sanction and approval and to the satisfaction of municipal authorities, the public and the railway companies, are the following: Milwaukee, Minneapolis, Denver, Indianapolis, Cincinnati, Dubuque, Ia.; Battle Creek, Kalamazoo, New Haven, and Montreal, Canada. As indicating the general trend of opinion in this direction, it may be stated that a considerable stretch of T-rail for electric railway operation is now being laid on Boylston Street in Boston."

Prof. B. V. Swenson, secretary and treasurer of the American Street and Interurban Railway Association, under date of May 3, 1906, says:

"The easier and more comfortable riding in cars which are operated upon T-rails than when the cars are run upon girder rails. The public does not seem to recognize the fact that in any form of girder rails one side of the rail (that side opposite the tram or groove) is virtually in all respects a T-rail. The public is therefore familiar with at least half a T-rail in all girder-rail construction. Under the recognized law of economics that which accomplishes the same result or gives better results for less capital, outlay or investment, reacts to the general good, weal and welfare of the people or public as a whole."

In addition to the foregoing, I wish to quote from President Ely's annual address at the Philadelphia convention, as follows:

"The experience of the steam railroads with double and single-track construction is being repeated by the electric interurban railroads. There is practically no difference between them, except that of motive power. In all other things it would seem that good, common judgment would dictate that we avail ourselves of the long experience of the steam roads. Double tracks are much simpler, easier and safer of operation, and the increased fixed charge occasioned by the double track is, in the judgment of experienced operators, more than compensated for by the saving in dispatchers, signal men and other like employees, and the injuries and damage accounts, to say nothing of the greatly increased carrying capacity.

"In consideration of this branch of the case are involved proper traffic agreement between interurban and city roads,

and the laying of T-rails in cities where practicable to accommodate the deeper flange and broader tread of the wheels of the interurban cars. It is interesting to observe the growing tendency on the part of municipal authorities to recognize the good to be derived from the installation of T-rails in paved city construction.

"There is a great tendency towards the use of Standard T-rails as against the high T-rails which are used in some cities. Such standard T-rails are used in many of the representative cities of America, such as Schenectady, Scranton, Sandusky, Montreal, Milwaukee, Minneapolis, Denver, Indianapolis, Cincinnati, Dubuque, Battle Creek, Kalamazoo and New Haven. The Boston Elevated is also installing a considerable amount of T-rail in Boylston Street, Boston. The standard T-rail can be readily adapted to deep-block paving by using a method which has been employed in several cities which is somewhat similar to the accompanying sketch. The results obtained have been very good indeed, and this construction employing the standard A. S. C. E. section appears to my mind to be much preferable to the unsymmetrical and top-heavy rail sections which are required in some cities."

Worcester, Mass.: Prof. E. A. Engler, president of the Worcester Polytechnic Institute, under date of April 16, 1906, says: "I believe it is generally understood that the T-rail is preferable to the girder rail because the metal in it is better distributed in the cross-section and because the weight of the car goes more nearly, if not directly, over the web."

E. G. Connette, general manager of the Consolidated Railway Company, under date of April 16, 1906, says: "Ninety-pound T-rail track paved with vitrified paving blocks is the best construction that could be placed in streets, for the reason that the continuity of the rails is not so easily disturbed at the joints, consequently not so much wear and tear to the streets."

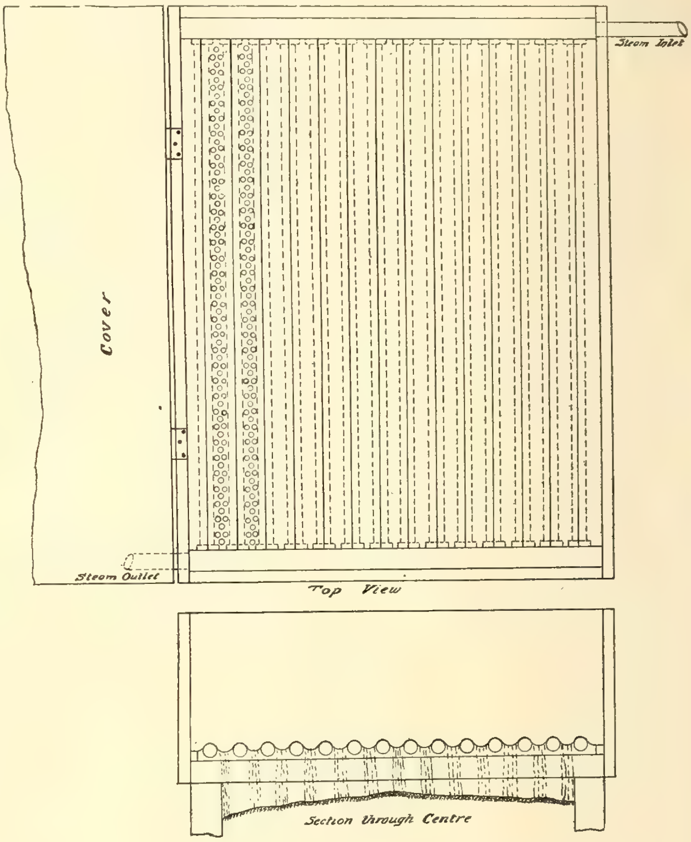
Since the presentation of this paper at Buffalo, the Common Council of Kingston has granted permission to the Kingston Consolidated Railroad Company to lay standard T-rails as requested by Mr. Reel.

SAND DRYER AND TRACK SANDING METHODS IN NEWBURGH, N. Y.

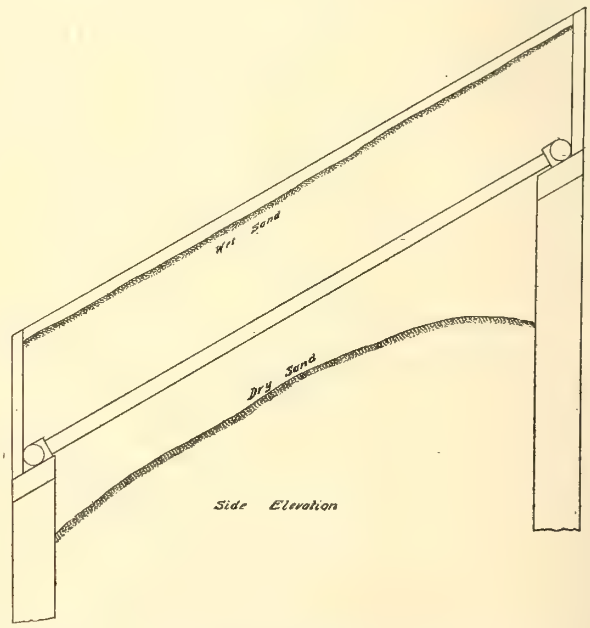
Newburgh, N. Y., is built on several of the hills in the Highland region of the Hudson River, and some of the street grades on which the Orange County Traction Company operates are so steep that they cannot be surmounted without great difficulty even by using more or less circuitous routes. Hence the problem of keeping the tracks well sanded is of unusual importance on this system. To secure plenty of dry sand and then distribute it efficiently, General Manager Boynton and Supt. F. S. Berry devised the sand dryer and sanding mechanism described in this article.

After being screened the sand is placed for drying in an inclined wooden bin heated at the bottom, by exhaust steam circulating through fourteen coils of 1½-in. wrought-iron pipe covered with a sheet of galvanized iron perforated with holes of ¼-in. diameter. As soon as the sand dries the lumps break up and drop through the screen to the floor.

In addition to the ordinary sanding from passenger cars, Mr. Boynton has installed a special sanding car, which is kept going all the time in bad weather. The car is a single-truck freight car, furnished with a sand bin on each side These bins are fully 18 ft. long, 1 ft. 6 ins. wide and, owing to their sloping sides, vary in depth from 1 ft. 6 ins. at the ends to 2 ft. 6 ins. in the middle. From the center of each bin there is a 4-in. diameter wrought-iron pipe directly over the rail. This pipe sands the rail on curves just as well as on straight track, as it is rigidly attached to the truck. An interesting feature of the sanding is the type of sand valve, whereby the size of the apertures through which sand can flow is regulated in the same fashion as a camera shutter. The levers to operate these valves are placed directly opposite one another, so that one man standing in the center of the car can work both sides at the same time. The extent of opening is indicated by the position of an indicator on the lever over a dial plate corresponding to the four degrees of opening adapted for different track conditions.



PLAN AND SECTION OF SAND DRYER



SIDE ELEVATION OF SAND DRYER USED BY THE ORANGE COUNTY TRACTION COMPANY

ENGINEERING OF INTERURBAN RAILWAY CONSTRUCTION

This was the subject taken by Robert P. Wood for his presidential address before the Indiana Engineering Society at the meeting in Indianapolis, Jan. 17-19, 1907. After referring to the difficulty of drawing a hard and fast distinction between suburban and interurban lines, Mr. Wood discusses the principal factors entering into their construction, which he defines as organization, franchise, contracts, specifications, materials of construction, details of construction, distribution of accounts, blank progress forms and reports on projects.

Under the subject of franchises he outlines in abstract a municipal franchise considered fair to all parties, which would consist of fourteen sections, as follows:

Sec. 1. Consent of authorities and designation of route. Sec. 2. Kind of rails with top conforming to surface of highway or street. Sec. 3. Right of company to repair and obligation to maintain existing pavement for width of 8 ft Sec. 4. Obligation to repave the 8-ft. width with new materials when balance of street is being paved, but the railway company is allowed privilege of doing its own work. Sec. 5. Right of company to maintain, construct and operate the railway over and across all railroads and bridges. The bridge provision is omitted in county franchises. Cars are entitled to the tracks against all vehicles, except funeral processions and fire department when on duty. Sec. 6. Location, kind and manner of setting poles, and height of cross-wires. Poles and wires are not to interfere with existing telegraph, telephone, fire alarm or electric light wire unnecessarily. Sec. 7. In a municipal franchise the city is relieved from any responsibility or damage done by or to Traction Company. Sec. 8. Nothing granted shall be construed to take away from the Common Council the exclusive power it now has over the streets and alleys. Sec. 9. Right to transport passengers, mail, express and freight and regulate its own rates. Sec. 10. Company agrees to adjust tracks and fix grades during new improvement work. Sec 11. Company has right to run schedule it deems consistent. Sec. 12. Length of franchise, fifty years. Sec. 13. As a consideration for franchises the company shall construct, complete and operate a line of electric railway in said city, town or county, within two years from acceptance of grant, otherwise franchise is void. Sec. 14. Ordinance is in force from and after its passage and acceptance by grantee.

He then takes up the subject of accounts and offers a suggested form with forty-three items, assembled under sixteen subdivisions, as follows:

1. Organization.—This account includes all expenses incurred in getting out the papers of organization and incorporation, attorneys' fees, etc., also all incidental expenses connected with the calling of meetings, railroad fares, hotel bills, getting out of stock and minute books and the issuance of stock.

RIGHT OF WAY

2. Real Estate.—This account includes the actual cost of real estate purchased for right of way purposes only.

3. Franchises.

ROADWAY

4. Grade.—This account includes the cost of grading roadbed, whether excavations or embankments; clearing up fences, clearing out brush and trees (includes supplies for blasting, etc.), building temporary roads or bridges in order to get at work with teams; running ditches and drains along grade for drainage; cost of material taken from borrow pits, and amounts paid for privilege of making waste banks outside of company's property. Also includes cost of retaining walls and other masonry or riprap for protection of embankments, cuts and slopes. Also expenses of securing labor, transporting labor and tools while on the work, and other miscellaneous expenses connected with building roadbed. Also material and labor for temporary trestling for fills.

5. Bridges, Culverts and Trestles.—This account includes cost of all bridges, concrete arches, culverts and trestles erected to carry tracks over water courses, streams, ravines, streets or other railways. This covers all material, as iron pipe, and tile for culverts, sand, gravel, crushed stone, cement, lumber, nails, wire for cribbing and forms for concrete work, piling and timber for wooden trestles and bridges (the cost of temporary trestling for fills should be charged to account 4); iron material for superstructures; fastening for bridge ties and guard rails and lumber for guard rails, including transportation. Also, labor, excavating for pipe and placing same; excavating, building cribs and forms and handling concrete, building trestles and erection of iron work for bridges (this includes labor and material of false work for same, when false work is removed it should be credited to this account and charged to account benefited); framing, bridge ties and guard rails, and placing same. Also expenses of unloading, storing and hauling material chargeable to this account. Also expenses of securing labor, transporting labor and tools while on the work, and supplies for machinery, such as fuel, oils, waste, etc.

6. Fencing.—This account includes cost of labor and material used in constructing fences along right of way or limits of roadbed. Do not charge to this account cost of fences around stations or other properties outside of right of way, which should be charged to their appropriate accounts.

7. Crossings and Cattle Guards.—This account includes the cost of labor and material used in constructing farm, country road or street crossings at grade, overhead bridges, cattle guards and wing fences to same and transportation.

8.

TRACK

9. Track Laying.—This account includes cost of unloading from cars, hauling and distributing ties, rails and rail fastenings; the placing of the ties ready for the rails, laying the rails, spiking and bolting. Also proportionate charge of construction-train service and supplies. Also expenses of securing labor, transporting labor and tools while on the work, supplies such as fuel, oils, waste, etc., and miscellaneous expenses connected with track laying.

10. Ties.—This account includes cost of cross, switch, bridge and other ties including inspection and transportation.

11. Rails and Fastenings.—This account includes cost of rails, splices, fish-plates, rail-joints, tie-plates, chairs, spikes, bolts, nuts, tie-rods, etc., including transportation.

12. Special Work.—This account includes cost of all special work for switches, crossings, Ys, turnouts and sidings, including transportation.

13. Bonding Material.—This account includes cost of all rail and cross-bonds; transportation charges and cost of unloading and hauling.

14. Bonding Labor.—This account includes cost of labor and expenses of drilling rails and placing bonds in track.

15. Ballast Material.—This account includes cost of all ballast, whether broken stone, slag, gravel or other material especially provided for this purpose, together with transportation, when purchased outright. When secured from pit it covers only the cost of rental of land used for gravel pit.

16. Ballast Labor.—This account includes cost of labor and expenses of distributing ballast and ballasting, lifting, lining and surfacing track. When ballast is taken from company's pit, this account includes all expenses of pit.

17. Street Pavement.—All kinds, excepting macadam and cheaper varieties.

18.

LINE

19. Line Construction.—This account includes cost of unloading, hauling and distributing poles and overhead material, dressing, gaining and setting poles, stringing wires and all work in construction of overhead line; also all expenses of securing labor, and the transporting of labor and tools while on the work.

20. Poles.—This account includes cost of poles and transportation.

21. Overhead Material.—This account includes cost of all materials and supplies used on construction of line, except poles, such as cross-arms, braces, lag screws, pins, brackets; all guy,

trolley and high-tension feeder wire, hangers, pull-overs, switches, line insulators, eye bolts, etc., including transportation.

22. Dispatching System.—This account includes cost of installing system for handling cars, whether by block or telephone, and includes cost of labor, apparatus, and supplies for erection of same.

23.

24. Real Estate Used in Operation of Road.—This account includes cost of land for car and power station, sub-stations, storehouses and offices.

25. Building used in Operation of Road.—This account includes cost of buildings complete for car and power stations, sub-stations, repair shops, store houses and offices, including platforms, sidewalks, excavations, foundations, drainage, water, gas and sewer pipes and connections, outhouses, oil houses, sand sheds, steam heating apparatus, electric light and power fixtures, including wiring for same; pits in car houses, preparing grounds before and clearing up same after construction, connections with water supply systems and shop wells. This account includes amounts paid when erected by contract, and labor materials, including transportation when built by company. This account includes track and overhead work, inside of buildings.

POWER-PLANT EQUIPMENT

26. Foundations.—This account includes the labor and material (including transportation) of all descriptions used in the construction and foundations of engines, boilers, pumps, heaters, condensers, generators, etc., in power station. Also the cost of excavating for same.

27. Boilers and Accessories.—This account includes cost of boilers, heaters, pumps, piping, etc., up to the engines; all coal and ash conveyors, mechanical stokers, stacks, etc., also all transportation charges and expenses of unloading and erection.

28. Engines and Condensers.—This account includes cost of engines and condensers and lubricating devices to be used therewith. Includes transportation charges, expenses of unloading and erection and incidental expenses thereto.

29. Electrical Equipment.—This account includes cost of generators, rotary converters, transformers, switchboards and appurtenances thereto, including transportation for main and substations, also cost of unloading and installation of same.

30. Miscellaneous Expenses.—This account includes items arising in connection with installation of power plant which cannot be directly charged to any of the foregoing accounts.

31.

ROLLING STOCK

32. Car Bodies and Trucks.—This account includes cost of car bodies complete, with all fittings, such as seats, heaters, registers, bell register and bell cords, wiring supplies for lights and light fixtures, head lights, pilots, etc. Also cost of trucks and braking apparatus. Also cost of unloading and transportation.

33. Electrical Equipment.—This account includes cost of motors, controllers, trolley stands, etc., wiring supplies for same and all electrical equipment used in connection therewith. Also cost of unloading and transportation.

34. Assembling.—This account includes the labor and miscellaneous supplies in setting up the cars ready for operation, such as mounting bodies on trucks, installing motors and brakes, etc., etc., etc.

35.

SUSPENSE ACCOUNTS

36. Construction Train Service.—This account includes labor and expenses in connection with handling the construction trains. (Items included in this account are to be recharged to appropriate account as fast as necessary data is secured, otherwise a pro rata charge will be made to the different kinds of work for which the train is used.)

37. Fuel, Oils, Waste, Etc.—This account includes the cost of supplies for construction trains, steam shovels and accessories, such as fuels, oils, waste packing, etc. (Items included in this account are to be recharged to appropriate account as fast as necessary data is secured, otherwise a pro rata charge will be made to the different kinds of work for which machinery is used.)

38. Storehouse.—This account includes the expenses connected with the care of general material from time of receipt to such times as same is called for to be used in the construction work. This includes cost of storehouses, wages of storekeepers, watchmen, etc. (This account will be charged pro rata to the different accounts upon completion of work.)

39. Engineering and Superintendence.

40. Legal.

41. General Office Expense.

42. Miscellaneous.

43. Construction Equipment.—If same is permanent fixture with the company, and includes locomotives, steam shovels, ballast, flat and push cars and hand cars, proper working tools for each class of work, camp outfits, gravel-pit track layouts, coal docks and water supply and piping, blacksmith shop and tools, a per cent for depreciation may be charged off to each individual road.

Specifications should be prepared for the following:

1. Roadway.—(a) grading, (b) fencing, (c) cattle guards, (d) trestles, (e) masonry abutments, (f) arch masonry, (g) reinforced structures, (h) steel super-structures.

2. Track.—(a) ties, (b) rails, (c) track bonding, (d) special track, (e) track-laying, surfacing and lining.

3. Line.—(a) poles, (b) overhead materials, (c) line construction.

4. Buildings.

5. Power-Plant Equipment.—(a) foundations, (b) boilers and accessories, (e) engines and condensers, (d) electrical equipment, (e) miscellaneous items.

6. Rolling Stock.—(a) car bodies, (b) trucks, (c) heater, (d) air brakes, (e) electrical equipment, (f) assembling.

Details of work would include design and selection, two items that cover an immense field. The scope of this paper will not permit of much discussion along those lines. Exclusive of the elements of construction given under specifications, other features are the following:

Location.—Maximum curves and grades on open track in municipalities, width of right of way, probable second track, grade separation from railroads and highways, maps and profiles.

Grade.—Width of roadbed and rate of slopes, allowance for shrinkage and overhaul, method of staking work, progress, profiles.

Track.—Throat and flange ways for all special work; car house track layouts, Ys, hard center points in city streets, single or double-spring rigid frogs, split or spring switches, distance between double tracks or turnouts, tie plans for standard turnouts.

Line.—Arrangement of wires and fixtures on poles.

Power-Plant Equipment.—Scheme and character of power and distribution of current, location of power station and substations with or without waiting rooms.

Rolling Stock.—Lengths, widths, weights and heights of cars.

Construction Outfits and Tools.—Locomotives, steam shovels, ballast, flat, push and hand cars, proper working tools for each class of work, camp outfits, store houses, gravel pit or stone quarry, including coal docks and water supply and piping, blacksmith shop and tools, pit-track layout.

Miscellaneous.—Train schedule.

Blank Progress Forms are very essential, although not all used in the same piece of work, yet at sometime or another the following printed forms are used to advantage. An ordinary time-book, a field foreman's daily report, a board deduction blank, a postal card report on daily progress and distribution of ballast, the same for amount of track laid, another for track surfaced, a daily report blank on overhead progress on which are the various sub-divisions of that class of work, a notice to the tie inspector, a report from the tie inspector, requisitions for materials, requisitions for tools, receipt for tools, time slips, storekeeper's daily report, notice of shipment, report of cars released by railroad company, freight notice, voucher, order for material, contracts for small purchases, damage release from injured persons, weekly report on disbursements, force account blank, bi-monthly progress reports.

MATERIALS OF CONSTRUCTION

A thorough knowledge of these, including costs, is one of the most valuable assets of the engineer, and like Details of Work, should be systematically tabulated under some such subdivisions as the basis heretofore assumed. The nature of a particular proposition may be such as to require

a further subdivision of these. Sufficient enumeration has been made of these items, and it remains but to submit a form of compilation. It has been found practicable to take sheets of plain paper 11¼ ins. x 30 ins. x 36 ins. and rule lines lengthwise or horizontally across the sheet about ⅜ ins. apart. Vertical columns the short way of the sheet are then made of varying widths and on the top line, or near thereto, are the captions. 1. Between stations. 2. Name of section or division of road, as preferred. 3. Length in miles, and then following in order the various items under the different subdivisions or kinds of work. The name of the subdivision itself, as grade, track, line, etc., is placed in large letters above the items pertaining thereto. Three or four horizontal lines may be used for each division, the first containing the units per mile required in number, pounds, tons, pairs, kegs, etc.; second, containing price per unit, number, pounds, tons, pairs, kegs etc.; third, containing amount of material required for the division; fourth, total cost for the division.

In writing the captions better results are obtained by placing at an angle of 45 degs. Manifestly materials of such subdivisions as buildings, power plant equipment, rolling stock and construction equipment are not listed in units of quality or price per mile. They are itemized separately. The method outlined, however, suits the needs of roadway, track and line admirably. Line alone requires as many as sixty items.

REPORTS ON PROJECTS

It requires a familiarity with commercial affairs to properly assemble facts for a report on a prospective railway. The engineer must not necessarily air too much knowledge, nor must he be too brief. The general character depends largely on the extent of the purpose in view as well as the information on the subject already known by the persons to whom the compilation is prepared. There are general lines around which a report can be made that would suit a majority of cases, to-wit:

(a) Organization, the essentials of which are: Name of company, purpose, capital stock, bonds, State laws of special interest, franchises, construction details, estimate of cost, revenues and expense.

(b) Location of Route.

(c) Tributary population, including that of cities and towns en route and the rural for 3 miles on either side of the line, dividing the totals along the line per mile of track including cities and towns and number of people.

(d) Industries, including agricultural, manufacturing and other products, local conditions as, general property, as indicated by public buildings, colleges, etc., parks, possibilities for municipal and commercial light and power supply.

(e) Character of construction, specifying in more or less detail, kind of roadbed, grades, curves, rails, ties, rail-joints and bonds, bridges and their capacities, ballast, line materials and power.

(f) Estimate of cost, detailed to accord with purpose and summarizing under sub-headings of 1, right of way; 2, roadway; 3, track; 4, line; 5, buildings; 6, power contract equipment; 7, rolling stock; 8, superintendence, engineering and legal; 9, contingencies.

(g) Earnings include gross receipts, gross expenses and net income. Gross receipts per annum are often approximated by comparison with other similar roads assumed gross receipts per mile of track per annum, or ascertaining the gross receipts by multiplying the number of persons tributary to the line by an assumed amount per person per annum. A more comprehensive method is to estimate probable passenger, freight and special revenues separately, that for the passenger receipts by multiplying number of car-miles run by unit receipts per car-mile, and adding thereto a lump sum for special occasions and conventions, athletics and amusements. The freight receipts are sometimes found by number of car loads of freight in and out of the territory served multiplied by an average rate per car and adding thereto a lump sum for express and light package business. Special revenues would include rentals and sale of power. Gross expenses are operating and interest charges, damages and taxes. Net income is generally applied to depreciation and dividends on common stock.

The scope of interurban engineering is wide and, like many other things worth acquiring, requires much hard work. There is a multiplicity of involved factors, commercially and technically tending to affect the result, and it remains for the engineer to prove himself equal to the demands either way, and at any time.

PREMIUM SYSTEM FOR POWER HOUSE EMPLOYEES AT SHEBOYGAN, WIS.—MAKING BOILER WALLS TIGHT

At the convention of the Northwestern Electrical Association held at Chicago, Jan. 16, 17, 18, Ernest Gonzenbach, general manager of the Sheboygan Light, Power & Railway Company, Sheboygan, Wis., gave some interesting facts concerning a system he employs in the power house for encouraging the men to operate the station in the most economical manner. Ten per cent of the reduction of the total cost incurred for the month below 1.1 cents per kw-hour is divided among the employees. The basis, 1.1 cents, was the average cost per month before the inauguration of the premium system. At the present time the company is paying out in premiums from $40 to $80 per month. This means, of course, that from $400 to $800 per month is being saved in power house expenses, and the company is saving nine-tenths of this. The premium is divided among employees according to rank, the engineers receiving the highest per cent and the oilers the lowest. Firemen at $45 per month usually receive a premium of from $5 to $10. The inauguration of the system in a power house, he said, produces quite a change in the interest taken by the men in their work. Every man not only tries to do his best, but in addition helps the other man to do his best also. The engineers watch the firemen to see that the coal is burned under the most economical conditions, and the firemen in turn object if the engineers run the larger units at low load instead of putting in smaller units. As costly repairs would wipe out premiums every employee is on the alert for hot bearings. Carelessness in one employee will not be tolerated by the others, and the incompetent man cannot remain long in the station.

In a paper read at the same meeting of the association A. Bement spoke of the attention that the passage of cold air through boiler walls is receiving at the present time. He said that even at the very best brick settings are very leaky and allow the entrance of much cold air. Steel jackets for the walls and reinforced concrete have been used as a remedy, and in some instances brick settings have been sealed by the application of a tight cement covering over which canvas has been pasted and then painted.

The Indiana, Columbus & Eastern Traction Company has adopted the policy of putting its agents in small towns upon a strictly commission basis. Heretofore agents owning stores have been allowed to send and receive freight without charge, as well as to have other courtesies shown them that resulted in a saving. While the company will treat its agents with the utmost consideration, this practice of courtesies will be stopped and the business put upon a cash basis as nearly as possible.

REPORT OF NEW YORK RAILROAD COMMISSIONERS

In the last issue of the STREET RAILWAY JOURNAL a table was published showing the capitalization and operating statistics of the New York State companies, as compiled from the official figures on file with the Railroad Commissioners. Advance sheets from the annual report are now available and supplement the matter already published. According to the report the total gross earnings from operation of the street surface, elevated and subway railways were $78,819,-304.09, which is an increase of $8,089,218.43 over 1905 Operating expenses were $43,501,438.27, which is an increase of $3,305,994.73 over 1905. A complete year for the subway was not included in 1905, as it was in operation but eight months of that year. The percentage of dividends to capital stock of said companies is 4.79; in 1905 it was 4.83. The miles of said railways operated increased 58.049 miles. The number of passengers carried on street surface railroads in the boroughs of Manhattan and the Bronx, New York City (including transfers), was 630,297,151; an increase of 28,536,284 compared with 1905. The number of transfers was 198,632,861. The number of transfers in these boroughs increased 9,894,552. The average number of passengers carried on street surface railways in the boroughs of Manhattan and the Bronx per day (365 days) was 1,726,841 during 1906. These figures as to Manhattan and the Bronx include some passengers carried in Westchester County. The number of passengers carried in the borough of Brooklyn (including transfers and including those carried on the elevated railways) was 492,659,270. The number of transfers was 102,887,834. The average number carried per day (365 days) in the borough of Brooklyn was 1,349,-751. These include some carried in the borough of Queens by the Brooklyn roads.

Following will be found tables giving percentages of operating expenses:

PERCENTAGES OF OPERATING EXPENSES TO GROSS EARNINGS.

	1905.	1906.
Maintenance of way and structures	4.93	5.37
Maintenance of equipment	7.95	7.64
Operation of power plant	9.50	9.30
Operation of cars	25.05	23.55
General expenses	9.40	9.33
	56.83	55.19

PERCENTAGES OF SUBDIVISIONS OF OPERATING EXPENSES.

	1905.	1906.
Maintenance of way and structures	8.70	9.72
Maintenance of equipment	13.99	13.87
Operation of power plant	16.70	16.85
Operation of cars	44.07	42.66
General expenses	16.54	16.90
	100.00	100.00

PERCENTAGE OF OPERATING EXPENSES TO GROSS EARNINGS FROM OPERATION FOR TEN YEARS

1897	60.57
1898	60.07
1899	59.62
1900*	58.78
1901*	56.89
1902*	58.91
1903*	57.70
1904†	56.30
1905†	56.83
1906†	55.19

*Including elevated roads in Brooklyn.
†Including elevated roads in Brooklyn and Manhattan and (beginning with 1905 the Subway in Manhattan

The table at the bottom of the page gives statistics relative to the operation of some of the more important companies.

The following table shows increases and decreases in street surface and subway railroad mileage in the State during the year:

INCREASES.

Brooklyn, Queens County and Suburban	.622
Bush Terminal (Brooklyn)	2.675
Cortland County Traction	5.000
Electric City (Niagara Falls)	2.415
Glen Cove	3.280
Interborough (New York City):	
Rapid Transit (Subway)	4.830
Ithaca and Cayuga Heights	2.380
Long Island Electric	.100
Marcellus and Otisco Lake	9.000
Newark and Marion	8.190
New York City Railway and leased lines	.593
New York City Interborough	4.120
Ocean Electric (Far Rockaway)	.240
Oneonta and Mohawk Valley	2.980
Rochester:	
Rochester and Sodus Bay	.170
Rochester and Suburban	.060
Rochester and Eastern Rapid:	
Ontario Light and Traction	.060
Syracuse, Lake Shore and Northern	.430
Syracuse Rapid Transit	.150
Union (New York City)	.071
Warren and Jamestown	10.000
Waverly, Sayre and Athens	1.330
Westchester Electric	.055
City of New York—Williamsburgh Bridge	1.577
	60.32

RECEIPTS AND EXPENDITURES PER PASSENGER AND COST OF OPERATION PER CAR MILE FOR YEAR ENDING JUNE 30, 1906.

NAME OF ROAD.	Number of Passengers Carried, Including Transfers.	Total Car Mileage.	*Based upon Gross Earnings from Operation and Operating Expenses.		*Based upon Receipts from all Sources and Total Expenditures, Including Fixed Charges.		Per Car Mile.		
			Average Earnings per Passenger. Cents.	Average Cost of Operation per Passenger. Cents.	Average Receipts per Passenger. Cents.	Average Expenses per Passenger. Cents.	*Gross Earnings. Cents.	*Operating Expenses. Cents.	*Total Expenses Including Fixed Charges. Cents.
Albany and Hudson	1,395,461	703,088	15.16	12.11	19.04	18.76	30.09	24.03	37.27
Auburn and Syracuse	4,931,345	1,184,058	6.28	3.72	6.31	5.25	26.17	15.48	21.89
Binghamton	7,289,545	1,477,900	3.97	2.07	4.00	3.27	19.61	10.21	16.13
Brooklyn Heights†	323,534,625	49,208,602	4.04	2.25	4.12	3.59	26.56	14.82	23.51
Coney Island and Brooklyn	40,093,248	6,871,509	4.10	2.98	4.15	3.74	24.12	17.37	21.85
Crosstown Street (Buffalo)	17,744,498	2,806,971	3.38	1.94	3.41	3.00	21.56	12.26	18.09
Forty-Second Street, Madison and St. Nicholas Avenues (New York City)‡	32,588,835	3,841,281	2.83	2.15	3.08	3.36	24.02	18.28	28.53
Geneva, Waterloo, Seneca Falls & C. L.	1,940,164	446,990	4.69	2.82	4.69	3.96	20.18	12.25	17.19
Hudson Valley	6,555,010	1,977,596	8.48	4.99	8.71	9.05	28.11	16.55	30.00
International (Buffalo)	102,264,448	16,358,461	4.00	2.36	4.12	3.30	25.04	14.72	20.62
Interborough Rapid Transit	395,716,386	93,654,185	4.97	2.13	5.16	4.36	21.03	8.97	18.41
Jamestown	4,716,490	817,584	3.28	2.21	3.31	2.92	18.93	12.75	16.84
Kingston Consolidated	2,686,244	563,316	4.86	2.78	4.88	4.25	23.27	13.27	20.29
Nassau Electric	83,227,057	11,989,411	3.94	2.31	4.10	3.38	26.92	16.03	23.44
New York City¶	494,230,839	52,047,663	3.53	1.94	3.74	4.21	33.48	18.40	39.97
New York and Long Island	3,055,681	853,912	6.73	3.37	6.78	5.09	24.09	12.06	18.26
New York and Queens County	21,125,464	3,623,929	3.97	2.67	4.03	3.64	23.17	15.58	21.20
Rochester	54,448,964	8,036,938	3.76	2 21	3.86	3.24	25.46	14.99	21.92
Rochester and Eastern	1,146,497	730,656	19.98	12.64	20.75	20.06	31.34	19.84	31.47
Schenectady	12,794,203	3,241,573	6.79	4.37	6.89	6.02	26.79	17.25	23.80
Syracuse and Suburban	1,995,687	497,559	8.76	5.13	8.87	7.96	21.05	12.33	19.14
Syracuse Rapid Transit	25,453,517	4,320,371	4.01	2.28	4.04	3.29	23.62	13.41	13.41
United Traction	36,331,703	7,562,079	4.86	3.07	4.91	4.03	23.34	14.76	19.35
Utica and Mohawk Valley	16,535,761	3,545,233	5.43	3.16	5.46	4.25	25.33	14.76	19.84
Union (New York City)	47,214,708	7,028,279	3.18	2.24	3.22	2.85	21.38	15.09	19.16

*Includes earnings and expenses of freight, express, mail and all other business. †Includes all lines operated by Brooklyn Heights not making separate reports. ‡Includes portion operated by horses. ¶Includes all lines operated by New York City Railway Company not making separate reports and also includes lines operated by horses

The above does not include the following, which have constructed road since June 30, and up to Jan. 1, 1907, as follows:

Buffalo, Lockport & Rochester, 2 miles.

Syracuse & South Bay, 10 miles of track laid and poles set up.

Danbury & Harlem, 6.50 miles.

Liberty & Jeffersonville, 2.40 miles. This track has also been constructed for some time previous to this year.

Rochester, Syracuse & Eastern, constructed from Rochester to Lyons, 37 miles, in operation since the early part of September and turned over to the company, which began operations on Nov. 1, 1906.

Elmira, Corning & Waverly. "None of the railroad is absolutely finished, although a large part of the construction work has been completed."

The average number of persons, including officials, employed during the year ending June 30, 1906, on all the street railways of the State (including street surface electric, cable and horse railways, the Brooklyn Union Elevated Railroad, the Manhattan elevated railway and the subway) was 43,285. The aggregate amount of salaries and wages paid them was $28,882,153.60. The percentage of gross earnings from operation paid in salaries and wages in 1906 was 36.64. The companies owned and operated on June 30, 1906, 6855 electric motor or cable box cars; 3895 electric motor or cable open cars; 1035 electric motor combination box and open cars; 545 electric motor semi-convertible and combination passenger and baggage cars; 42 electric motor mail cars; 536 electric motor express, freight and other cars; 400 electric motor snow plows, sweepers and sprinklers; the total being 13,308. Fenders to the number of 15,-837 were reported in 1906 as in use on cars. Some of these fenders are transferred from one end of the car to the other at terminals, and some of the devices reported as fenders are wheelguards; 2529 other cars (being cars operated by horses, and box, open, freight, express, service cars and snow plows not equipped with motors) were also owned and operated on June 30, 1906.

The number of tons of freight reported as carried on the street surface railroads of the State during the year ending June 30, 1906, was 1,603,182; the number carried during each of the years, beginning with the year 1899, was as follows:

1899	129,040
1900	153,343
1901	287,311
1902	394,641
1903	516,460
1904	633,674
1905	829,291
1906	1,603,182

On some of the roads separate express companies operate and in some of these cases the amount of freight carried is not reported.

The Boston Elevated Railway Company is building an extension at its Milton car house which will require the casting and sinking of 413 concrete piles from 10 ft. to 35 ft. long. The work of casting piles has already been begun, and as soon as the piles are sufficiently set they will be driven. The piles are square in section, 13 ins. x 13 ins., reinforced with No. 3 Clinton wire cloth. They will be sunk to ledge by means of a water jet, and are required to sustain a load of 30 tons each. The addition to the car house will more than double its present capacity.

REPORT OF MASSACHUSETTS RAILROAD COMMISSIONERS

The report of the Massachusetts Railroad Commissioners for the year ending Sept. 30, 1905, figures from which have been briefly quoted in the STREET RAILWAY JOURNAL, has just been issued. Returns for the year were received from ninety street railway companies. During the year two new companies were organized under the general law and added to the list, namely, the Worcester & Northern, and the Worcester & Providence. One company was organized during the year under the general law and added to the list being the purchaser of a railway sold at receiver's sale; the Ware & Brookfield, purchaser of the Hampshire & Worcester. During the year the Georgetown, Rowley & Ipswich (Sept. 28, 1906) was consolidated with the Boston & Northern; the Hoosac Valley (June 30, 1906) with the Berkshire; the Lowell & Woburn (Sept. 28, 1906) with the Boston & Northern; and the Taunton & Buzzards Bay with the New Bedford & Onset (June 11, 1906).

The Massachusetts companies now own 2,230.020 miles of street railway line, 420.124 miles of second main track, and 153.478 miles of side track, making a total length of track, reckoned as single track owned 2,803.622 miles. All of the street railway mileage owned is located in this State except 18.766 miles of main track and 0.760 of a mile of side track belonging to the Woonsocket,—in all 19.526 miles of track—which is located in Rhode Island. All the track owned is surface street railway track with the exception of 6.644 miles of elevated line and 6.468 miles of elevated second track. Of the sidings, all are surface track with the exception of 2.903 miles of elevated track. All of the elevated track is confined to Boston. The Old Colony leases and operates the Newport & Fall River, having a mileage of main and second track of 19.289 miles located in Rhode Island; and the Boston & Northern leases and operates the Nashua, having a mileage of main and second track of 14.899 miles located in New Hampshire. Accordingly 52.954 miles of main and second track are operated outside the State. The total miles of main track (including trackage rights) operated is 2,736.052,—an increase of 67.551 miles over the previous year.

The aggregate capital stock of the ninety companies, Sept. 30, 1906, was $71,216,925,—a net increase of $889,940.22 over the preceding year.

The total amount of dividends declared the last year was $3,554,073.24,—an increase of $379,568 over the preceding year. Thirty-seven out of the ninety companies paid dividends ranging from 2 to 10 per cent, and fifty-three companies declared or paid no dividends.

One company paid 10 per cent; five, 8 per cent; one, 8 per cent on preferred and 7 per cent on common; one, 7.22 per cent; one, 7.20 per cent; two, 7 per cent; eleven, 6 per cent; one, 5.5 per cent; eight, 5 per cent; two, 4 per cent; one, 3.75 per cent; one, 2.50 per cent, and two, 2 per cent.

CAPITAL STOCK, NET INCOME AND DIVIDENDS, 1897–1906.

YEARS.	Capital Stock.	Net Divisible Income.	Dividends Declared.	Percentage on Total Capital Stock
1897	$32,670,273	$2,593,147	$1,965,243	6.02
1898	38,933,917	2,534,002	2,076,233	5.33
1899	41,380,143	2,502,942	2,318,398	5.60
1900	48,971,168	3,037,502	2,409,874	4.92
1901	54,069,933	3,398,183	3,417,117	6.32
1902	60,036,328	3,388,851	3,138,711	5.23
1903	68,404,480	3,602,917	3,586,248	5.24
1904	68,542,038	2,998,114	3,214,496	4.69
1905	70,326,985	3,556,690	3,174,505	4.51
1906	71,216,925	4,160,073	3,554,073	4.99

per cent; eight paid 5 per cent; two paid 4 per cent; one paid 3.75 per cent; one paid 2.50 per cent, and two paid 2 per cent.

The aggregate funded debt of the companies, Sept. 30, 1906, was $58,176,000,—an increase of $2,395,500 over the preceding year.

The amount of real estate mortgages outstanding Sept. 30, 1906, was $74,400,—an increase of $2,400 over the preceding year.

The total unfunded debt, including the above mortgages, was $20,279,338,—an increase of $783,580.

The gross debt, funded and unfunded, was $78,455,338,—an increase of $3,179,080.

The net debt (the gross debt less $10,447,216 of cash and current assets) was $68,008,122,—an increase of $5,047,569. In computing the net debt the sum of $6,096,828 returned as "miscellaneous assets," covering materials and supplies on hand, etc., is not included with cash and current assets in the deduction from gross debt.

CAPITAL INVESTMENT

The total capital investment (capital stock and net debt) of the street railway companies of the State advanced the last year from $133,287,538 to $139,225,047,—an increase of $5,937,509. The average cost of the street railways of the State, per mile of main track (including the cost but not the length of side track), as reported by the companies Sept 30, 1906, was $28,974.35 for construction; $10,211.87 for equipment, and $13,616.23 for lands, buildings (including power plants) and other permanent property,—making a total average cost of $52,802.45 per mile of main track.

The total income of the companies from all sources, for the year ending Sept. 30, 1906, was $31,237,446.83, and the total expenditures (including dividends declared) were $30,631,447.12,—making a net surplus of $605,999.71 to be added to the surplus of previous years.

The gross earnings and expenses of operation the last year are classified and compared with those of the previous year, in the following table:

GROSS EARNINGS AND EXPENSES OF OPERATION, 1905 AND 1906.

Earnings and Expenses.	1905.	1906.	Increase.
Revenue from passengers	$26,384,587	$28,793,806	$2,409,219
From mails and merchandise	105,625	134,456	28,831
From tolls and advertising, etc	551,079	635,630	84,551
Gross earnings from operation	$27,041,291	$29,563,892	$2,522,601
Operating expenses	18,269,259	19,954,000	1,684,741
Net earnings from operation	$8,772,032	$9,609,892	$837,860

VOLUME OF TRAFFIC

The total number of passengers carried during the last year on the railways in operation of the ninety companies making returns to the board was 581,450,906,—an increase of 48,719,889 passengers over the previous year.

GROSS AND NET EARNINGS FROM OPERATION PER MILE OF MAIN TRACK OWNED, 1897-1906.

YEARS.	Average per Mile of Track Owned.		
	Gross Earnings.	Expenses of Operation.	Net Earnings.
1897	$11,187	$7,713	$3,474
1898	10,998	7,589	3,409
1899	10,459	7,132	3,327
1900	10,452	6,878	3,574
1901	9,998	6,690	3,308
1902	9,609	6,510	3,099
1903	10,124	6,944	3,180
1904	10,178	7,145	3,033
1905	10,300	6,959	3,341
1906	11,156	7,529	3,627

GROSS AND NET EARNINGS FROM OPERATION PER CAR MILE RUN AND PER PASSENGER CARRIED, 1897-1906.

YEARS.	Average per Car Mile.			Average per Passenger.		
	Gross Earnings.	Expenses of Operation.	Net Earnings.	Gross Earnings.	Expenses of Operation.	Net Earnings.
	Cents.	Cents.	Cents.	Cents.	Cents.	Cents.
1897	25.68	17.71	7.97	5.12	3.53	1.59
1898	24.80	17.11	7.69	5.11	3.52	1.59
1899	24.74	16.87	7.87	5.09	3.47	1.62
1900	24.46	16.10	8.36	5.06	3.33	1.73
1901	23.40	15.66	7.74	5.02	3.36	1.66
1902	23.42	15.87	7.55	5.05	3.42	1.63
1903	23.76	16.30	7.46	5.06	3.47	1.59
1904	24.29	17.05	7.24	5.04	3.54	1.50
1905	24.75	16.72	8.03	5.08	3.43	1.65
1906	25.86	17.46	8.40	5.08	3.43	1.65

The total number of miles run by street cars was 114,312,626,—an increase of 5,053,887 miles over the previous year.

The following tables give for each of the last ten years the average gross earnings, operating expenses, and net earnings from operation, (1) per total mile of main track owned, (2) per car-mile run and per passenger carried,—thus showing more in detail the changes from year to year in the earnings, cost and net results of operation.

GENERAL DISCUSSION

Following the action of the Legislature of last winter declaring its adherence to the old-time policy of prohibiting railroads from holding the stocks of other corporations, the Attorney-General of the Commonwealth in October instituted certain proceedings which are now pending in the Supreme Judicial Court to test the legality of the action of the New York, New Haven & Hartford Railroad Company in dealing with street railways in Massachusetts.

Meanwhile petitions have been brought for the approval of consolidation of railways and issues of stock by some of the street railway companies, which, whether by valid or invalid processes, are directly or indirectly controlled by the same interests that control the New York, New Haven & Hartford Railroad.

These petitions relate to the economic administration of business and to improvement in street railway accommodation. In instances where action upon these matters would promote the public interests it would seem that, whatever the outcome of the legal contest as to holdings of stock in these companies may be, the management of their affairs, in so far as it affects the traveling public, ought not to be affected by the pending litigation. The street railway companies are independent corporations, and their issues of capital, their charges and methods of conducting business are under State supervision. The board is therefore proceeding with an inquiry into the merits of the pending cases upon the assumption that an economical and progressive management of existing lines is desirable.

SAFETY DEVICES FOR STREET CARS

In the annual report of the board for 1895 will be found a discussion of street car fenders, including an exhaustive report by Prof. George F. Swain. The facts and opinions there stated have a pertinent value in connection with the investigation which we have been making during the past year, and should be taken into consideration with what is said in this report.

Following the report of 1895 the board issued a circular to street railway companies, under which various fenders have been in use upon different railways. From time to time since that circular was issued the board has inspected models, witnessed experiments and observed the working of fenders.

The Legislature of 1906, in order to enable the board to complete an investigation of safety devices, authorized an appropriation to meet the necessary expense. With the means thus furnished an inquiry has been conducted in this and in other states in foreign countries, records of experience have been consulted, opinions of experts obtained public hearings given, and practical tests with fenders and wheelguards made.

There is to-day a very general skepticism among railway officials, employees and persons having no interest either in companies or patents, as to the value of any fender that projects in front of a car. The feeling is widespread that instances in which such projecting attachments injure persons who might otherwise escape, or introduce new perils by distracting the attention of motormen or by increasing chances of derailment, go a great way toward counterbalancing the instances in which they prevent injury. This feeling has led to a greater interest in wheelguards.

The remarkable record of the wheelguard used for several years in Liverpool affords a striking argument for the use of that device rather than a projecting fender. For two years this wheelguard has been used in connection with the vast traffic of that city without a single instance of failure to accomplish its purpose. Of course the freedom from snow and ice and the smooth street surface found there favor the working of such a wheelguard.

The use of reserved spaces for street railways and the recent progress in perfecting the surfaces of our streets tend to make an effective wheelguard more available. There is reason to believe that with such a wheelguard the safety of those who are exposed to moving cars will depend upon proper devices for controlling speed, proper rules for operating cars and the alertness and skill of motormen, rather than upon the adoption of any type of fender. However, experience proves that fenders do occasionally prevent loss of life or limb, and in view of this fact, and with the possibilities of better results from improved devices, companies ought to equip street cars with fenders. It is simply a question as to what fenders shall be used.

The practical tests made at Newton with dummies shaped like human bodies of different sizes, covered twenty-seven different devices, and showed the uselessness of some of them and excellent results in the use of others. Those designed to trip and catch a person standing or crossing a track were more generally successful than those which were designed to pick up prostrate bodies.

There has been much hostile criticism of the Pfingst fender. The record of that fender shows many instances when persons have been saved from injury. This of course happens when accidents are prevented and therefore when public attention is seldom drawn to the fact through newspaper paragraph and never through police report or inquest. On the other hand, this fender has frequently failed to do its work. One reason for failures, particularly upon suburban lines, is carelessness in attaching the fender to the car, especially in respect to the height at which it is carried. Upon a large percentage of the surface cars in Boston the fender is useless from the fact that projecting parts of the car so reduced the available area of the fender as to leave no room for catching or holding a person who falls or is thrown upon it.

Assuming that the Legislature had in view an investigation that will enable the board to require the use of such devices as shall seem to be suitable, no opinion is expressed at this time upon the comparative merits of different fenders. Street railway companies have been asked to present for approval on or before the first day of May such type of fender and wheelguard as they may desire to use.

Experience shows that for safe and successful work with lifting jacks suitable for raising a modern street car there is need of expert knowledge; also of blocking and other apparatus. The use of wheelguards properly attached to the trucks and proper control over the car must tend to make accidents in which there is occasion to lift the car exceedingly rare, and to meet the cases which do arise we believe in the maintenance of wrecking crews within convenient call prepared to move at once to the place of accident with all necessary apparatus. One trouble in the past has been that too little attention has been given to wheelguards. Some in use are wholly inefficient, and others so carelessly attached as to be practically worthless in keeping bodies away from the wheels.

VENTILATION OF STREET CARS

Two public hearings have been given, at which methods of ventilating street cars were the subject of consideration. No report is presented, for the reason that the inquiry is not yet completed.

EXHIBITS AT THE ELECTRICAL SHOW AT CHICAGO

The first week of the electrical show at the Coliseum, Chicago, which closed Jan. 19, established a record for attendance, and presaged for this week a continuance of the large crowds. Unofficial reports are to the effect that the attendance one day established a record for the building. While the exhibits covered the whole range of the electrical industry, several of them were of such a character as to be of special interest to street railway and allied industries.

One of the most interesting of these was the exhibit of the Chicago City Railway Company, which had on show one of its latest type of passenger cars, one hundred of which are now being received. Attendants in uniform explained to the public the striking features of the car and distributed illustrated circulars which set forth briefly the company's reasons for changes in design. In the design of the new car the company has provided for the changeable Chicago weather, for the lessening of noises and for more sanitary conditions. The general design and dimensions of the car are practically the same as those of the car described in the Street Railway Journal for Sept. 16, 1905. The later cars, however, have been provided with ventilators in both the front and the rear ends of the monitor. These are fitted with shutters to throw the air up against the ceiling and avoid draughts. Recent tests showed the inflow of air through the new ventilators averaged 370 ft. per minute. A decrease of 500 lbs. in the weight of the new car has been made possible by the use of standard steel seat pedestals instead of cast iron. The car exhibited was built by the J. G. Brill Company and is mounted on Brill 27-E-1 trucks provided with Schoen steel wheels. About 18,000 of the illustrated circulars dealing with the car were passed out during the first few days—striking evidence of the interest of the public in the new equipment.

Hardly any of the exhibits was without interest for street railway men, even though in cases the connection was remote. In a number of instances, however, there were many things of interest, as strikingly illustrated in the exhibits of the Westinghouse Company, the General Electric Company, Allis-Chalmers Company, Electric Service Supplies Company, and a number of others, of which brief mention is appended:

THE UNITED INDURATED FIBER COMPANY showed several applications of the specially treated fiber of its manufacture. Probably the most interesting feature of the exhibit were the samples of third-rail insulators, among which were those of the type made for the New York Central Railroad. Another interesting application was a fiber trolley-wire trough for railroad crossings. This trough is lined with a conducting material so that when the trolley jumps the wire it is caught by the trough and the current is not broken. The trough is designed particularly for service over railroad crossings where it is highly desirable that the car be not stopped for any reason whatever. Switch tanks for high-tension switches, insulating rings for various purposes, rail-end insulators and several other articles made from the fiber also were shown. Morris W. Sheldon represented the company.

THE ALLIS-CHALMERS COMPANY gave up the central portion of the exhibit space to generators and motors. Around a three-phase, 75-kw, a. c. motor were grouped several a. c. and d. c. machines of smaller capacity. In one corner of the space was shown a section of the stationary and movable blading of a 500-kw Allis-Chalmers turbine. Near by was a complete cylinder and valve gear of an Allis-Chalmers Corliss engine. The north end of the exhibit served as an office and reception room for visitors. Catalogs and other advertising matter were distributed to those interested. C. A. Tupper and S. R. Kerr were in charge of the exhibit. They were assisted by J. W. Gardner, manager of the Chicago office, and several of the company's salesmen, including C. H. Helvey, C. S. Buell, C. H. Lowe, H. I. Keen, P. C. Van Zandt, George Voight, A. W. Catlin, L. St. J. Smith, D. K. Chadbourne, E. R. Jacobs, J. M. Denniston, F. L. Webster and Ervin Dyer. W. H. Whiteside, president; L. M. Harvey, manager of the Milwaukee sales office, and W. S. Heger, assistant to the president, also were in attendance.

THE NATIONAL CARBON COMPANY was installed in a booth made of pure carbon. In it, on a central pyramid, was shown dry batteries of various types in the construction of which the company's products are used. Railway motor brushes, telephone parts, arc light carbons and other carbon products also were shown. The company was represented by M. C. Cotabesh, manager of sales; A. L. Haskell, Wallace O'Connor, A. B. Ward and C. W. Wilkins, salesmen.

THE ELECTRIC SERVICE SUPPLIES COMPANY exhibited a very extensive line of electric railway and lighting specialties, including Dossert solderless connections, Garton lightning arresters and Imperial arc headlights. Several types of Locke high-tension insulators and a complete line of railway overhead material also were shown. A very interesting feature of the exhibit was an apparatus for the comparison of the brilliancy of regular incandescent, metallized filament and tantalum lamps. Other features of the exhibit were Benjamin wireless clusters, Schwarze Electric Company's bells and G. & W. potheads, which are used where conduit wires are brought up on poles. W. J. Porter, M. A. Berg, E. R. Mason, P. E. Davenport, H. L. Adams and C. D. Willison represented the company.

THE ALBERT & J. M. ANDERSON MANUFACTURING COMPANY exhibited the Anderson time switch and remote-control oil switches. The main portion of the exhibit, however, consisted of trolley wheels and a complete line of Anderson overhead line material. The company was represented by Wm. W. Hincher, manager of the Chicago branch, and John M. Anderson, treasurer of the company.

THE SIMPLEX ELECTRIC HEATING COMPANY included in its exhibit of a complete line of heating apparatus glue pots for shop use. These pots are of the immersion-coil type. A one-quart pot consumes about 100 watts. This company also manufactures car heaters of various types. C. W. Richards and H. R. Hixon, Chicago representatives, were in attendance.

W. N. MATTHEWS & BROTHER showed the manner in which Stombaugh guy anchors are installed in the ground by means of an earth section placed in a large box in the rear of the booth with an anchor in position. Other features of the exhibit were the Kearney cable clamps, Hold-Fast lamp guards, Lima jack boxes, Harges cable splicing joints, O. K. sleet cutters and Callahan cable rollers. The company announces that it is getting up a ratchet wrench for the Stombaugh guy anchor which will facilitate the installation of anchors in close fence-corners and other places where the T wrench cannot be used. Claud Matthews, W. N. Matthews and V. L. Crawford represented the company.

W. H. SCHOTT, the well-known central-station heating and power-plant engineer, of Chicago, had an artistic booth provided with seats and couches for the comfort of visitors.

THE WAGNER ELECTRIC COMPANY exhibited a very extensive line of its products. A Wagner variable-speed, single-phase, alternating-current motor was shown, operating a small-pressure blower. In this motor the speed variation is obtained by means of an auto-converter speed regulator. The motor operates with the brushes on the commutator as a repulsion type of motor, and the speed of the motor depends upon the voltage compressed and the load under which the motor is working. There was also on exhibition a new single-phase elevator motor. This motor has a very large torque at the instant of starting. If conditions of service require at starting it will develop 300 per cent to 400 per cent of normal full-load torque. Other single-phase motors shown were a 5-hp standard type and a 15-hp vertical motor. A 10-hp, three-phase induction motor created considerable interest. The construction of the Wagner type M standard lighting and power transformers was well shown by a transformer from which the front side of the case had been removed. Included in the exhibit was a complete line of switchboard and portable indicating instruments, both for a. c. and d. c. work. These were shown in several styles, including the round pattern, horizontal, edgewise, vertical edgewise and fan shape. One instrument shown was a three-phase, a. c. ammeter which answered the purpose of three a. c. ammeters. A combination voltmeter and frequency indicator was also exhibited. The exhibit was in charge of F. N. Jewett, Chicago district office manager, assisted by C. B. Richardson and C. C. Warner, of the Chicago office, and V. W. Bergenthal, assistant sales manager of the home office.

THE OHIO BRASS COMPANY was installed near the center of the building. The exhibit comprised samples of high-tension porcelain insulators made expressly for the company. Another feature of the exhibit was several sections of track rails showing the application of terminal and soldered bonds. The exhibit of third-rail insulators included a section of the underrunning third-rail used by the New York Central Railroad. Lima jack boxes for interurban railway telephone work and Hunter illuminated signs for street railway work also were shown. The company was represented by F. H. Jamieson, A. L. Havens, E. A. Hurlburt and G. W. Cooper, of the Chicago office.

THE GENERAL ELECTRIC COMPANY made the first public exhibit of the new tungsten lamp. These lamps have an efficiency of 1¼ watts per candle-power, and were shown in 100 watt units of 85 cp. The exhibit was made by installing a row of the lamps in the roof of the booth with rows of tantalum and Gem incandescent lamps, all with Holophane globes on either side. The rows of different kinds of lamps were connected to flashers, so that they were lighted alternately. The main feature of the exhibit, however, was the display of cooking and heating devices. The exhibit was in charge of E. L. Callahan.

THE SCHWARZE ELECTRIC COMPANY was represented by J. Allen Haines, who exhibited a line of Schwarze Universal bells, which are particularly adapted for installation on electric cars.

THE WESTINGHOUSE ELECTRIC & MANUFACTURING COMPANY exhibited as "details and supplies" various types of electric instruments mounted upon marble switchboards. There were also shown a line of portable instruments, samples of low-voltage line material, catenary line material for high-voltage single-phase railway installations, and various types of lightning arresters, oil switches and circuit breakers. The company was represented by S. L. Nicholson, manager industrial and power sales, Pittsburg; C. S. Cook, manager railway and lighting sales, Pittsburg; T. P. Gaylord, manager Chicago office, and the following associates from his office: A. L. Millard, W. D. McDonald, Malcolm C. Carrington, R. H. Moore, Norman Stewart and Stephen Gardiner.

THE ELECTRIC STORAGE BATTERY COMPANY, of Philadelphia, exhibited a variety of batteries manufactured by it, ranging from the H-61 tank with a capacity of 4800 amps. for a hour down to the little BT cell with a capacity of 2½ amps. for 1 hour. All of these batteries are of the "Chloride Accumulator" type, and include the R-73 elements in R-85 tank, 2600 of which cells are now being installed by the New York Central Railroad

Company in its electrification. Cells of this type will be used at Gary, Ind., by the Indiana Steel Company in its plants now under construction. The G-51 tank is used by street railway companies throughout the country, and the other types shown are the F-21 for lighting and telephone work, both in wood tanks and in glass tanks, the F-15, E-13, D-7 and C-5, all in glass jars. This company makes a specialty of car lighting work, and the exhibit includes their two-compartment tank, containing ELS-11 elements and a variety of accessories for railway car lighting. In addition to the batteries a cell-filling device, with an automatic signaling hydrometer, was shown in operation. The company was represented by Chas. Blizzard, third vice-president; G. H. Atkin, manager of Chicago office, and Messrs. J. M. S. Waring, district engineer; W. F. Bauer, W. F. Rath, H. B. Marshall, F. W. Hyde and George Neth.

AN ECONOMICAL AND EFFICIENT FORCE FOR CAR HOUSE AND SHOP OPERATORS *

An economical and efficient force for car house and shop operation should be a force thoroughly systemized in every respect and separated into departments that are also systemized in every detail of their work. In the writer's mind the most important department for the good of the operation of a street railway company is the night force, when the inspection is done at night; and this is the case with most street railway properties. The night force should be under the supervision of a thoroughly competent and broad-minded man. To be a competent night foreman a man should be brought up to this position by practical experience by taking care of each class of work that is done at night. With this experience he will be able to judge the amount of work that should be done by each man under him.

To get the best results the night foreman should rate the positions in the shop according to their importance, and he should instil into each man the importance of the position he holds and the responsibility that is on him, and also that it is in his power, to an extent, to make the operation of the road a success. This should be carried on down the line from the best position to the one of the least importance. Any shortcomings of the workmen should be brought to their attention at once and he should get a report each night of the trouble that has shown up during the day on the cars for which he is responsible. Each man should know that he is performing the part for which he is held responsible, and that upon the efficiency of his work depends the successful operation of that part.

In employing new men for shop work they should be thoroughly instructed as to what they are to do. It should be explained to them that they will have to start at the bottom, in case they are inexperienced, and that they will gradually be promoted to better positions and better pay as they become familiar with the work, and that the rate of promotion will be governed by their interest and good work.

If the foreman should adopt this system and put all of his new men through the different classes of work that are done at night he will gradually be surrounded by a class of men who are termed as "all-around" street car men. This will enable the foreman to be more independent than if he should employ a man and keep him on one job indefinitely. The writer has known of cases of this kind, where a shop was operated by a so-called good lot of men but there were no two men in the shop who could exchange places and give any degree of satisfaction until they had become familiar with the work of the other. This, as can be readily seen, will place the foreman in an embarrassing position in case he should have a man, or a number of men, off and have to arrange the force to suit the conditions. The particular job to be filled would not receive the proper attention in the absence of the regular man, even if it were possible to fill the vacancy.

To the writer's mind the best results can be obtained by classifying the men and encouraging them to take all the interest possible in the work and letting them know that they will be promoted to better positions and better pay. With these conditions the most reliable men can be selected for promotion. If a force of men are thoroughly familiar with all classes of work, and have had practical experience in each department, they may be of invaluable service to a new employee, as well as to the foreman and company.

In the writer's mind it is more necessary to have a good, competent night foreman than a good, competent day foreman, in case it is not possible to have both, as it is possible for the master mechanic to stay in closer touch with the operation of the day force.

To get the best results all operating cars should be put over the pits and thoroughly inspected every night (or day in case of all night cars). The pit inspectors should each have certain pits to work in and certain cars to inspect, and the same cars each night. They can be held responsible for their work in this manner, and it makes it possible to tell who is not keeping his work up to the standard. Where the pit room is limited, it is impracticable to hold the cars over the pit for any considerable length of time when the cars are coming in off their runs; in case more work is required than can be quickly disposed of, it is best to shift such cars to storage tracks and put them over the pits for such work as is necessary after the rush is over, or it may be necessary to hold it over for the day force.

The writer has under his supervision the care of 45 double-truck quadruple equipments and 109 double equipments handled and inspected in the above manner in one car house, having eight pits 200 ft. long. The inspecting and cleaning is done by thirty-three men. The average number of cars in the shop for repairs during the day does not exceed 5 per cent of the operating equipment. It may be added that a record of inspection of each part of each car is made by the several inspectors and filed in the master mechanic's office.

The method of educating and handling night men holds good for the day force in the same manner as it does for the night men. The day force should be divided into departments which should be governed by the number of cars operated. The machine shop and car house should be divided into departments, having a competent, economical and broad-minded foreman for each department, who should report to the general foreman. There should be a foreman for the carpenter shop and a foreman for the paint shop who should report direct to the master mechanic. The number and class of men in these departments should be governed by the class and amount of work that is being done.

This system in a car shop, together with a wide-awake foreman in each department and a master mechanic who never ceases trying to bring his men up to a higher standard, will produce excellent results, but it cannot be kept up to what it should be by the master mechanic only putting in office hours with his men.

* Paper read before the June, 1906, meeting of the Newman Properties Association by A. D. McWhorter, Master Mechanic of the Memphis Street Railway Company.

TURBO UNITS OF 10,000 KW. FOR BROOKLYN

Details are now available of the contract placed by the Brooklyn Rapid Transit Company through the Transit Development Company for additional turbine units for installation in the addition to the company's Kent Avenue plant, as briefly mentioned in the STREET RAILWAY JOURNAL for Dec. 15, 1906. Not only is this the largest single order ever placed for turbines, but the units are the largest so far on record. Besides the five 10,000-kw units before mentioned the order includes a large amount of converting, transforming and controlling apparatus, all to be manufactured by the Westinghouse interests.

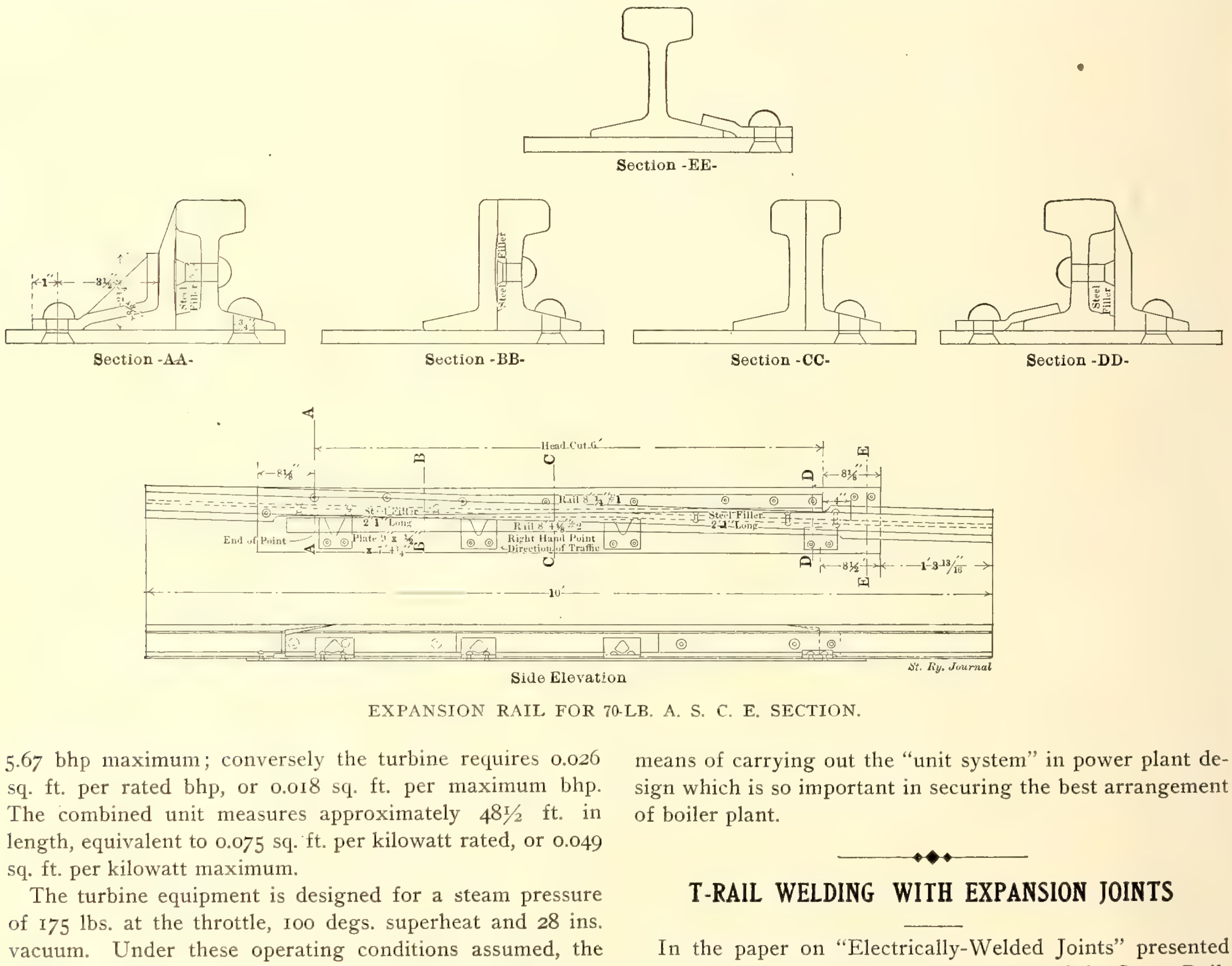
In compactness, the unit establishes a new standard. Over all the turbine measures 24½ ft. in length, 15 ft. in width, and 12¼ ft. in height above the floor level. This is equivalent to 3.8 bhp (rated) per square foot occupied, or 5.67 bhp maximum; conversely the turbine requires 0.026 sq. ft. per rated bhp, or 0.018 sq. ft. per maximum bhp. The combined unit measures approximately 48½ ft. in length, equivalent to 0.075 sq. ft. per kilowatt rated, or 0.049 sq. ft. per kilowatt maximum.

The turbine equipment is designed for a steam pressure of 175 lbs. at the throttle, 100 degs. superheat and 28 ins. vacuum. Under these operating conditions assumed, the units are capable of sustaining their full rated load continuously with a temperature rise of 35 degs. C. with power factor ranging from 90 to 100 per cent. In the event of loss of vacuum, accidental or otherwise, the turbines will automatically "go to high pressure," carrying their full rated load without the assistance of a condenser. This feature will be obtained through the use of a secondary admission valve of construction similar to the primary valve and operated by the governor in such a manner as automatically to come into operation when the overload upon the machine reaches a certain point. The action of this valve is to raise the pressures in the various stages and thus increase the capacity of the machine.

Speed variation may be adjusted to a nicety by a distant control mechanism attached to the governor and operated from the switchboard. Close regulation may be obtained if desired when running alone, and when running in parallel with other machines the regulation may be changed to 3 per cent or 4 per cent if found desirable.

In the construction of the generator the standard rotating field design will be employed with frame entirely enclosed so as to facilitate forced ventilation and incidentally obviate the noise emanating from high-speed turbines. Current may be delivered at 6600 or 11,000 volts according to the method of connecting the windings.

In spite of the compactness of these large units, the surface condenser will be located, as usual, directly beneath in the power house basement, together with all of the condensing auxiliaries, thus giving a clear engine room floor. This arrangement likewise permits of the most effective means of carrying out the "unit system" in power plant design which is so important in securing the best arrangement of boiler plant.



EXPANSION RAIL FOR 70-LB. A. S. C. E. SECTION.

T-RAIL WELDING WITH EXPANSION JOINTS

In the paper on "Electrically-Welded Joints" presented by P. Ney Wilson at the Jan. 11 meeting of the Street Railway Association of the State of New York, he mentioned that the Lorain Steel Company had recently welded T-rails with expansion joints, and presented a blue print from which the accompanying cut was made. The first T-rail which the company welded, in which expansion joints were used, was in Brooklyn, on 1000 ft. of old 65-lb. rail on the West End Line to Coney Island, in October, 1905. Only one rail was welded, and ordinary split switch points were used at the ends of the 1000-ft. section. During the summer of 1906 the company welded about 2 miles of third rail on the Canarsie extension of the Brooklyn elevated lines. This was 85-lb. A. S. C. E. rail and was welded up in sec-

tions 1000 ft. long with nosings at the ends. The company also welded the new rail on the north and south roadways of the Brooklyn Bridge when the track was renewed last October. In this case five expansion joints, of a type similar to the Lorain, were used in each rail. The longest stretch of T-rail welded is about 6 miles on the River Point Line at Providence, R. I. In this expansion joints were furnished every 1000 ft.

The joint shown herewith is an improvement on the type used in Providence, which had a number of separate plates for holding the two rails together, instead of one plate extending the full length of the bevel cut. It is considered that this form of joint should give excellent satisfaction, in view of the fact that there is no thrust against the point rail as in the case of a split switch, so there will be no great amount of wear against the point.

So far the results on all the T-rail welded have been very satisfactory. In Brooklyn there have been no breaks at all and out of 1500 joints in Providence there have been but two breaks, which were plainly due to old fractures in the rails.

PROGRESS ON ELECTRIC ENGINEERING BUILDING OF THE WORCESTER POLYTECHNIC INSTITUTE

The construction of the new electrical engineering building of the Worcester Polytechnic Institute is well advanced and the building is expected to be ready for the accommodation of students during the spring of 1907. As previously noted in the STREET RAILWAY JOURNAL, the cost, exclusive of equipment, will be about $125,000. The ground floor will contain recitation rooms, special high-potential laboratories, etc. The feature of the building is the general laboratory. This will be some 200 ft. in length and 55 ft. wide and will contain three galleries. This laboratory will be served by a 10-ton electric traveling crane covering the entire central portion of the laboratory between the galleries. The galleries will be served by an 8-ton trolley hoist covering their entire length. In the east wing on the main floor will be located the department offices and the library and reading room with a capacity of more than 3000 volumes. In the west wing will be located a lecture hall with a seating capacity of 300 persons. In the east wing above the department library and offices will be located the electrical engineering design room, blue print room, recitation room and offices. Power for the new building will be supplied at 220 volts from the power laboratory of the institute, where have recently been installed three series units which are in charge of the electrical engineering department.

Besides the general equipment of generators, motors, transformers and other apparatus there will be provided a complete equipment of electric railway apparatus, partly of standard equipment and partly of special design. Two tracks connecting with the local street way system and in that way with the suburban and interurban railways of New England will afford ample facilities for tests of electric railway apparatus. One of these tracks will in fact be fitted with a pit for its entire length, so as to offer facilities for inspection of motor equipments. The second track enters a test plant. Here will be provided facilities for dynamometer and other tests. There will be provided for the use of the student a complete double-truck four-motor interurban car, fully equipped with special apparatus and available for test work either upon the stand in the laboratory or on the electric lines with which the laboratory tracks connect. Besides the equipment mounted on the car the laboratory will contain various types of motors, brakes, control and signal apparatus.

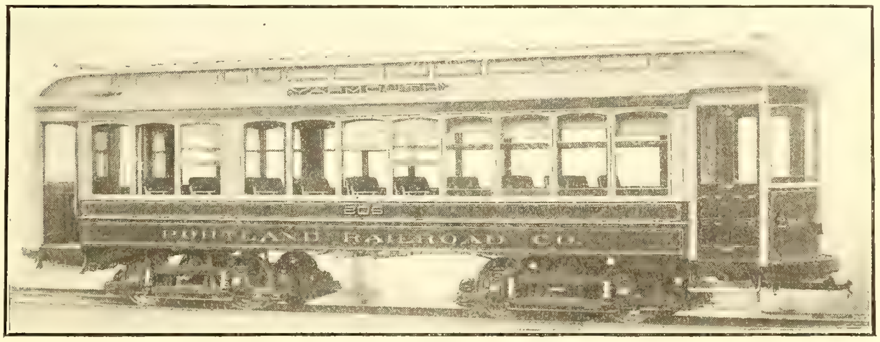
The building was planned by members of the department of electrical engineering at the Institute. Messrs. Peabody & Stearns, of Boston, are the architects, and Prof. A. W. French, of the department of civil engineering, the consulting engineer and superintendent of construction.

NEW COMBINATION CARS FOR PORTLAND, MAINE

A notable addition to the rolling stock of the Portland Railroad Company is a number of combination passenger and smoking cars built by the J. G. Brill Company, and including that company's grooveless-post semi-convertible window system. This lot of cars follows closely on a con-

INTERIOR OF COMBINED PASSENGER AND SMOKING CAR FOR PORTLAND

signment of four double-truck closed cars which lately left the works of the John Stephenson Company. Brill semi-convertibles are largely used on the Portland Railway Company's system, and are found to be particularly well adapted for handling the big excursion travel to the many nearby resorts. The new combination cars will run over the Yarmouth division. They are mounted on No. 27-E1 trucks with a wheel base of 6 ft. The interiors are of mahogany;



EXTERIOR OF PORTLAND CAR

ceilings of quartered oak. The company is a large user of plush covering for seating purposes and the cars in the present instance were upholstered in this manner. Arm rests are provided. The chief dimensions are: Length over end panels, 31 ft. 8 ins., and over vestibules, 41 ft. 1 in.; width over sills, including sheathing, 7 ft. 8½ ins.; over posts at belt, 8 ft.; the side sills are 4 ins. x 7¾ ins.; end sills, 5¼ ins. x 6⅞ ins.; sill plates, ⅜ in. x 12 ins.

FINANCIAL INTELLIGENCE

WALL STREET, Jan. 23, 1907.

The Money Market

Increasing ease characterized the local money market in all its branches during the past week. The unusually heavy inflow of money from all parts of the country was reflected in a much freer offering of funds for all maturities, and this, together with a much smaller demand resulting from the heavy liquidation in the securities market, caused rates for both call and time loans to recede sharply. Money on call was in abundant supply at from 4½ to 2 per cent, the latter figure being the lowest point reached in nearly a year. Time loan rates declined ½ per cent for all periods extending from sixty days to six months, accommodations for the short dates being obtainable at 5 per cent, while six months' money was offered in quantity at 5½ per cent. Mercantile paper reflected the lower rates for time money, sales of exceptionally good names being made as low as 5½ per cent. The general market quotation, however, was about 5¾ and 6 per cent. Specialists in mercantile paper reported a better inquiry on the part of the New York banks and also at all of the leading interior points. The position of the banks has been materially strengthened by a further heavy return movement from the interior, the gain from this source and from the Government amounting to more than $18,000,000 during the week ending Jan. 19. Since that time the local institutions have gained $1,559,000 from the Sub-Treasury, not including $1,000,000 transferred to this city from San Francisco. All indications point a continued heavy influx of money from the interior for some weeks to come, but at the same time the opinion prevails that no further reduction in rates will be made at this time. It is pointed out that on Feb. 1 the national banks will be called upon to repay to the Federal Treasury part of the special deposits made by Secretary Shaw several months ago, and in addition to this the demand for money from railroads and other corporations will be sufficiently large to maintain rates at the present level. On Feb. 1 the city of New York will offer for sale $30,000,000 bonds, which also must be provided for. During the week announcements have been made of further borrowings by some of the larger railroads, the most important of which was that of the Southern Railway Company, which placed $15,000,000 three-year 5 per cent notes, all of which were taken by a well-known banking house at 97 and interest. The European markets have improved considerably. Following the reduction in the Bank of England discount rate to 5 per cent the Imperial Bank of Germany announces a reduction in its discount rate from 7 to 6 per cent, the former rate having been in force since Dec. 18 last. The market for sterling exchange has ruled firm, owing to the ease in the local money market, but rates have not changed appreciably.

The bank statement published on last Saturday made an extremely favorable exhibit; loans increased $15,148,600, due largely to the transfers of loans from Europe to New York. The increase in cash was $18,198,000. The reserve required was $8,378,000 larger than in the preceding week, which, deducted from the gain in cash, resulted in an increase in the surplus of $9,820,000. The surplus now stands at $18,460,700, and compares very favorably with the surplus reserves in the corresponding periods of former years. In 1906 the surplus was $16,764,575; in 1905, $23,733,800; in 1904, $26,072,675; in 1903, $26,414,975 and 1902, $25,332,400; in 1901, $27,256,600, and in 1900, $24,185,675.

The Stock Market

Transactions on the Stock Exchange assumed much larger proportions during the past week, but the increased activity was generally at the expense of values. Such favorable factors as a further pronounced relaxation in rates for money both here and abroad, the continued heavy earnings reported by the railroad companies, and a further advance in the price of copper metal, were entirely ignored. One of the principal influences working for lower prices was the apprehension in some quarters that the present easy condition of the money market would be only temporary, and that the requirements of the railroads for new equipment, etc., might result in higher interest charges for all classes of accommodations in the near future. This, together with rumors of the serious illness of a prominent financier, resulted in heavy selling by the professional element and forced liquidation by some of the pools, which carried prices materially below those prevailing at the close of last week. The Erie issues were weak on reports that the company would enter the money market as a borrower, coupled with the statement that the underwriting syndicate of the Erie "B" bonds had been dissolved and that the members had been compelled to take the greater portion of the issue. The failure of the Amalgamated Copper directors to increase the dividend rate caused a sharp decline in the price of the Copper stocks, and rumors that the dividend on United States Steel common would not be changed influenced considerable selling of the iron and steel shares. Toward the close of the week prices recovered somewhat, but the market was in a very unsettled condition. The Hill stocks were well supported throughout the week, and St. Paul, Union and Southern Pacific were conspicuously strong. The announcement of the decision of Judge Harlan in restraining the Great Northern from issuing $60,000,000 of new stock until such time as the company may secure the approval of the State Railway Commission, caused a decline of several points in the Great Northern and Northern Pacific stocks. The technical position of the market has been greatly improved by the heavy liquidations, and a recovery in prices is warranted, or short covering, if nothing else. Saturday's bank statement was a remarkably good one, showing an increase in cash of more than $18,000,000, a record which has seldom been exceeded in any one week. The reductions in the official discount rates by the Bank of England and the Imperial Bank of Germany reflects the easier monetary conditions abroad, and will no doubt tend to partially offset whatever hardening there may be in money rates here.

The local traction stocks have been in line with the general market. Interborough and Brooklyn Rapid Transit were under pressure at times and yielded sharply, but in the late trading there were substantial recoveries. It is expected that the advertisements for the construction of the subway loop between the Brooklyn and Williamsburg Bridges will appear within two months. It is understood that the Brooklyn Rapid Transit has offered to pay 4 per cent for the privilege of running their cars through the loop; 3 per cent of which will go to pay the interest on the bonds, and the other 1 per cent to go to the Sinking Fund, as required by law.

Philadelphia

Dealings in the local traction shares assumed much larger proportions during the past week, and were attended with sharp recovery in prices for all of the active issues. The weakness which characterized the market on the closing days of last week was still in evidence at the beginning of the current week, but at the close the announcement of a settlement of the traction controversy was the signal for general buying which advanced prices sharply. The plan, among other things, provides for an assessment of $20 a share on Philadelphia Rapid Transit, thus making the stock full paid, payments to be extended over a period of two years. This will give the company about $12,000,000 for completion of the Market Street subway and extensions. Philadelphia Rapid Transit stock was the overshadowing feature of the trading, about 35,000 shares changing hands. After a weak opening at 19½, the price moved up to 20⅞, but at the close there was a further advance to 24. The improvement was extended to Union Traction, which rose from 54½ to 60⅜ on the exchange of about 1400 shares. The other traction issues were extremely quiet and without important price changes. Transactions included Consolidated Traction of New Jersey at 76¼ and 76, Indianapolis Street Railway at 115, Philadelphia Traction at 94 to 96, Philadelphia Company at 46¾ and 47½, Philadelphia Company preferred at 47½, Frankfort & Southwark Passenger at 420 and American Railways at 50¾.

Baltimore

Trading in the traction issues at Baltimore was rather quiet, but prices generally held firm. United Railway incomes furnished the principal feature in point of activity, upwards of $75,000 changing hands at 58¾ and 58½. United Railways 4s sold at 89¾ and 90 for small amounts, and an odd lot of the free stock brought 13. Norfolk Railway & Light 5s were a shade firmer, $10,000 selling at 98 and 98¼. Other sales included Baltimore City Passenger 5s at 103¾, Macon Railway & Light 5s at 95½, Knoxville Traction 5s at 106¾, and Richmond Traction 5s at 105¾.

Other Traction Securities

The most important development in the Chicago tractions was the action of the directors of the Metropolitan West Side Elevated in resuming dividend payments on the preferred stock. On Monday the board declared a regular quarterly dividend of three-quarters of 1 per cent on the preferred stock, payable on March 30. This is the first dividend declared by the company on the preferred stock since Feb. 28, 1903, when 1½ per cent was paid for the half-year. The annual meeting of the company will be held on April 4. The transfer books will close on March 21, and will reopen on April 5. Trading was extremely dull and uninteresting, the stocks of the various surface lines being entirely neglected. Metropolitan Elevated common brought 27 and 27½, while the preferred stock fluctuated between 71¾ and 70½. The extension bonds were active at 84 and 84½. South Side Elevated brought 89½. The Boston market was decidedly irregular. Boston & Worcester common, after selling at 26½, dropped to 25 and then recovered to 25½. About 1000 shares were traded in. Massachusetts Electric advanced from 19 to 20, but later lost all of the gain, while the preferred stock, after changing hands at 70, dropped to 68. West End common sold at prices ranging from 90½ to 92⅛, and the preferred sold at 108 and 107.

Cleveland Electric continued to be a feature of interest on the Cleveland Stock Exchange the past week. The figures varied several points at different times, but did not show any tendency to return to their place before the holding plan was suggested. Washington, Baltimore & Annapolis stands at about the same figure, with closing quotations Tuesday of 11 bid and 12 asked on the stock-pooling certificates. Syracuse Rapid Transit 5s had some inquiries during the week, closing at 96 bid and 101 asked; Cleveland Electric 68 bid, 70 asked.

Security Quotations

The following table shows the present bid quotations for the leading traction stocks, and the active bonds, as compared with last week:

	Jan. 16	Jan. 23
American Railways	51	50½
Boston Elevated	a151	151
Brooklyn Rapid Transit	81	76⅝
Chicago City	160	160
Chicago Union Traction (common)	5½	5
Chicago Union Traction (preferred)	17¼	17
Cleveland Electric	71	68
Consolidated Traction of New Jersey	75½	75½
Detroit United	80	80
Interborough-Metropolitan	36¼	36½
Interborough Metropolitan (preferred)	73½	72½
International Traction (common)	a62	a62
International Traction (preferred), 4s	82½	82
Manhattan Railway	142¾	142½
Massachusetts Electric Cos. (common)	19	19
Massachusetts Electric Cos. (preferred)	69½	68¾
Metropolitan Elevated, Chicago (common)	27	29
Metropolitan Elevated, Chicago (preferred)	70	70
Metropolitan Street	105½	—
North American	89	85½
North Jersey Street Railway	40	40
Philadelphia Company (common)	46¾	46½
Philadelphia Rapid Transit	19¼	22⅞
Philadelphia Traction	94	95¾
Public Service Corporation certificates	67	67
Public Service Corporation 5 per cent notes	96	96
South Side Elevated (Chicago)	89	85
Third Avenue	121	116
Twin City, Minneapolis (common)	107½	105
Union Traction (Philadelphia)	55¾	59½

a Asked.

Metals

The "Iron Age" says, there is distinct evidence, notably in the New York market, of eagerness on the part of some sellers of pig iron to secure business for spot and for early delivery, and the market is weaker, with lower prices accepted for what little business there is. Unless weather conditions prove adverse, there is the prospect that the famine is over. It appears, too, as though shipments from the Birmingham district are improving, at least to tidewater markets. Buying for delivery during the second half has continued on quite a good scale. Sales of steel rails aggregate about 75,000 tons during the week. The outlook for structural material is promising.

Copper metal continues strong, at a further advance of ¼c a pound for all grades. The new quotations are: Lake, 24¾c to 25c; electrolytic, 24½c to 24¾c; castings, 24¼c to 24½c.

EMBARGO ON ELECTRICS RAISED BY STEAM LINES

The statement was made in Chicago Jan. 19 that the steam railroads in the territory of the Central Passenger Association have decided to discontinue their boycott against their electric competitors, and that as a result of a conference with D. G. Edwards, vice-president of the Schoepf properties in Indiana and Ohio, having about 1200 miles of track, the passenger officials of the steam roads have decided to abrogate their agreement not to interchange traffic with electric lines. The electric lines had agreed to notify the Interstate Commerce Commission of the boycott declared against them by the steam roads, and ask that body to enforce that section of the act to regulate commerce which requires all carriers to interchange traffic.

T. P. SHONTS ELECTED PRESIDENT OF THE METROPOLITAN-INTERBOROUGH COMPANY—OTHER CHANGES

The Interborough-Metropolitan Company, of New York, announced Wednesday afternoon, Jan. 23, that it had secured, with the consent of President Roosevelt, the services of Theodore P. Shonts, chairman of the Isthmian Canal Commission, who will come to New York and take the presidency of the Interborough-Metropolitan Company, assuming charge of the whole subject of transportation now covered and to be covered by the constituent companies of the system. This has been accomplished by Mr. Belmont because he felt that the subject was one to which a man must give his entire time and undivided attention, his large business interests making that impossible. Mr. Belmont, however, will become the chairman of the board of directors, and the company will have the benefit of his general supervision and co-operation. Mr. Belmont in like manner and for the same reason has taken the chairmanship of the board of the Interborough Rapid Transit Company, and Mr. Bryan has been elected president, Mr. Bryan and Mr. Vreeland thus continuing to be the chief operating officers in charge of the two principal companies. John B. McDonald has been elected vice-president of the Interborough-Metropolitan Company, to have general supervision of the construction of new subways.

Mr. Shonts, when appointed to the position of chairman of the Canal Commission, was president of the Toledo, St. Louis & Western Railroad, a place he had taken only a year before. He had gone into the executive control of the Clover Leaf Railroad after more than twenty years of service with the Indiana, Illinois & Iowa Railroad, during which his reputation as a railroad man was established. When he became chairman of the Canal Commission he continued to hold his place as executive head of the Clover Leaf for some time. Mr. Shonts will, at present, give as much attention to the affairs of the Interborough Company as his time will permit, and after March 4, when the president will definitely release him, he will come to New York and enter actively upon his duties.

PENNSYLVANIA'S GOVERNOR ON THE ELECTRIC RAILWAYS—SOME PROPOSED LEGISLATION

A number of the expected measures affecting electric railway interests in Pennsylvania have reached the Legislature. In connection with them, one thing is certain; this is, that all reasonable measures will receive the support of Governor Edwin S. Stuart, who was inaugurated Jan. 15. In his inaugural address, Governor Stuart went on record as favoring certain legislation for the electric companies, as evidenced in the following extracts:

"I most earnestly recommend the enactment of legislation to confer upon trolley companies, under proper supervision and control, the right to carry freight. The early passage of a bill to this effect is most desirable. Such a law will enable the farmer to market his products more cheaply, and will enhance the value of countless farms through reduced expenses and increases facilities."

Concerning the proposal to confer upon trolley companies right of eminent domain, the Governor says: "Properly guarded, the exercise of such power may be highly advantageous to the public. It has its dangers, which must be carefully looked into and avoided as far as possible. If by this means it is made more practicable for future trolley lines to avoid the public highway and build over private property, a double purpose will be served. It will protect and maintain free roads for the unrestricted use of the public, while making travel on such roads safer for the driving community. This subject is submitted for the thoughtful consideration of the Legislature."

On the subject of rate discrimination he says: "Another important question which confronts the Legislature is the propriety or necessity of creating a State Railway Commission, to prevent discrimination or favoritism by common carriers within the State, with powers similar to those conferred upon the Inter-State Commerce Commission for the regulation of inter-State transportation, or such other powers as the General Assembly may designate. This tribunal would be useful in promoting needed facilities, remedying abuses and adjudicating all State questions touching transportation.

"In the preparation of legislation upon this subject care should be exercised to keep within legitimate limits. I do not believe that it is the intention or desire of the people of the State unnecessarily to harrass, annoy, or attempt to destroy corporations; for these have their rights under the law the same as individuals, and those rights must be respected.

"It should be our purpose not to attempt to destroy or tear down, but to regulate. In other words, corporations receiving rights and powers from the State should be compelled to exercise those rights and powers, not for their own benefit solely, but in the interest and for the accommodation of the public from whom they receive their charters."

The Governor "most earnestly recommends legislation that will secure a rate not exceeding 2 cents per mile upon all railroads within the Commonwealth, and such further legislation as will require the sale of mileage books at a rate not exceeding 2 cents a mile, without the requirement of a $10 deposit, and without any other obnoxious regulation or restriction attached."

Measures affecting transportation corporations have already been introduced as follows:

Providing for a maximum charge of 2 cents per mile on all railroads of the State, the maximum charge for children under twelve years of age to be 1 cent per mile, and free transportation for children under six years of age, when accompanied by a person paying fare. All tickets must be good until used and on any train scheduled to stop at the station for which ticket has been purchased. Excursion tickets may be limited as to time of expiration.

Providing for the creation of a Board of State Railroad Commissioners, which shall have authority to supervise all carrying companies and to make thorough investigations into the acts of all such companies in the State.

Providing for the regulation of rates of transportation of freight on railroads and prohibiting discrimination in rates for long and short hauls. The State Grange (an agricultural organization) is backing this measure.

Providing for the proper sanitation of railway cars.

Providing that any street railway company or any traction motor company, which has leased any street railways wholly or in part, shall be permitted to carry freight and to charge a reasonable compensation therefor. All limitations of charters on this subject are repealed in this bill, the only provision being that the act is subject to the regulations of municipal councils.

Requiring railroad companies to publish their train schedules in at least three newspapers in each county they traverse.

Providing for the enlargement of the powers of Common Pleas Courts or Courts of Equity, to decree the forfeiture of rights and privileges of any corporation occupying any highway whenever the company shall have "violated, neglected or failed to keep any of the conditions, stipulations or agreements imposed, or under, or upon which the consent of a municipality to occupy highways was given or obtained." The same course of action is provided by the measure if any public service corporation shall fail or refuse "to properly perform any of the corporation functions, obligations or duties for which it was incorporated, or the duties which are essential to the service for which it was organized." The court can either decree forfeiture or fix a time for corporations to comply with their obligations, the decree not to affect charter rights or franchises.

Providing for the taxation of corporations to the extent of 10 mills upon each dollar of the actual value of whole capital stock of all kinds, one-half the revenue obtained to be returned to the various counties for support of schools and the relief of local taxation.

Providing that corporations shall be held responsible in damages for personal injury to an employee, when such employee had exercised due care at the time of the accident, and when such accident is caused by any defect in machinery used. That all persons in control of signals, switches, locomotives, trains or telegraph offices at the time of accident shall be deemed "vice principals," and that where any fact of defect in arrangements or machinery is shown, it shall be taken as prima facie evidence of neglect.

Requiring transportation companies to equip their cars with enclosed vestibules for the better protection of employees in cold and inclement weather.

THE PLANS FOR A FOUR-TRACK LINE BETWEEN BUFFALO AND NIAGARA

Henry J. Pierce, president of the International Railway Company, is quoted as follows regarding the Frontier Electric Railway, a subsidiary of the International Company.

"The Frontier Electric Railway Company has been organized as a subsidiary company of the International Railway Company, which will own all of its stock. The new company will construct a modern high-speed, double-track electric railway, mainly on its own right of way, from Buffalo to the entrance of the new bridge, for which charters have already been obtained from the State of New York and the Dominion of Canada, and which will be built over the Niagara River, the American approach of which will be at the foot of Niagara Street, in Niagara Falls, N. Y. It is proposed to double-track the existing line between Lockport and Tonawanda, not only to take care of the ever-increasing traffic from Lockport to Buffalo and Niagara Falls, but also to provide for the very large increase in traffic which will immediately follow the completion of the electric railway now being constructed between Rochester, Brockport, Medina, Albion, Middleport and Lockport.

"The new railway company will also make connection at the new bridge at Niagara Falls with the fast electric railroad owned by the Mackenzie-Mann-Nicholls syndicate, running from Toronto through Hamilton to Niagara Falls, the rights of way for which have been acquired and the contracts for the construction of which are now about to be let. Upon the completion of the new line between Buffalo and Niagara Falls, the International system will have the only four-track interurban electric railway in the world. It will only be a matter of months when passengers from Toronto and Hamilton and from Dunkirk and Erie will be brought without change of cars into the heart of the city of Buffalo."

The Trans-Niagara Bridge Company was incorporated at Albany early last year with $1,000,000 authorized capital stock, to construct the aforesaid bridge across the river at Niagara Falls, 300 ft. below the present upper steel arch bridge. The bridge, it is said, will cost about $800,000.

RIGHTS SOUGHT TO OPERATE IN ST. LOUIS

The Central Interurban Traction Company was incorporated Friday, Jan. 18, and immediately asked the Municipal Assembly for a franchise to operate a 3-cent fare system in St. Louis. The capital stock of the company, as shown by the incorporation papers, is $50,000. The incorporators are Charles A. Gutke, formerly a member of the House of Delegates, who owns 460 of the 500 shares; Lee A. Hall, an attorney, ten shares; John A. Laird, an engineer, formerly connected with the water department, ten shares; Samuel J. Will, of Jefferson Barracks Station, ten shares, and John G. Clark, of New York, ten shares. Mr. Laird, speaking for the company, said the railway for which a franchise was asked was expected to form a connection for the Hillsboro, Kimmswick & Northern Railway, of which Mr. Gutke is president, and which received a franchise Thursday, Jan. 17, from the St. Louis County Court to run an electric railway on the Lemay Ferry Road, south from the city limits.

The bill to grant the franchise was introduced by Andrew Gazzole, Jr. He declared that a man he had never seen before accosted him in the chamber of the House before the meeting, handed him the bill and asked him, as chairman of the railroad committee, to introduce it. Besides the clause providing for eight adults tickets for 25 cents it is stipulated that six children's tickets shall be sold for 10 cents.

The railroad agrees to build a new viaduct across the Mill Creek Valley at Ewing Avenue, and to turn it over to the city for public use, and to build a bridge over the River Des Peres, near the southern limits of the city, under similar conditions. After Jan. 1, 1935, the city can buy the road, if it wishes, on an agreed valuation by appraisers appointed for both sides. In addition the company offers $250,000 for the franchise.

The route of the railroad as set forth in the bill brings it into St. Louis by the bridge over the River Des Peres. The road is to be confined to the southern end of the city, running no further north than Wash Street. It is to go no further west than Morganford Road in the South Side, or than Ewing Avenue in the central part of the city.

CLEVELAND & SOUTHWESTERN MEETING—CHANGE OF NAME

At the annual meeting of the Cleveland & Southwestern Traction directors at Berea last week, action was taken resulting in a change of the name of the new merger company from the Cleveland & Southwestern Railway Company to the Cleveland, Southwestern & Columbus Railway Company, indicating that the intention is eventually to build the road into the Capital City or make such connections as will insure a through route. With the Cleveland, Ashland & Mansfield built, the company will be able to reach Bucyrus, to which an extension of Columbus, Delaware & Marion is now being constructed. It seems that this would probably be the best route that could be chosen, on account of the amount of building already done, but it is not known whether the two companies will be able to co-operate or not, or whether the Cleveland, Southwestern & Columbus could secure the line by lease or purchase. If the company should decide to build a line a shorter route would be from its southern terminus, Wooster, through Mt. Vernon to Newark, where some arrangement might be made with the Indiana, Columbus & Eastern, or from Mansfield or a point near there on the new line under construction through Mt. Vernon to Newark, or from Mansfield through Mt. Gilead and Delaware to Columbus. And one of the three would make a direct line for fast passenger and freight service.

In the organization of the new company provision was made for $5,000,000 bonds more than needed for the consolidation. At the time it was said that these bonds would be retained in the treasury for future extension, but the directors probably had the plan just mentioned in view when the provision was made. President Pomeroy has refused to say anything in detail, more than the change in name would indicate, so the intentions of the officers and directors cannot be ascertained at this time.

The report of the president showed gross receipts of $645,849.95, a gain of $102,623.20 over 1905. The operating expenses were $363,856.39, leaving net receipts of $281,993.56, showing a gain of $53,020.65. Deducting taxes and interest leaves $102,741.86 for stock, a gain of $26,461.64 over the previous year. In his report President Pomeroy referred to the reorganization and the fact that the company was about to enter upon a broader field of activity, but did not say anything about the change of name.

The officers were re-elected as follows: President, F. T. Pomeroy; vice-president, A. E. Akins; second vice-president, S. C. Smith; secretary, E. F. Snyder; treasurer, J. O. Wilson; assistant secretary, H. B. Cavanaugh. C. N. Wilcoxen was continued as general manager of the road.

B. R. T. COMPANY'S EMPLOYEES ENTERTAINMENT

The annual entertainment of the employees of the Brooklyn Rapid Transit Company, provided under the auspices of the Brooklyn Rapid Transit Benefit Association, was brought to a close this week, the last performance being given Saturday night. As heretofore, the performances were all given in the central club house at East New York, the features of which for such purposes have been described in the STREET RAILWAY JOURNAL before. This time, however, the scope of the entertainment was changed, and instead of extending over a week the performances were repeated every evening for two weeks, beginning Monday, Jan. 14, with special matinees in the afternoon. The entertainment, which was vaudeville in its nature, and included some of the best local New York talent, was absolutely free to the employees, transportation even being provided to and from the club house. The schedule of entertainment was so arranged that different departments were in attendance different nights, so as to avoid seriously taxing the accommodations. Despite inclement weather the attendance was very large, and Secretary Edwards, of the association, is well pleased with the working of the plan extending the program over two weeks. On Thursday evening of each week the regular uniformed band of employees was in attendance and rendered a program of classic and popular selections. Dancing also was a feature of these evenings, the band furnishing the dance music.

In this connection the association has announced a unique entertainment for Washington's Birthday, to be given at the East New York building. In it company talent only will appear, and, to enliven interest, prizes will be awarded to the performer who, in the eyes of competent judges, make the best showing.

HOW THE OHIO LAW REQUIRING INTERURBAN COMPANIES TO PROVIDE STATIONS WILL BE INTERPRETED

O. P. Gothlin, member of the Ohio Railroad Commission, in an interview granted a representative of the STREET RAILWAY JOURNAL, informally outlined the position of the Commission, relative to the section of the new Ohio railroad law, requiring the erection and maintenance of suitable stations at all regular stops, as applied to the interurban roads of Ohio.

He said it would be manifestly unreasonable to expect interurban roads to erect and keep properly cleaned and heated stations at all the stops they make, and for this reason it is probable that a liberal interpretation of the law in this respect will be made, should the question ever be brought before the Commission. The ruling will probably define "regular stops" as meaning the principal stops in cities, towns and villages, all other stops, at street crossings, road crossings, farms, etc., to be designated as accommodation or flag stops. In this way the interurban roads will be obliged to maintain stations only in the towns through which they pass.

A literal interpretation of the law as regards interurbans, Mr. Gothlin said, would work a special hardship on roads that are required to make frequent stops at farms and road crossings by the terms of their franchises. Other interurban roads, that are not bound by such franchise requirements, would necessarily cut out a great many of the stops that they now make, and this would work a hardship and inconvenience to farmers and others who depend upon these roads to get to and from neighboring towns. Many of the interurban roads are voluntarily erecting small shelter houses at road crossings and other country stops.

Mr. Gothlin said the question of whether or not street railway companies, a portion of whose systems extend outside the municipal corporation lines, are legally under the jurisdiction of the State Railroad Commission, has not been decided. The Commission asked the Attorney-General of the State for an opinion on this subject some time ago, but has not received a reply.

MR. ANDREWS AND MR. DUPONT CONFER ON CLEVELAND QUESTIONS

President Horace E. Andrews, of the Cleveland Electric Railway Company, and President A. B. Dupont, of the Municipal Traction Company, took up the consideration of the holding company plan at a meeting in Mr. Andrews' private office last Friday, and a few hours were spent Saturday by the two gentlemen also. While there is considerable anxiety upon the part of the city administration and the people that matters be brought to a focus as soon as possible, it is clear that but little was accomplished in the time they were at work, more than to map out a plan of operation. Secretary H. J. Davies, of the Cleveland Electric, was confined to his home all of last week by illness, and it was announced Saturday that not much could be done until he was able to return and furnish data for consideration.

The belief seems to prevail that the Cleveland Electric will refuse to consider a holding proposition on a stock valuation of less than 70. This, including interest on outstanding bonds, would bring the rental of the system to $1,433,800 a year. With the rental on the Forest City line at $120,000 a year would increase the amount to $1,553,800. The bonds outstanding, $9,026,000, draw 5 per cent interest. It is said that the holding company may propose to issue new stock and redeem the bonds, but if this should be done there would be no profit in the operation, as 6 per cent dividends would have to be paid on the stock.

According to the interviews of Mayor Johnson in the local papers at Cleveland, he adheres to the assertion that if the holding plan is adopted upon a 3-cent fare basis, it will never be any higher. He seems to have the greatest faith in the success of the low-fare plan financially, and always states that it will pay enough money to make fair dividends possible.

It is quite probable that little news will be made public regarding the progress of negotiations between Messrs. Andrews and Dupont until the work is completed. In fact, they both expressed the belief a few days ago that the publication of the matters discussed at their conferences might retard any progress they should make, or injure the success of any plans that should be adopted, until they are ready to report in detail.

BENEFIT ORGANIZATION FOR INTERBOROUGH EMPLOYEES

The Interborough Rapid Transit Company, according to an announcement issued Monday, Jan. 21, has devised for the benefit of its employees a Mutual Benefit Association, which will bestow financial aid in case of accident, sickness or death. An important feature of the proposed association is an agreement under which the company will assume the payment of any deficiency in the relief fund which may develop. Thus, the corporation undertakes to care for the welfare of its employees and their families. Mr. Bryan has estimated that the fund will amount to about $50,000 annually. The management of the association will be assumed by a superintendent and an advisory committee, in its choice of which the employees who are members of the fund and the board of directors of the company will have equal voice.

The statement sets forth that the rates of payment and the benefits are calculated upon a liberal scale. The employees are to be divided into three general classes, and their payments and benefits are to be graduated accordingly. The first class will be composed of men who receive less than $35 a month. Those who receive a monthly salary of more than $35 and less than $75 will be included in the second class. The third class will be composed of all employees receiving more than $75 a month. The monthly payments of the members will be 75 cents for the first class, $1.50 for the second class and $3 for the third class. The benefits will provide for cases of accident, sickness resulting from other causes, and for death of the members.

In the case of a motorman or conductor who is injured, the society will pay to him or to his accredited representative $2 a day for the first fifty-two weeks. A benefit of 50 cents a day will be paid by the association in cases of sickness after the termination of the first six days, and not longer than fifty-two weeks, to members of the first class. Under the same arrangement, members of the second class will receive $1 a day, and members of the third class $2. The system includes a death-benefit plan, under the terms of which the members of the first class may insure their lives to the extent of $250, those of the second class $500, and of the third $1,000. The details concerning the distribution of the relief fund will be managed by the Interborough Company. There will be no charges against the fund for this work.

The inauguration of the relief department took place on Jan. 15. In order that old employees may enter the association under the most advantageous circumstances, persons who were in the service of the Interborough at the time of inauguration will be received as members without regard to age and without physical examination until July 1, 1907. After that time a system of examination will be introduced, and, in so far as death benefits are concerned, the age of the members will be taken into consideration upon a liberal basis.

ELEVATED ROAD PROPOSED FOR RIO DE JANEIRO

One of the last acts of the retiring administration of Brazil was the granting of a seventy-year franchise to Carlos Schmidt and others, of Rio de Janeiro, for the construction of an elevated railroad to serve the city of Rio de Janeiro and its suburbs. Consul Anderson, of Rio de Janeiro, says the franchise was obtained for an American company, and represents a purely American enterprise, and present plans are that all the equipment will be purchased in the United States. The company, according to statements made by its projectors in Rio de Janeiro, was organized a short time ago in the State of South Dakota, and was capitalized at $50,000,000. Charles E. Browne, of New York City, is its president. It is planned to send engineers and technical experts to Rio de Janeiro this month to commence the preliminary work. Within four years 13-5 miles must be in operation. Plans call for about 60 miles of right of way, which is to be double-tracked throughout. The third rail electric system will be used, motive power to be derived from the company's own plant or one of the two concerns now preparing to develop water power in the mountains near Rio de Janeiro. It is planned to establish a local and a through service for the benefit of the people living in the suburbs. For its privileges the company holding the concession must pay the municipality some $16,000 per annum for the first year, $20,000 per annum for the next thirty years, and $23,000 per annum for the following thirty years.

ROUTES APPROVED FOR SUBWAY IN PITTSBURG

Upon the condition that the Pittsburg Subway Company build its entire line from downtown to the East End, the committee on routes of the Rapid Transit Commission of Pittsburg Councils has approved the original route of the company, including the downtown loop from Grant Street and Oliver Avenue, down Oliver Avenue, along Liberty Avenue, Ferry Street, Third Avenue and Grant Street, to the place of beginning.

The ordinance presented by the company to Councils and referred to the Rapid Transit Commission, provided that the company should have the right to decide whether it should build the subway beyond Center Avenue and Neville Street extension. The company, in its ordinance, also reserved the right to decide whether it should build the branch line from the main tunnel at right angles to Forbes and Brady Streets and thence to the Twenty-Second Street Bridge.

The plans adopted by the routes committee provides that the company shall be required to build not only to Center Avenue and Neville Street extension, but to the far eastern terminus at Kelly Street and the Beechwood Boulevard in the Twenty-First Ward. It also provides that the branch to the Twenty-Second Street Bridge must be built in order to provide relief for the South Side. It gives the company the option of building or not building the branch to Bouquet and Bayard Streets in the Fourteenth Ward.

The subway to the East End, according to the route laid out by the committee of the Rapid Transit Commission, will circle the downtown section, and beginning at Grant Street and Oliver Avenue, will run eastwardly almost in an air line to a point in Neville Street extension, about 130 ft. north of the north line of Center Avenue. It will run thence across intervening properties to the intersection of Center Avenue and Enfield Street; thence underground along Center Avenue clear to Frankstown Avenue; along Frankstown Avenue to the first angle east of Finley Street, and thence in a straight line to Kelley Street and the Beechwood Boulevard.

B. R. T. CONSIDERS SUBWAY LOOP IN NEW YORK

President E. W. Winter, of the Brooklyn Rapid Transit Company, had a long conference with Mayor McClellan on Monday, Jan. 21, regarding transit matters. It is understood that Mr. Winter told the Mayor that he was perfectly satisfied with the proposal to allow the Brooklyn Rapid Transit to operate its cars in the subway loop, to be built according to the McDonald plan, and stated that the only thing that was puzzling him in that regard was whether the engineers could arrange the grades so that it would be possible to run the cars off the elevated structure and into the subway. If this difficulty could be overcome, he intimated, everything would be all right, and the question of the inflammability of the company's present supply of cars, could be discussed later. It is also understood that the possible terms to be made for the franchise were discussed. The Brooklyn Rapid Transit Company hoped that the elevated loop would be built down Center Street. The opposition to the Center Street plan has been general on the New York side of the river, however.

The Board of Estimate, on Friday, Nov. 18, gave its final approval to the application made by the Nassau Railroad Company (controlled by the Brooklyn Rapid Transit) for a surface trolley system in Livingston Street, Brooklyn. The terms of the contract were referred to the Corporation Counsel for formal approval. The company agrees to pay the city 3 per cent of its gross receipts, with a surety deposit of $10,000. The tracks in Livingston Street are designed to relieve the congestion in Fulton Street, which since the beginning of construction on the subway extension has been almost unbearable. The Board authorized the issue of corporate stock to the amount of $49,000 for improvements in Livingston Street.

PROPOSED TERMINAL CHANGES IN BOSTON

Advices from Boston received last week indicate that an important project is afoot in steam railroad circles with respect to the rehabilitation of the time-honored "Providence Station" in Park Square. It is proposed to remove the New York Central and Boston & Albany trains from the present South Terminal Station, and to bring them into the Park Square property, leaving the former terminal free for the New York, New Haven & Hartford service. Legislative authority will, of course, be necessary to enable such a plan to be carried out, and the advantages and disadvantages can be thoroughly threshed over only at the public hearings which will surely follow any formal steps in the direction indicated above.

These problems of urban terminal location and operation are of no little interest to the electric railway engineer, and chiefly for two reasons. The first is the possible redistribution of local trolley and third-rail traffic in the city itself, following the creation of new steam railroad terminal facilities in any section; and the second, the possibilities of solving existing terminal problems by recourse to electrification of present steam railroad suburban service.

It is too early to balance the arguments for and against the specific proposition outlined above, for much fuller information will certainly be forthcoming if the matter is seriously pushed by the interested railroads at the present session of the Massachusetts Legislature. At the same time it is certainly the tendency of these days to consolidate rather than to separate terminal stations, and in the light of what is being done in New York, it is difficult to call to mind any suburban service problem in Boston which cannot be better solved by electrification than by adherence to the steam locomotive regime. It has long been realized by electrical engineers that the Newton-Brookline circuit of the Boston & Albany Railroad offers one of the most attractive propositions in the country for electrification. Given a double-track loop about 20 miles in length, with stations approximately a mile apart, and a dense passenger traffic through one of the most beautiful residential regions in this country, a terminal station with an underground loop specially designed and completed for suburban service, and a river paralleling nearly half the trackage, with plenty of power house sites and ample condensing water, it would seem as though electrification would have a pretty strong case. At all events, it is to be hoped that the electrical side of the question will be thoroughly aired before any decision is reached which tends to perpetuate the reign of that anachronism of the highest urban civilization—the steam locomotive.

KINGSTON PLANTS REPORTED DESTROYED

Cable despatches indicate that the power houses and lighting plants of the West India Electric Company, operating the street railway and lighting service at Kingston, have been entirely destroyed, and that the other physical property has suffered severely as a result of the disaster to the city. The company is owned almost entirely in Montreal. It has a capital of $800,000 and $600,000 of bonds. James Hutchison, of the Montreal Stock Exchange, is president.

ADDITIONAL ELECTRICAL EQUIPMENT FOR THE WEST JERSEY & SEASHORE RAILROAD

Because of the increased traffic on the Camden-Atlantic City electric trunk line it has become necessary to add to the present rolling stock some twenty-one cars. Both the new cars and the generating apparatus to care for the extra load are similar to the present equipment. Each of the cars will be driven by a GE-69 (200 hp) double-motor equipment, and will be fitted with the Sprague-General Electric type M control.

At the Westville power house a fourth 2000-kw, 6600-volt, 25 cycle, three-phase Curtis steam turbo-generator will be installed. Additional boiler capacity with the necessary condenser and feed pumps, switchboards, etc., will also form a part of the new equipment, as well as a 75-kw, 125-volt, horizontal Curtis steam turbo-generator for excitation purposes. Three extra 700-kw, air-blast transformers will step-up the generator voltage to 33,000 volts for transmission.

Six 1000-kw rotary converters will be distributed in the substations; one each at South Camden, Glassboro, Newfield, Mizpah, Atlantic City and one at the Westville power house. The accompanying air-blast transformers for these machines have a capacity of 370 kw each, three being installed with each of these rotaries. The Pennsylvania Railroad has ordered all the additional apparatus, as outlined, from the General Electric Company, which also furnished and installed the initial equipment.

NEW YORK SUBWAY CONTRACTS

The committee on plans and contracts of the Rapid Transit Commission has submitted, for the action by the full Board, a draft of the contract for the construction of the Lexington Avenue subway. This contract is drawn so as to provide two alternatives: for construction alone, and for construction, equipment and operation. The contract is prepared in accordance with the provisions of the Elsberg bill, and if approved by the corporation counsel and the Board of Estimate, will be adopted for all future routes.

The contractor is required to deposit $1,080,000 if he bids for the construction of the entire route. This is about 3½ per cent of the contract price. For part of the road the deposit will be proportionate. This deposit will be returned when the road is accepted. A bond for an amount equal to the deposit will be required, to be canceled when the contract is completed, if the contract be for construction only. If the contract be for construction, operation and equipment, the bond will be continued to secure payment of rentals. Ten per cent of all payments will be held up until the work is accepted. This means that the city will have 17 per cent of the cost of construction as security for the proper performance of the contract.

The work will be divided into seven sections, and contractors may bid for one or more sections. Adequate pipe galleries will be installed throughout the route, with the exception of two short spurs. Owing to recent legislation it will be necessary to incorporate provisions for an 8-hour day and payment of the prevailing rate of wages to employees engaged in the construction work.

The operating rental will be the interest paid by the city on its bonds issued for construction purposes, plus 1 per cent. All bonds used in acquiring rights, purchasing land, etc., will be included in making the computation for rental purposes.

The equipment will include rolling stock, power houses, electrical devices, rails, ties and ballast. The city will have a lien on this equipment in case it should decide to declare the contract forfeited.

A clause is inserted in the contract which provides that the commission may order the operating company to add rolling stock and equipment when necessary, and change methods of operation.

ST. LOUIS CAR COMPANY ORDERS IN 1906

No better index can be found to the output of a company for a year than a list of the more important contracts executed for that period. Such a summary of the work of the St. Louis Car Company of cars built for street railway and interurban use during the year just ended has been made available for the Street Railway Journal, and is necessarily indicative of a large output in other branches of the industry. The summary follows:

American Railways Company, six 20-ft. closed-motor car bodies; twenty 20-ft. closed-motor car bodies; ten 30-ft. closed-motor car bodies.

Allegheny Valley Street Railway Company, Pittsburg, Pa., nine semi-convertible car bodies.

Fort Wayne & Wabash Valley Railway Company, two cars 40 ft. 6 ins.

Boston & Northern Street Railway Company, one sample car 33 ft. 11 ins., semi-convertible.

Birmingham Railway Light & Power Company, twelve fourteen-bench open trailer cars, ten motor cars, nine double-truck closed trailer cars.

Boston Elevated Railroad Company, one hundred cars 46 ft. 2 ins.

Columbus Railway & Light Columbus, Ohio, ten twelve-bench, open-motor car bodies.

Campania Nacional de Tranvias Electrico, Lima, Peru, seven 34-ft. cars, one work car, one tank car.

Campania Tranvia Electrico Lima A'Callao, Lima, Peru, one vestibule car body, two car bodies.

Campania de Tramways Electrico Del Sud, Buenos-Aires, S. A., two vestibule passenger coaches.

Central Illinois Traction Company, ten 45-ft. interurban cars.

Coal Belt Electric Railway Company, Marion, Ill., two semi-convertible car bodies.

Central California Traction Company, four motor car bodies.

Chicago Union Traction Company, one hundred closed cars.

City & Elm Grove Railroad Company, five 34-ft. cars.

Centralia & Central City Traction Company, one car.

Dallas Consolidated Electric Railway Company, five thirteen-bench open car bodies, six 20-ft. cars.

Deka Development Company, Shawnee, Oklahoma, three 29-ft. car bodies, four twelve-bench open car bodies.

Detroit United Railways Company, three cars 41ft. 2 ins.

Elgin & Belvidere Electric Railroad Company, six interurban passenger cars.

Evansville Suburban & Newburgh Railway Company, two combination passenger and baggage.

East Shore & Suburban Railway Company, Richmond, Cal., three Los Angeles type cars.

El Paso Electric Railway Company, four California type cars.

Horatio Valdez, five double-deck cars.

Illinois Traction System, Danville, Ill., five freight and express cars, twelve cars 40 feet 6 ins., three cars 61 ft. 6 ins.

Illinois Valley Railway, La Salle, Ill., one 50-ft. baggage and express.

Knoxville Railway & Light Company, ten cars 30 ft. 5 ins.

Los Angeles Railway Company, one hundred city cars.

Los Angeles Pacific Company, twenty-five motor cars, twenty-five trailer cars.

Louisville Railway Company, fifty cars.

Metropolitan Street Railway Company, Kansas City, Mo., twenty-five cars, twenty cars 33 ft. 3½ ins.

Milwaukee Electric Railway & Light Company, twenty-five double-truck closed car bodies, thirty double-truck trail cars, ten cars.

Mexico Electric Tramway Company, four first-class funeral cars, six second-class funeral car bodies.

Metropolitan Street Railway Company, Dallas, Tex., three 36-ft. cars, six thirteen-bench open car bodies.

Michigan Traction Company, Kalamazoo, Mich., ten fourteen-bench open car bodies.

Michigan United Railways Company, ten 21 ft. semi-convertible.

Northern Texas Traction Company, three single-end car bodies, ten 22-ft. semi-convertible cars.

Northern Indiana Railway Company, South Bend, Ind., one baggage and express car body.

New Jersey & Pennsylvania Traction Company, one car body.

Ontario Construction Company, six fifteen-bench open cars.

Omaha, Lincoln & Beatrice Railway Company, one combination passenger and baggage car, one car 33 ft. 11 ins., one 20-ft. vestibule car.

Oklahoma City Railway Company, four cars.

Oriental Tramways Company, Montevideo, seventy 21-ft. cars, ten 29-ft. cars.

Puget Sound Electric Railway Company, Tacoma, Wash., two 31-ft. closed car bodies.

Pacific Electric Railway Company, Los Angeles, Cal., fifty-two interurban cars.

Philadelphia & Western Railway Company, twenty-two interurban cars.

Pittsburg Railway Company, Pittsburg, Kan., six 28-ft. cars.

Rio de Janeiro Tramway, Light & Power Company, thirty-five ten-bench open cars.

Rockford & Interurban Railway Company, Rockford, Ill, six ten-bench open cars.

Richmond & Chesapeake Bay Railroad Company, Richmond, Va., four cars, combination baggage and smoker.

Rockford & Interurban Railway Compny, four 21-ft. semi-convertible cars.

Rapid Transit Company, Dallas, Tex., two 26-ft. cars.

Seattle Electric Company, Seattle, Wash., twenty-five 30-ft. closed-motor car bodies.

St. Joseph Railway Light, Heat & Power Company, six eleven-bench open car bodies.

Stockton Electric Railroad Company, Stockton, Cal., six car bodies.

South Covington & Cincinnati Street Railway Company, ten 21-ft. semi-convertible cars.

Spokane Traction Company, seven cars 29 ft. 6 ins.

Santiago & San Bernardino Electric Railway Company, ten cars.

Schenectady Railway Company, six cars, six cars 29 ft. 6 ins.

Seattle Electric Company, fifty-two cars 43 ft. St. Clair Land & Improvement Company, one 20-ft. car.

Tacoma Railway Light & Power Company, nine semi-convertible, eight California type car bodies.

Tampa & Sulphur Springs Tramway Company, eight fifteen-bench cars.

Utah Light, Railway & Power Company, five 28-ft. cars.

United Railways of San Francisco, 250 cars, twelve interurban cars.

Whatcom County Railway & Light Company, Bellingham, Wash., two 25-ft. cars.

Washington Railway & Electric Company, Washington, D. C., forty cars.

Evansville & Mt. Vernon Electric Company, one baggage.

Erie Railroad Company, four passenger (electric); two combination passenger and baggage (electric).

PRESIDENT BEGGS OF ST. LOUIS COMPANY FAVORS A SUBWAY FOR ST. LOUIS

John I. Beggs, president of the United Railways Company, in an address before the Engineers' Club of St. Louis, on Wednesday, Jan. 15, aired his theories upon the rapid transit problem confronting the city, recommended the subway as the solution of the matter, and pointed out the physical and financial difficulties to be overcome in order to get the system. Mr. Beggs said that it is a mistaken idea to think that construction of subways is only trifle, to be settled in a few months. Mr. Beggs is quoted unofficially as having said: "If St. Louis gets a system of subways in ten years the people may be thankful. The problem is a gigantic one. As Mr. Perkins has pointed out to you, the subways of New York cost over $2,000,000 a mile, and the financing of the proposition is something that will take time. The restrictions thrown about corporate interests by the laws of your State, forbidding capitalization beyond a certain figure, make the problem still more difficult. Then there are physical problems to be overcome which will take the best engineers years to solve."

Among the present remedies suggested was a system of loops enabling part of the cars on a line to turn back without making a full trip. Mr. Beggs favored this idea, and said that it would be put in operation probably by the company.

DISTRICT COMMISSIONERS REPORT ON BILLS AFFECTING STREET RAILWAYS IN WASHINGTON

In an official report Wednesday, Jan. 16, to Chairman Babcock, of the District committee of the House, on the Wiley and Madden universal transfer bills, the District Commissioners recommended favorable action as far as transfers were concerned, but where the Madden bill provided other changes in the control of the street railways the Commissioners offered amendments. The Madden bill, aside from the universal transfers, provided a 5-minute schedule for the running of all cars within the District and the paying of 20 per cent of the gross earnings of the companies to the District in lieu of personal taxes, and the selling of twenty-five tickets for $1.

In their report the Commissioners recommended that the bill be amended so as to provide the paying of 6 per cent of the gross earnings of the companies to the District and the adoption of a 15-minute schedule throughout the District between the hours of 6 a. m. and 1 a. m., and between the hours of 1 a. m. and 6 a. m., every 60 minutes. In regard to the twenty-five tickets for $1, the Commissioners say that the present method of six tickets for 25 cents is satisfactory.

The report of the Commissioners is based principally upon a large public hearing at the District Building two weeks ago, at which the various arguments for and against the proposed measures were thoroughly discussed. They reported upon the two bills separately. The Wiley bill simply provides universal transfers, and the Commissioners, without much comment, put their stamp of approval upon it. The Madden bill was commented upon at some length by them.

EXPOSITION OF SAFETY DEVICES IN NEW YORK

The exposition of safety devices and industrial hygiene, to which reference was made in the Street Railway Journal of Jan. 12, 1907, will be held at the American Museum of Natural History, New York, in the west hall, Jan. 29 to Feb. 12, 1907, between the hours of 10 a. m. and 10 p. m. each day, under the auspices of the American Institute of Social Service of New York. The exhibits will consist of devices for safeguarding the lives and limbs of workmen and preventing accidents under the ordinary conditions of life and labor to which the general public is exposed. The exposition will consist as much as possible of "live exhibits," that is machines or devices in operation; models of actual or reduced size, and photographs. Wood and metal-working machinery; stamping, grinding, and polishing machines; presses; textiles; the building trades; safeguarded elevators, windlasses, cranes and hoisting machinery; transportation security by sea and land; safety lamps and explosives; quarrying, agricultural and chemical industries; safety from fire. The section of industrial hygiene will include improved dwellings; first aid to the injured; prevention of tuberculosis and other dread diseases harmful to the life of workmen; respirators and devices for supplying and maintaining pure air and industrial betterment. The object of the exposition is to direct the attention of American public opinion to the necessity of doing something to lessen the causes of accidents to American life and labor, by means of a permanent museum of safety devices, where all problems of safeguarding life and limb can be studied in their working details. Admission and exhibit space will be free. W. H. Tolman, 287 Fourth Avenue, New York, is director of the exposition.

A RAILWAY AND LIGHTING ASSOCIATION FOR SOUTH CAROLINA

At a meeting of the electric railway and lighting interests of South Carolina, held in Columbia last week, it was decided to organize an association to be known as the South Carolina Railway & Lighting Association, to include among its members representatives of electric railway and lighting companies throughout the State. P. H. Gadsen, of Charleston, president of the Charleston Consolidated Railway, Gas & Electric Company, was elected president of the association and instructed to prepare a constitution and by-laws. None of the other offices has as yet been filled. It is expected that a permanent organization will be effected shortly.

NEW ENGLAND STREET RAILWAY CLUB TO MEET JAN. 31

The January meeting of the New England Street Railway Club will be held at the American House, Boston, on Thursday evening, Jan. 31. A paper will be presented by Dr. C. J. H. Woodbury, of the American Telephone & Telegraph Company, entitled "The Development of the Telephone and Its Application to Railway Service." The meeting was originally arranged for last week.

UTICA & MOHAWK COMPANY SUBSIDIARIES HOLD MEETINGS

The Rochester Railway & Light Company and the associated local and suburban lines held their annual meetings last week. The stockholders' meeting of the Rochester Railway & Light Company resulted in the election of the following board of directors: Horace E. Andrews, Edward Bausch, W. C. Brown, John Carstensen, T. W. Fiucano, A. H. Harris, G. A. Hollister, A. M. Lindsay, E. V. W. Lindsay, Eugene Satterlee, John J. Stanley, Henry A. Strong, W. K. Vanderbilt, Jr., W. J. Wilgus and Charles T. Chaplin, who succeeds H. D. Walbridge. In the election of officers, J. C. Collins was changed from treasurer to secretary; E. L. Rossiter was advanced from assistant treasurer to treasurer; C. A. Tucker, secretary, to assistant treasurer, and James T. Hutchings, formerly superintendent of the electrical department, was made assistant general manager. The complete list of new officers is as follows: Horace E. Andrews, president; George A. Hollister and W. G. Vanderbilt, Jr., vice-presidents; J. C. Collins, secretary and auditor; E. L. Rossiter, treasurer; C. A. Tucker, assistant treasurer; A. L. Linn, Jr., general auditor and assistant secretary; R. M. Searle, general manager; James T. Hutchings, assistant general manager; ohn Carstensen, W. C. Brown, G. A. Hollister, W. K. Vanderbilt, Jr., and John J. Stanley, members of executive committee.

The Rochester Railway Company stockholders elected the following directors: John J. Stanley, who succeeds C. J. Bissell, and W. N. Kernan, who succeeds A. G. Hodenpyle being the new members; H. E. Andrews, W. K. Vanderbilt, Jr., E. V. W. Rossiter, John Carstensen, W. J. Wilgus, W. C. Brown, J. J. Stanley, W. N. Kernan, A. H. Harris, Y. W. Archer, C. T. Chapin, George F. Roth. The officers elected by the directors at their meeting were as follows: Horace E. Andrews, President; William K. Vanderbilt, Jr., John J. Stanley, R. E. Danforth, vice-presidents; J. C. Collins, secretary and auditor; E. L. Rossiter, treasurer; C. A. Tucker, assistant treasurer; A. L. Linn, Jr., assistant secretary and general auditor; R. E. Danforth, general manager.

The Rochester & Sodus Bay Railway Company elected the following directors and officers: Horace E. Andrews, President; Granger A. Hollister, vice-president; J. C. Collins, secretary and auditor; E. L. Rossiter, treasurer; A. L. Linn, Jr., assistant secretary and general auditor; C. A. Tucker, assistant treasurer; R. E. Danforth, general manager; H. E. Andrews, W. K. Vanderbilt, E. V. W. Rossiter, John Carstensen, W. J. Wilgus, W. C. Brown, Benjamin Strong, Y. A. Hollister, R. E. Danforth, directors.

The Rochester & Suburban Company, which held its election of directors December 11, elected these officers: H. E. Andrews, president; W. K. Vanderbilt, Jr., C. J. Bissell, vice-presidents; J. C. Collins, secretary and auditor; E. L. Rossiter, treasurer; C. A. Tucker, assistant treasurer; A. L. Linn, assistant secretary and general auditor; R. E. Danforth, general manager. The directors are: Horace E. Andrews, William K. Vanderbilt, Jr., E. V. W. Rossiter, W. J. Wilgus, John Carstensen, W. C. Brown, George W. Archer, C. J. Bissell, Charles T. Chapin.

The Rochester & Eastern Rapid Railway Company held its annual directors' meeting in New York City, at which time it was decided to move the auditing and accounting department offices from Canandaigua to Rochester, where J. C. Collins will be placed in charge. The officers elected are as follows: Horace E. Andrews, president; W. K. Vanderbilt, Jr., vice-president; J. C. Collins, secretary; A. L. Linn, Jr., assistant secretary and auditor; F. L. Rossiter, treasurer; C. A. Tucker, assistant treasurer.

THE RECORD OF INDIANAPOLIS SUBURBAN BUSINESS

The Indianapolis Traction & Terminal Company has made its annual settlement with the city for the use of the streets by the interurban traction cars. The round trips made by the various companies were as follows:

THE YEAR'S FIGURES

Union Traction Company—	
Muncie division	8,640
Logansport division	7,894
Broad Ripple division	13,539
Army Post division	2,557
Indianapolis & Cincinnati Traction Company—	
Shelbyville division	7,460
Rushville division	7,306½
Indianapolis & Northwestern	8,405
Indianapolis & Eastern	7,549½
Indianapolis, Columbus & Southern	9,989½
Indianapolis & Martinsville	6,943½
Indianapolis Coal Traction Company	6,557½
Indianapolis & Western	889
Total	87,730½

The Indianapolis & Western is a new road and did not operate through the entire year.

The total number of round trips for 1906 exceeded those for 1905 by more than 7000. The number of trips in 1905, as stated in the annual report to the city controller, was 80,150.

Upon the basis of an average of thirty passengers per car it will be seen the various lines carried 2,631,900 passengers into Indianapolis and carried that number out again during 1906. Upon the same basis the number of passengers in 1905 was 2,404,510, and the gain for the year was more than a quarter of a million round-trip passengers, or over half a million one-way passengers.

ANNUAL MEETING AND REPORT OF TOLEDO COMPANY

Reports of the officers of the Toledo Railways & Light Company, at the annual meeting Thursday, show that 1906 was one of the most prosperous years the company has ever enjoyed. Not only were the receipts larger, but the net surplus at the end of the year showed a gratifying increase. The report of President Henry A. Everett showed that the gross receipts were $2,047,610.75, an increase of $134,154.69 over the preceding year, while the operating expenses were $1,071,733.33, or 52.34 per cent. Interest charges on the funded and floating debt were $509,607.12, leaving a net income of $466,230.30, or 3.89 per cent of the capital stock.

Besides building a small amount of new track and reconstructing a little over 3½ miles of track, the company installed a lot of new machinery to put the road in position to take care of its business. Two 3000-kw turbines were ordered from the General Electric Company last year, but they have not been delivered. Instead, the company put in two 2000-kw turbines until the others can be built. Two 1000-kw rotary converters for the system in the city and two 500-kw rotaries for a point near the Casino, with necessary switchboards and other appurtenances, with a 1000-kw motor generator set for the D. C. lighting system, and a 125-kw exciter set and four 700-hp Sterling water-tube boilers fitted with Green traveling chain grates have been put in. A three-phase 40000-volt line has been built to supply the sub-station at the Casino. This is partly underground and partly overhead. In other respects the report of the president was interesting, as showing the progress that has been made in that city.

The stockholders voted to authorize the company to lease the Toledo, Ottawa Beach & Northern and to operate it as part of the system. This is intended as a feeder for the company's new resort, to be known as Toledo Beach.

Louis E. Beilstein and Albion E. Lang, of Toledo; Henry A. Everett, E. W. Moore and Charles W. Wason, of Cleveland, and William L. McKenna and Robert Van Cortland, of New York, were chosen as directors. They organized by the election of the following officers: Chairman of the Board, Albion E. Lang; president, Henry A. Everett; vice-president, Louis E. Beilstein; secretary, Herman S. Swift; treasurer, Spencer D Carr.

Briefly summarized the operating figures for 1906 and 1905 compare as follows:

	1906 Amount	1906 Per Cent	1905 Amount	1905 Per Cent
Gross earnings	$2,047,610	......	$1,913,456	......
Operating expenses	1,071,773	52.34	972,994	50.8[illegible]
Net earnings	975,837	47.66	940,462	49.15
Charges	509,607	24.88	510,307	26.67
Surplus	466,230	22.78	430,155	22.48

The percentage earnings on the $12,000,000 capital stock during the last six years compare as follows:

	Per Cent		Per Cent
1906	3.89	1905	3.58
1904	2.75	1903	2.66
1902	2.27	1901	2.16

CONNECTICUT RAILWAY & LIGHTING IMPROVEMENTS

It has been announced that $2,000,000 will be spent by the Consolidated Railway Company of New Haven in improving the various properties recently acquired from the Connecticut Railway & Lighting Company. These betterments will extend to all branches of the service, but have not yet been outlined fully. it is understood they include the double tracking of the Waterbury system, general electric lighting work, improvements to the company's Bull Bridge plant and new work in New Milford.

ANNUAL REPORT OF AMERICAN LIGHT & TRACTION COMPANY

The annual report of the American Light & Traction Company for the year ended Dec. 31, 1906, which has just been made public, shows gross earnings of $2,263,735, an increase of $890,115, and net earnings of $2,215,735, an increase of $879,567. The surplus, after deducting the $680,500 placed in the reconstruction reserve, is given as $361,266, a decrease of $224,499. The gain for the year in the surplus account before deducting the reconstruction reserve was about 48 per cent, and after deducting the account the increase was equal to something like 16 per cent, as compared with the preceding year. The income account is as follows, with comparisons:

	1906	1905
Gross earnings	$2,263,735	$1,373,620
Expenses	48,000	37,452
Net earnings	$2,215,735	$1,336,168
Dividend, preferred	853,068	570,822
Dividend, common	320,901	179,581
Total dividends	$1,173,969	$750,403
Balance	$1,041,766	$585,765
Reconstruction reserve	680,500	....
Surplus	$361,266	$585,765

The total profit and loss surplus on Dec. 31, 1906, was $2,490,145.

The condensed balance sheet shows the following changes:

Assets—	1906	1905
Investment account	$26,739,735	$24,103,177
Furniture	....	1,299
Treasury stock	1	1
Undivided profits sub. companies	2,385,333	1,468,155
Bills received subsidiary companies	1,575,537	1,625,904
Certificates indtdns sub. companies	1,708,184	....
Accounts received	63,559	24,414
Mgrs.' stock con's	227,500	....
Temporary investment	26,155	2,976
Cash	494,455	409,738
Total	$33,220,459	$27,635,664
Liabilities—		
Preferred stock	$14,236,200	$9,633,200
Common stock	15,000,000	15,000,000
Bills payable	500,000	500,000
Reconstruction reserve	680,500	180,204
Deps. mgrs'. stock certificate	7,061	....
Taxes and miscellaneous	8,502	....
Dividends	298,051	192,029
Undivided earnings	2,490,145	2,130,231
Total	$33,220,459	$27,635,664

TRIAL TRIP ON ROCHESTER BRANCH OF ERIE

The first official trip by electric car over the electrified division of the Erie Railroad between Avon and Rochester was made Tuesday, Jan. 22. The distance between the cities is 19 miles, and the run from Avon to Rochester was made by the motor car in 39 minutes. On the return trip the private car of Superintendent Graham was attached to the motor car, and a speed of 35 m. p. h. was attained. This was considered an excellent showing, considering the physical condition of the new line and apparatus. This is the first 11,000-volt line to be operated in the United States. It will include, besides the main line of the Erie Railroad before mentioned, between Rochester and Avon, the branch between Avon and Mt. Morris, making a total of 34 miles of single track, besides sidings. Power is received at 60,000 volts from Niagara Falls. It is expected that by Feb. 15, the line will be ready to be put into permanent operation by electricity. The party that made the trip included the following representatives of the Erie Railroad: J. M. Graham, vice-president of the Erie Railroad, B. J. Arnold and L. B. Stillwell, composing the Electrical Commission; R. H. Bowron, division superintendent; J. H. Maddy, special representative; J. C. Tucker, superintendent of the Rochester division; G. W. Dowe, formerly superintendent of the Rochester division, and James Burke, engineer maintenance of way. There were also present from Westinghouse, Church, Kerr & Company, the contractors: O. S. Lyford, Jr., chief electrical engineer of Westinghouse, Church, Kerr & Company; W. N. Smith, chief engineer in charge of the design and construction of the work; Wm. McClellan, engineer in charge of the sub-station and car equipment; H. H. Esselstein, superintendent of construction, and E. J. Griffith. Mr. Graham operated the car from Avon to Rochester, and Mr. Griffin on the return trip.

UNITED RAILWAYS OF ST. LOUIS EARNINGS

The United Railways Company made a large gain last year over 1905. The increase in earnings was $686,000 in a total of over $9,146,000 receipts. Even the record of the World's Fair year, with its heavy street car traffic and earnings of $9,950,000, was almost equalled. The company almost doubled its net income. A summary of the financial statement is contained in the following statement, issued Friday, Jan. 18:

	1906	1905
Gross earnings and other income....	$9,146,348	$8,460,016
Expenses, taxes and depreciation....	5,567,412	5,318,369
Net earnings	$3,578,936	$3,141,647
Charges	2,377,476	2,387,915
Net income	$1,201,460	$753,732

The December statement shows gross earnings of $782,555, net earnings of $318,924 and net income of $120,898.

HARRIMAN AND THE SOUTHERN PACIFIC

The Los Angeles "Examiner" prints the following story: Instead of declaring a dividend for the stockholders of the Southern Pacific Railroad in 1905, President E. H. Harriman ordered an appropriation of $5,000,000 for the purpose of electrifying the western division of the system, which is the old narrow-gage route from Oakland by the way of Haywards and the Niles Canyon, through Alviso and San Jose to Santa Cruz. In addition to this, $800,000 was appropriated to tunnel the Potrero of South San Francisco, and another $1,000,000 was taken to build a bridge across the Bay of San Francisco at Dumbarton Point. All of this work is now under way, and is the starting point of the gigantic enterprise by which Mr. Harriman proposes to combine the electric road and power companies of Southern California and finally to give the Southern Pacific Company an electric line from Los Angeles to San Francisco.

To accomplish this Mr. Harriman, in addition to changing his narrow-gage line to Santa Cruz into an electric line, secured control of the Santa Cruz & Watsonville Railroad, and the Watsonville, Salinas & Spreckels Railroad Company, and consequently came into ownership of a direct line from Oakland and San Francisco to Salinas, a distance of 128 miles, which is all to be electrified. The next move is the combination of the entire electric railroad systems and small steam railroads of this section and the extension of a line by this combination to Santa Barbara.

STREET RAILWAY PATENTS

[This department is conducted by Rosenbaum & Stockbridge, patent attorneys, 140 Nassau Street, New York.]

UNITED STATES PATENTS ISSUED JAN. 15, 1907

841,105. Recording Signal Transmitter; Rollin A. Baldwin, New Haven, Conn. App. filed Nov. 10, 1905. Relates to signals for single-track trolley roads in which a plurality of cars are frequently run in one direction over a block before permitting of cars to pass in the other direction. The signals are transmitted by a device which makes a record of the number of cars so as to prevent a clear signal being shown until all of the cars have again left the block.

841,119. Metallic Railroad Tie; Francis M. Cain, Wesner, Okla. Ter. App. filed April 11, 1906. One side of the base flange of the rail is engaged by an integral jaw, while the other side is engaged by an adjustable jaw adapted to be keyed to the tie.

841,144. Track-Sanding Device; John H. Hanlon, Somerville, Mass. App. filed May 16, 1906. To obviate the rapid wearing away of the sand nozzle, a pocket is provided opposite the sand blast in which sand collects to act as a buffer.

841,231. Air Brake System; Fred. B. Corey, Schenectady, N. Y. App. filed May 26, 1906. Has a reservoir on each car, a train pipe, a valve for connecting brake cylinder to reservoir or to atmosphere controlled by the differential action of train pipe and brake cylinder pressures, and means for producing an emergency application of the brakes upon a breaking apart of the train.

841,242. Railroad Tie; Daniel C. Graham, Pulaski, Va. App. filed Oct. 16, 1906. The tie is made of plastic material and molded with a vertically-extending opening in which is seated a bolt, which extends through the base of the rail and is engaged by a nut, the web of the rail being cut away to admit the nut.

841,286. Automatic Switch; Andrew Underdahl, Hoffmann, Minn. App. filed Aug. 31, 1906. A movable switch-piece comprising a rotary cylinder having grooves therein for connecting one line of rails with another, and means on opposite sides of the switch for rotating the cylinder.

841,337. Switch; Edward L. Nugent, Charleston W. Va. App. filed April 21, 1906. The switch point is connected with a disc, a rod connected to the disc intermediate its center, said rod being connected with a crank shaft having a tappet in the path of the locomotive.

841,367. Railway Roadbed; Luther R. Zollinger, Philadelphia, Pa. App. filed March 28, 1906. A solid concrete bed forming a complete floor under the rails and extending below the frost line, having iron stringers embedded therein beneath the rails without disturbing the bed.

841,397. Trolley Head; Otto Hoffmann, Berlin, Germany. App. filed Aug. 22, 1905. A pair of spring-actuated guard plates adapted to close over the wire.

841,435. Swivel Truck for Electrically-Propelled Cars; Daniel M. Pfautz, Germantown, Pa. App. filed June 1, 1906. Relates to a swivel truck for attachment to the roof of a suspended car.

841,436. Switch for Elevated Railway Structures with Suspended Cars; Daniel M. Pfautz, Germantown, Pa. Two parallel girders connected with each other and swinging at one end upon girders of the main line structure, a single swinging girder pivoted at one end at a point where adjacent main and branch line girders meet, and extending therefrom to the free ends of the parallel swinging girders, the remaining girders of the main and branch line structures projecting beyond said point to the free end of the swinging parallel girders.

841,437. Crossing for Elevated Railway Structures with Suspended Cars; Daniel M. Pfautz, Germantown, Pa. App. filed June 6, 1906. The girders of the intersecting tracks do not cross each other, but are provided with doors or wings, so arranged as to form a continuation of one or the other of the crossing tracks, the cars having buffers adapted to control the movement of the doors or wings.

841,451. Railway Block System; William L. Rummel, South Sioux City, Neb. App. filed Aug. 16, 1905. Tappets along the roadway are actuated by a passing train to electrically set train stops in the path of a following train.

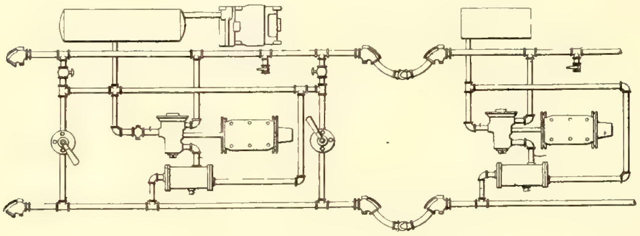
841,470. Air Brake Mechanism; Walter V. Turner, Wilmerding, Pa. App. filed April 23, 1906. Means for maintaining

different pressures in a plurality of reservoirs, a train pipe and an engineer's valve provided with service exhaust means and having connections with the reservoirs and the train pipe, and adapted to conect the different reservoirs with the train pipe, and to connect a high-pressure reservoir with the service exhaust means, whereby such means are operated.

841,575. Rail-Joint; Louis M. Sartain, Tracy City, Tenn. App. filed Sept. 8, 1906. The rail-joint is cast in one piece, and is provided intermediate its length with a section having beveled rail-meeting sides corresponding in contour at the top with the head of the rail. Has flanges engaging the web of the rail and flanges engaging the base flanges of the rail and spiked to the ties.

841,607. Railway Signaling Mechanism; Edwin J. Adams, Waco, Tex. App. filed May 3, 1906. A block signal system having a special track rail to complete circuits to the locomotive cab, and by which alarm signals are displayed on the engine in case a semaphore at danger is passed.

841,636. Automatic Air Brake for Cars; William J. Dankel, Pittsburg, Kan. App. filed March 24, 1906. An air inlet and dnscharge valve for air brakes, comprising a casing having one end provided with a connection for the brake cylinder, and the other end provided with a connection for the train pipe, and a passageway with check valve opening into the opposite ends of the casing, a piston within the casing having a central stem forming a valve, a concentric projection from the casing having a valve seat receiving the said stem, and an outlet passageway to the atmosphere formed in the concentric projection.



PATENT NO. 841,231

841,651. Guard or Fender for Cars; William T. Lane, Fostoria, Ohio. App. filed Oct. 27, 1906. A hood covering one side of the periphery of the car wheel and conforming to the curvature thereof, and having a frangible shoe at its lower end.

841,653. Adjustable Stairway for Suspended Railway Cars; Daniel M. Pfautz, Germantown, Pa. App. filed May 19, 1906. The stairway is pivoted at one end of the car and means for raising and lowering the stairway are provided at the other end of the car. When the car is running the stairway is raised parallel with the car body.

PERSONAL MENTION

MR. T. COMMERFORD MARTIN, editor of the "Electrical World, was elected president of the Engineers' Club, of New York, on Jan. 22.

MR. ARTHUR TOMALIN, news editor of the "Newark Evening News," has been appointed general advertising manager of the Central Railroad of New Jersey and editor of its monthly magazine, "The Suburbanite."

MR. ARTHUR B. SMITH has been appointed by President Mellen, of the New York, New Haven & Hartford Railroad, as general traffic manager of the Consolidated Railway Company. The appointment becomes effective Feb. 1. Mr. Smith will have his headquarters in New Haven.

MR. E. L. BROOME, steam engineer of the New York Central & Hudson River Railroad Company, has resigned to join the forces of the Stone & Webster Engineering Corporation, of Boston, Mass. Mr. Broome will be succeeded by Mr. W. C. Miller, Jr., formerly assistant steam engineer.

MR. P. NEY WILSON, formerly supervisor of the South Jersey division of the Public Service Corporation of New Jersey, has been appointed road master of the Rochester Railway Company. Mr. Wilson has just returned from a trip to South America, which he took in the interests of J. G. White & Company.

MR. F. F. BODLER, who resigned his position as master mechanic of the United Railroads of San Francisco some time ago, to engage in private business, was tendered a complimentary banquet on the evening of Jan. 7, by 300 employees of the mechanical department of the company at the Geneva Avenue car house. Mr. Bodler was presented with a handsome gold watch and a diamond pin.

MR. C. S. BIDWELL, purchasing agent of the Indiana, Columbus & Eastern at Columbus, has been appointed chief clerk to General Manager J. L. Adams, whose headquarters are at Dayton. The office of purchasing agent at Columbus will be abolished and the buying will hereafter be done from Cincinnati. Mr. C. T. Moon, who has been clerk to Mr. Bidwell, will hereafter have charge of the stores in Columbus.

MR. GEORGE MAC LEOD, of Versailles, Ky., formerly of Louisville, who has been assistant engineer of the Central Kentucky Traction Company, has been appointed chief engineer and assistant general manager of the Lexington Interurban Railways Company, succeeding Mr. William R. Allen, of Lexington, who resigned to accept a position at Norfolk, Va. Mr. MacLeod will have charge of all the track and the construction work of the interurban lines of Central Kentucky. His headquarters will be at Lexington.

MR. HARRY G. AULT, who has been in the service of the Big Four Railroad at St. Louis, has been appointed soliciting passenger and freight agent of the Indiana, Columbus & Eastern Traction Company, with headquarters in Columbus. His jurisdiction extends over the Columbus field, the Columbus & Springfield division and the Grove City division. Mr. Ault was formerly associated with General Passenger and Freight Agent Whitney in the service of the Chicago & Eastern Illinois Railroad at Muncie, Ind.

MR. S. E. WILLIAMS, manager of the Jacksonville Electric Company, of Jacksonville, Fla., since Feb. 1, 1906, is dead. Mr. Williams was born at Eastchester, N. Y., and was 31 years of age. He was graduated from Harvard, after which he entered the service of Stone & Webster, of Boston, with whom he remained in that city two years. Then he accepted, at the call of Stone & Webster, the position of assistant manager of their street railway property at Dallas, and later was appointed by them to the position of manager of the Jacksonville company.

MR. CHARLES L. FURBAY has just resigned as general superintendent of the Augusta Railway & Electric Company and the Augusta & Aiken Railway Company, of Augusta, Ga. The former conducts the city railway system in Augusta and also the commercial and municipal lighting of that city, and the latter is a 25-mile interurban line connecting Augusta with Aiken, S. C. The company also owns Hampton Terrace Hotel, a high-class modern resort near Augusta. Mr. Furbay has been engaged in electric railway construction and operation since soon after his graduation from Princeton, about ten years ago. He is a native of Ohio, and commenced electric railroading with the Brunswick Traction Company, of Bound Brook, N. J., now a part of the Public Service Corporation of New Jersey. From that road he was sent to Elmira by the MacAfee interests, to construct the Elmira & Seneca Lake Railway, an 18-mile line, and afterwards acted as superintendent of this road for a year. He was then transferred to Pomeroy, Ohio, as superintendent of the Ohio River Railway & Power Company, and then to Augusta, all of these roads being controlled by the MacAfee interests. He is at present on a short visit to New York.

MR. FREDERICK BUSHNELL will sever his connection with the Rhode Island Company, of Providence, R. I., as chief engineer, on Feb. 1, to enter the employ of Stone & Webster, of Boston. Mr. Bushnell settled in Providence twenty-four years ago, and received his early mechanical training at the Providence Steam Engine Company, filling various positions in the shop and drawing room until he became designing engineer in 1889. He then spent a year in Chester, Pa., returning to the Providence Engineering Works as general superintendent in 1891. In 1893 he left the company to take up the building of the improved Greene engine at the Fuller Iron Works in Providence, but owing to the financial troubles which occurred in the spring of that year, this project had to be abandoned. Mr. Bushnell then became chief engineer for the Narragansett Electric Lighting Company, which position he has held since that time. In 1901 he also became chief mechanical engineer for the United Traction & Electric Company, which controlled all the electric roads in Providence, Pawtucket and the surrounding towns, and in 1902, when these street railway properties were purchased by the United Gas Improvement Company, of Philadelphia, Mr. Bushnell was appointed chief engineer of the system.

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Changes of advertising copy should reach this office by 10 a. m. Monday preceding the date of publication, except the first issue of the month, for which changes of copy should be received two weeks prior to publication date. New advertisements for any issue will be accepted up to noon of Tuesday for the paper dated the following Saturday.

During 1906 *the Street Railway Journal printed and circulated* 426,950 *copies, an average of* 8210 *copies per week. Of this issue* 8500 *copies are printed.*

The Elevated Shops and Terminals of the Brooklyn Rapid Transit Company

We take pleasure in presenting in this number the first of several articles dealing with the elevated railway shop and terminal construction and operating practice of the Brooklyn Rapid Transit Company as developed within the last two years. It is a noteworthy and creditable fact that all of the plans were prepared and carried out by the company's regular engineering staff. A perusal of the first article will show that, in line with other progressive companies, the Brooklyn management has given a great deal of attention to fire prevention. This is clear from the extensive use of concrete for the buildings, the fire walls in the car yards, the isolated storage of combustible material, the inside alarm system, the shop fire brigade, etc. Other features are the excellent natural lighting of the East New York plant, the means of pit and shop heating and numerous other minor improvements, many of which are applicable elsewhere under almost any conditions.

Considered from the shop standpoint, the East New York installation, in addition to being thoroughly up to date in the exclusive use of electric drive for machine tools, is one of the most comprehensive manufacturing plants so far undertaken by an electric railway company. It is thus an example of the tendency of the larger companies to follow steam railroad practice in the manufacture of numerous parts which do not require a series of complex processes. While this is a feature more likely to claim the attention of like-sized railways, there are many commendable devices and methods of doing things in both plants that will appeal with equal interest to the management of the smaller railway companies.

Electricity for General Railway Service

The Institute paper of Messrs. Stillwell and Putnam, printed this week, is an interesting addition to the already somewhat large literature of the subject. For at least the last ten years engineers have been persistently discussing the advantages of replacing steam by electricity for motive power for ordinary railways. A large number of estimates have been from time to time published, showing quite uniformly a material saving by the proposed change, a saving irrespective of any gains in traffic which might reasonably be expected on account of change in motive power. So far as we recollect, the only adverse estimates have been some in which the authors practically demanded that the electric locomotive should not only do the work of the steam locomotive, but should also be a steam locomotive in all essential properties. Putting aside such extraordinary requirements on the one hand, and excessive estimates of saving on the other, there still remains a great mass of evidence gathered independently by thoroughly competent engineers, and all points directly to the same conclusion.

The present estimate differs from those which have been previously published chiefly in its minuteness of detail and in the fact that it deals with the whole scope of transportation, while most of the previous estimates have been based chiefly on passenger traffic. Passenger traffic, of course, responds so generously to increased facilities that it is a very promising field for electric traction. Freight traffic, on the other hand, involving as it does the hauling of very large amounts of goods at relatively low speeds, has not, until rather recently, been considered favorable for electric locomotives. Within the last decade, however, there has been a great widening in point of view in respect

to freight haulage; and, too, freight traffic on railroads has changed radically in the direction of bigger locomotives, larger cars and longer trains. Forty or 50-ton locomotives have been replaced by those of 100 to 125 tons; cars of 10 and 15 tons capacity have been abandoned for those of three times this capacity, and with relatively much less dead weight than the smaller cars. The saving of labor secured by running one long train instead of several small ones has developed co-ordinately with the general simplification of operating conditions due to the same causes. The electric locomotive, with its enormous possibilities of concentrating great hauling power in a single unit, and of simultaneous control of tractive effort at different points in the train, lends itself with a special readiness to this modern view of economical haulage. It also, through superior simplicity, should have a very material advantage in cost of maintenance. Upon this point the estimate of the authors, 2½ cents per locomotive-mile, seems conservative for electric locomotives used in what might be called normal railway traffic.

In their general analysis of operating expenses of electric and steam operation, to which the greater part of the paper is devoted, the authors have used the Interstate Commerce Commission's classification of accounts, and for their figures the general averages published by the commission. The treatment is, therefore, quite different from that which has been followed by previous authors in selecting some road as an example and from the existing conditions building up a hypothetical table of operating expenses under electrical conditions. Although the roads thus included are characterized by wide differences in density of traffic, the resulting figures have the considerable value which always pertains to averages of this kind. From the comparison thus secured, Messrs. Stillwell and Putnam arrive at the conclusion that the saving in operating expenses through changing over to electric operation would considerably more than compensate for the increased fixed charges. The net gain for the entire country averages several hundred dollars per mile of line per year, on a total mileage of nearly 217,000. Evidently in the districts of dense traffic like the Middle States, Middle West and New England, there is far greater opportunity for saving than in the regions of scarcer traffic, in as much as the fixed charges would be relatively much less. In the case of some districts the saving is dubious, but the conclusion on the whole is more favorable to electric traction than we would suppose probable at first thought. This saving, of course, is entirely apart from the advantage gained from increased output of tracks and stations and gain in traffic from the better service afforded,—factors of far greater importance, as shown by repeated instances, than any direct saving in cost.

These estimates are extremely striking, as showing the possibilities of electrical operation upon a very large scale, and some of the figures with respect to the aggregate plant required are somewhat startling. Messrs. Stillwell and Putnam figure the aggregate power house capacity should be capable of supplying continuously 2,100,000 kw. At present prices, nearly a billion and a half dollars' worth of copper, steel and concrete for the overhead construction would be necessary, even at the high voltage recommended, and the electric locomotives would run up to another three-quarters of a billion, assuming the premise of the authors that one electric locomotive will do the work of two steam locomotives. Add to this sum three hundred million more for power plants, including reserve capacity, and one gets a striking idea of some of the material difficulties involved in a complete change of motive power. But changes such as these do not take place in a day. Rather, they gradually spread the total expense over a period of many years. If, twenty years ago, anyone had predicted the total capital invested in electric railways at the present time, he would have been regarded as a fit subject for the madhouse. Another twenty years may go far toward justifying a most optimistic prediction regarding the general use of electricity on railways. For the present, the main thing is to take advantage of the many good opportunities for changing of motive power that are even now offered, leaving to the future the growth of the art. If the experiments now under way turn out well the future will justify itself.

The discussion upon the paper was confined to the electrical rather than to the economic questions raised by the authors, and for the greater part centered around the radical suggestion contained in the paper in favor of a lower frequency. Upon this point there was a striking unanimity of opinion that, assuming single-phase operation, fifteen cycles should be used instead of twenty-five. The debt of the electrical interests to Mr. Stillwell in reducing the frequencies prevalent in the past were eloquently set forth by Mr. Lamme, and a great step forward will be made in future electric railway development if his recommendations are followed in this particular. A gain of approximately one-third in draw-bar pull is a matter not lightly to be disregarded, and while the lower frequency may increase to some extent the cost of other parts of the installation, any such disadvantages are very much more than offset by the greater simplicity and lower cost secured in the rolling stock equipment by ability to increase the power capacity of the motors.

Wiring in Car Shops

The wiring problem in the car shop involves much the same restrictions in regard to fire risks that are encountered in any modern industrial structure, but after the insurance rules have been complied with there remain several other considerations which must be settled before a satisfactory installation can be made. Where the 600-volt trolley wire is carried into the shop over tracks extending from the car house proper, special care is needed to prevent the falling of the exposed conductor upon the machinery beneath, because the most disastrous short-circuits may easily occur in case the overhead construction fails. The use of pipe conduit in pit wiring is quite as desirable to prevent mechanical abrasion of circuits as to forestall fires. Convenience of wiring also is worth taking many pains to secure, with respect to the regular and special work of the shop.

Shop wiring must be inconspicuous and yet quickly accessible, if it is to be of the greatest service. Assuming that the proper sizes of wire have been figured for the different circuits, the problem is to so dispose of the wires that they will not in any way obstruct the movement of machines, materials and employees. Properly installed circuits need very little attention, but when taps are taken off

the old lines for new machines it is exceedingly inconvenient and troublesome if the wires are more or less covered by bar iron, brake-shoes, spare coils of motors, shovels and other articles whose storage rights have not been determined. It ought to be easy to follow the course of every shop power, lighting or heating circuit all through each department where it is carried without climbing up on barrels, tool racks and other impedimenta. Sometimes the concealment of circuits arises from the overcrowding of the shops, but if the wires are run in straight lines with 90-deg. bends as high up on the walls away from the floor as is feasible in each shop, the chance of interference can be vastly reduced. As far as possible it is better to wire direct-connected motors on individually driven machines by iron conduit rising from the floor than by dropping connections from overhead. The value of the air space above machine tools for crane and hoist work in facilitating the movement of the work is still far from realized in many shops.

Most street railway repair shops are equipped with quite a number of special circuits controlled by scattered switches. Pit, bench, machine and general lighting, all need to be subdivided to get the best results, and especially to avoid needless burning of lamps and waste of current where no work is being done; electric heaters in sand drying and armature or field coil ovens require separate switches for their control; blower motors, portable motors with flexible cable attachments, and various test circuits are cut in or out at odd places—and in general there is not much co-ordination of the switches. In many instances the shop wiring would be simplified by grouping auxiliary switches on a panel at some central point, and if red pilot lamps of low candle-power were installed at this common center of control, there would be less consumption of current from forgetfulness in shutting it off at isolated points. Auxiliary circuits in power houses are more and more coming to be controlled from the main or a special switchboard, and the practice might well be followed in many a shop which at present is hampered by its illogically arranged power and lighting circuits.

Reducing Power Losses in Repair Shops

The amount of power needed to operate the machine tools of a large street railway repair shop is often less than the combined horse-power rating of the motors of a single quadruple car equipment, so that at first sight it does not seem worth while to go to much trouble to reduce waste in this item. The larger problems of cutting down line losses, improving the economy of power plants and sub-stations, and of decreasing the power consumption of the rolling stock under different schedule conditions are rightfully given the places of importance in the work of the motive power superintendent and his assistants, but after all, a vast amount of good can be accomplished by looking into some of the numerous loose ends of the shop routine in the way of rainy-day jobs.

In work of this kind it is not always a question of decreased net waste of power or material which is most profitable in the long run. A broader advantage in "jacking up the low spots" of shop practice occurs through the improved morale of the whole establishment which results from the betterment of small things. It is well for the executive officer to remember that, while minor details look insignificant from his commanding point of view, which takes in the whole field, these same minute particulars loom large in the eye of the individual machinist or helper. Far better work will be done in a repair shop where the men feel that the company stands ready to provide them with all reasonable equipment and material than in one where out-of-date appliances and scantily-filled supply bins attest the parsimony of the management in the conduct of maintenance.

Few of the smaller street railway shops are equipped with motive power in anything but the most haphazard fashion. As was pointed out above, the power needed is ordinarily small—sometimes a 10-hp or 15-hp motor will drive all the tools used in repairing the cars of a road 40 or 50 miles long. The natural custom is to gather in either a second-hand railway motor which has seen its best days or to acquire some cast-off shunt motor of prehistoric design, couple it up to the shop system by a general scheme of group driving, tie in the circuit breaker and let things go.

A course of this kind may be the best solution of the problem of driving the repair shop in case the motor can be purchased at bargain prices and provided there is considerable chance that in the near future the shop facilities will be largely extended. It is better to have a reserve capacity of 5 hp or 10 hp in the shop motor if a single machine is to drive future shop equipment as well as the present installation, but it is a question if something better than such an extreme case of group driving is not available for large shops, considering the advances lately made in the design of motors of direct driving. By separating the shop tools into even two or three groups there is no doubt but that a more efficient system can be secured. A 20-hp motor running the present shop constantly at one-quarter to one-half its rating will waste more power than a couple of 10-hp machines, or better, four 5-hp units arranged to drive certain tools in simple, compact groups only when they are needed.

These power losses in the shop are greatly aggravated by errors in the arrangement of belts, pulleys, shafts and hangers. Friction losses in the shafting system seriously reduce the capacity of a given motor to handle increased machinery. Unless the hangers are installed as near as possible to the pulleys the resulting bending of the shaft will shorten the life of the equipment and greatly increase the idle losses. It is for this reason better practice to install the motor in the center of the group of tools which it drives, as regards shafting. Tight belts are also a source of much trouble and wasted power. Unless the pulleys are of reasonably large diameter for the work in hand the belt wear and friction losses are bound to be excessive. Lack of attention to the oil supply, bearings out of line and other mechanical defects need to be especially looked after in the driving of street railway shops. In some cases the wiring is too small for the amount of power consumed by the motors, or inferior makeshifts in the way of switches and terminals are used. All these little points need to be watched, for quite aside from the question of power loss is the danger of breakdowns in the shop on account of improper loading of the equipment. The tendency now is to keep cars in the shop as little of the time as is possible, and interruptions in the work of repairs are too costly to be justified by the preventable failures of shop motive power.

THE ELEVATED SHOPS AND TERMINALS OF THE BROOKLYN RAPID TRANSIT COMPANY—ORGANIZATION AND GENERAL LAYOUT AT EAST NEW YORK

Within the past year the Brooklyn Rapid Transit Company has placed in service two model plants for the elevated railway work of its mechanical department. The larger of these installations is at East New York and includes manufacturing for other divisions, while the smaller one at Thirty-Sixth Street, South Brooklyn, is simply an inspection and maintenance shop. An interesting feature common to both installations is the fact that they are located on grounds which served for older plants. At East New

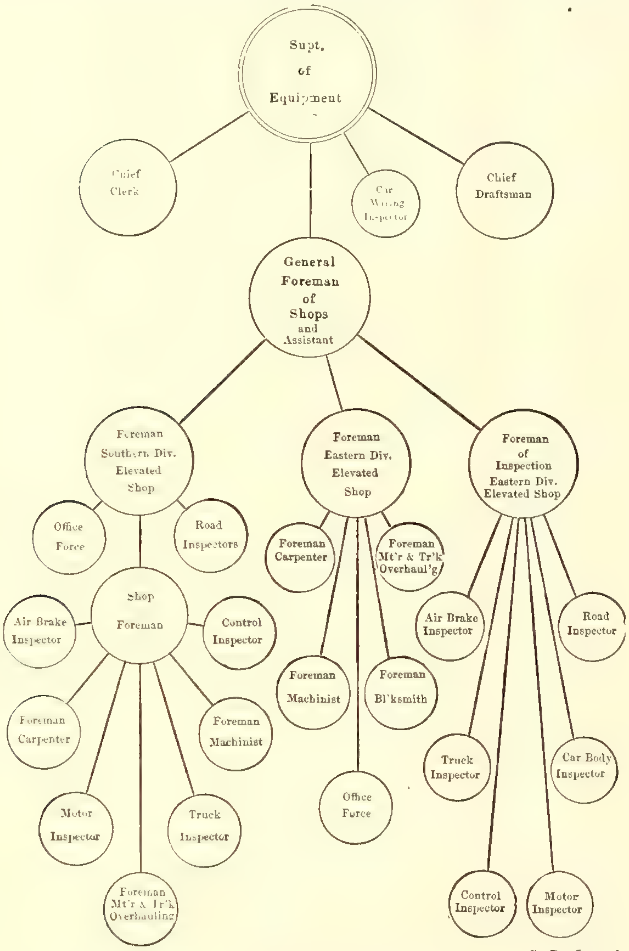


FIG. 1.—CHART SHOWING THE ORGANIZATION OF THE ELEVATED RAILWAY DIVISION, UNDER THE SUPERINTENDENT OF EQUIPMENT, BROOKLYN RAPID TRANSIT COMPANY

York an entirely new set of buildings had to be erected, but at Thirty-Sixth Street it was found possible to remodel as a part of the new plant the terminal station of the old Prospect Park & Coney Island Railroad, which is now a portion of the Brooklyn Rapid Transit system. As the inspection and maintenance methods of the two plants do not differ materially, it will not be necessary to describe the Thirty-Sixth Street shop in detail, emphasizing only such features as involve departures from the slightly earlier installation at East New York.

The reorganization and development of the shop system of the Brooklyn Rapid Transit Company has been under the direction of William G. Gove, superintendent of equipment in charge of the mechanical department. Mr. Gove was formerly connected with the Cincinnati Street Railway Company and with the Boston Elevated Railway Company in charge of the construction and equipment of their first elevated cars. He is a member of the American Society of Civil Engineers. While assistant mechanical engineer of the Brooklyn Rapid Transit Company he advanced ideas governing the construction of these shop plants, laid out the building arrangement and planned the machinery equipment throughout. The design of the buildings and the yard layouts was carried out in the office of the chief engineer. The chart presented in Fig. 1 will give a clear idea of the organization required for the operation of the two elevated plants described in this article.

THE EAST NEW YORK PLANT

A study of the splendid elevated railway shops and terminal yard at East New York reveals that they deserve a high place among electric railway engineering exploits, irrespective of their great size. Like other railways operating in cities where desirable locations are dear, the Brooklyn Company has been obliged to use a piece of ground far from ideal in its configuration. This drawback, however, proved an excellent incentive for the development of novel track and building ar-

FIG. 2.—THE EAST NEW YORK PLANT AS SEEN FROM THE DOUBLE-Y ELEVATED TRACK ENTRANCE

rangements best suited to the conditions, while the necessity of incorporating with the new machinery many tools used in former shops gave further opportunities for the solution of shop problems. In fact, so many interesting points have been worked out successfully in the construction, equipment and operation of this plant that both large and small

THE LOCATION

In the June 3, 1905, issue of the Street Railway Journal an article was published giving the preliminary plans in connection with this plant. Since the work as actually carried out differs in several details from the original specifications, Fig. 3 should be referred to as it shows the gen-

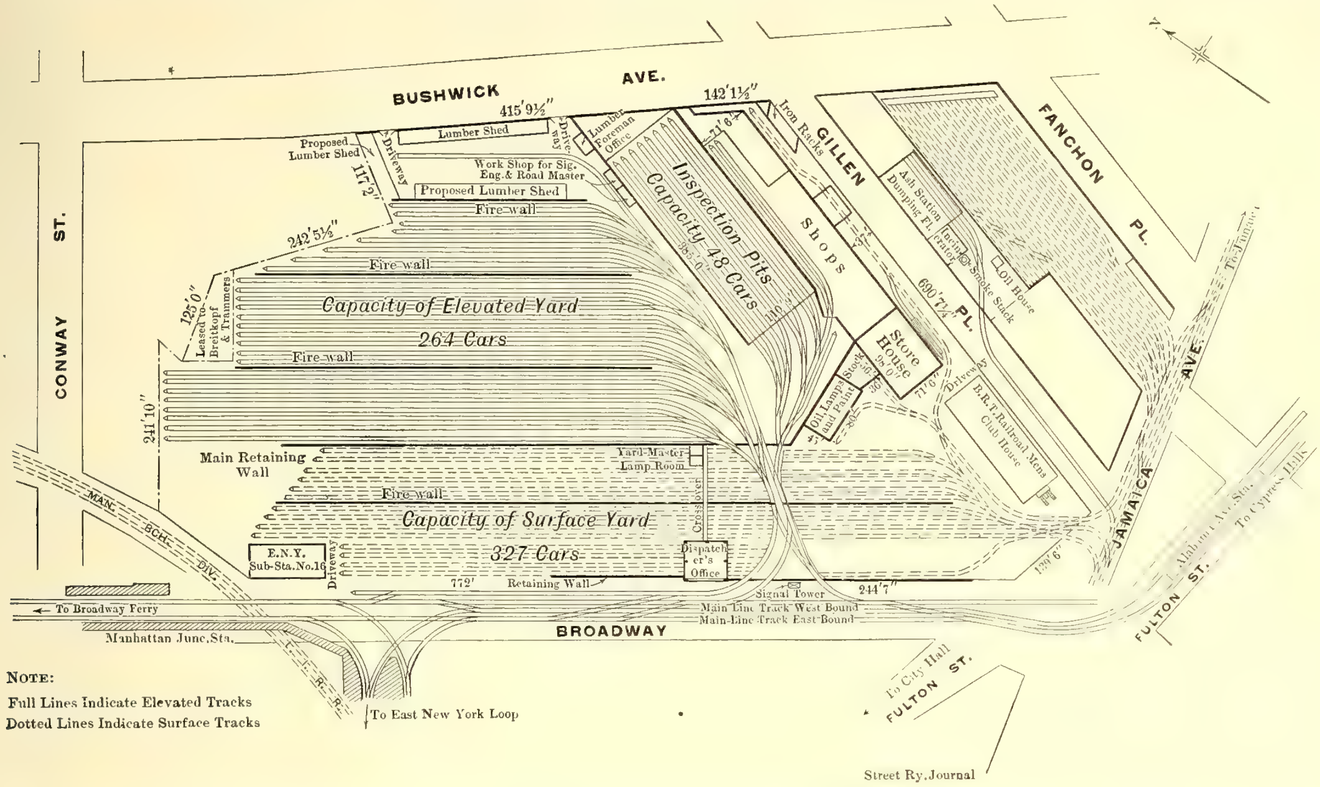


FIG. 3.—GENERAL LAY-OUT OF THE TRACKS AND BUILDINGS OF THE EAST NEW YORK INSTALLATION

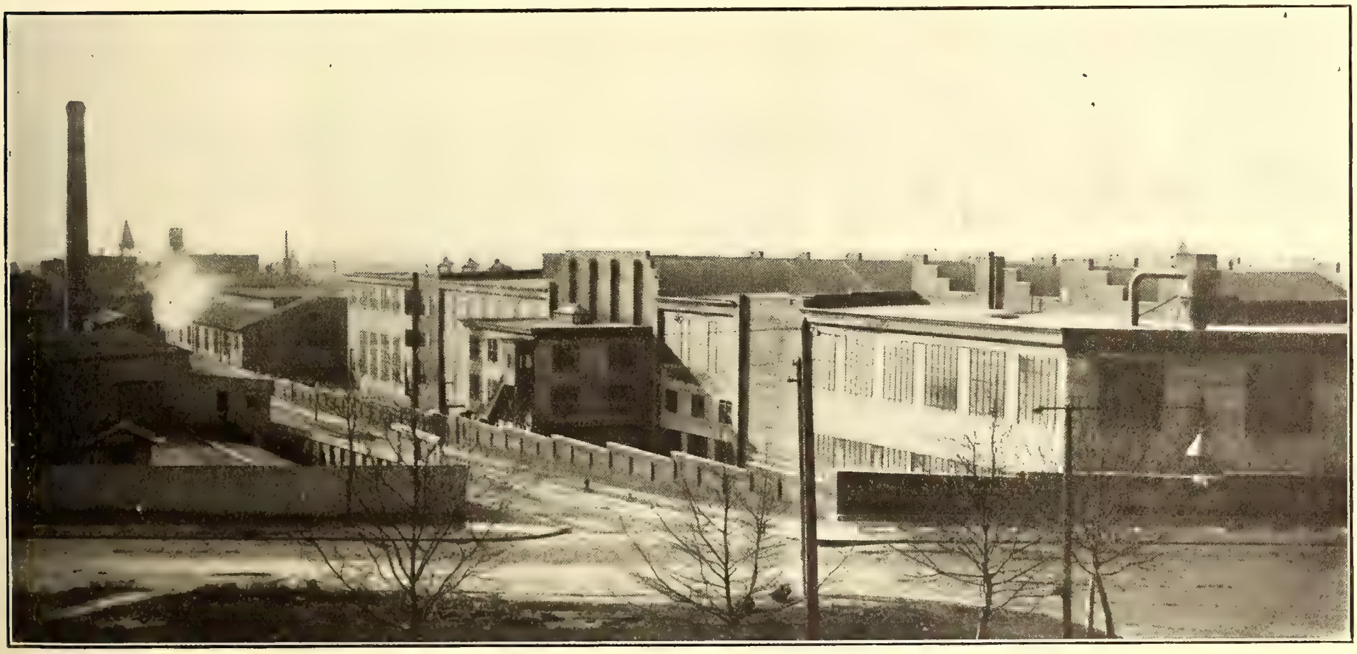


FIG. 4.—GENERAL VIEW FROM BUSHWICK AVENUE, OF THE INCINERATOR PLANT (AT THE LEFT), SHOP BUILDINGS AND CLUBHOUSE AT EAST NEW YORK

traction companies will find here more than one feature worthy of their acceptance.

The equipment of this plant is very extensive, embracing all the necessary provisions for the repair and overhauling of the elevated rolling stock and equipment, and for manufacturing the greater part of the car supplies for both elevated and surface departments.

eral layout exactly as it exists to-day. From this illustration it will be seen that the shop and storage grounds are bounded by Broadway, Fulton Street, Gillen Place and Bushwick Avenue, at the junction of the Broadway and Fulton Street surface and elevated lines. The plot between Gillen Place and Fanchon Place is occupied by a surface car house and a new rubbish incinerator plant,

which is operated by the company in connection with its refuse removal contracts with the Borough of Brooklyn.

Owing to the fact that there is a difference in level of 27.5 ft. between the Fulton Street corner and the rear of the property on Bushwick Avenue, it was found possible to convert the greater part of the plot into a two-story car storage yard, using the rest of the land along Gillen Place and Bushwick Avenue for the shop buildings. To accomplish this purpose a concrete retaining wall was built along the location indicated, and enough filling-in was done at the rear to bring that portion up to the same higher or elevated railway

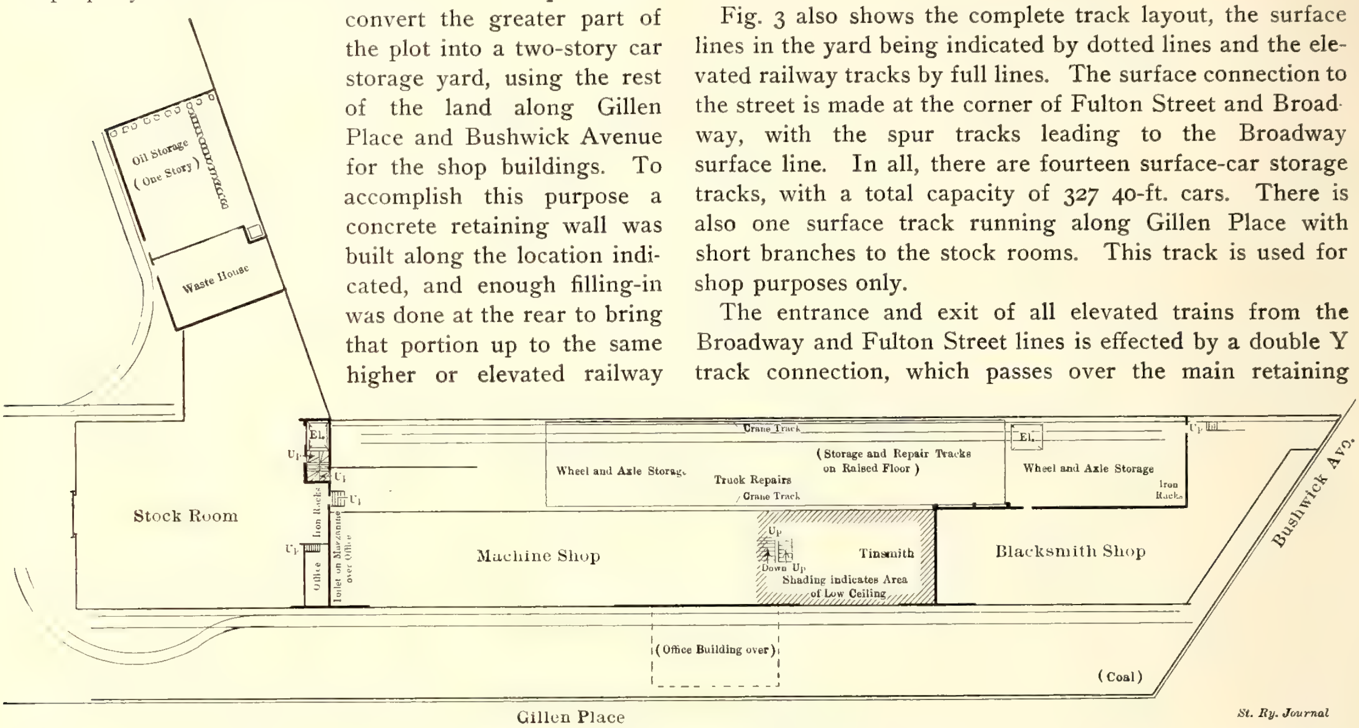


FIG. 5.—LAYOUT OF FIRST FLOOR OF MAIN SHOP BUILDING AND STORAGE HOUSES, SHOWING THE LOCATION OF THE DEPARTMENTS, SURFACE SUPPLY TRACK, ETC.

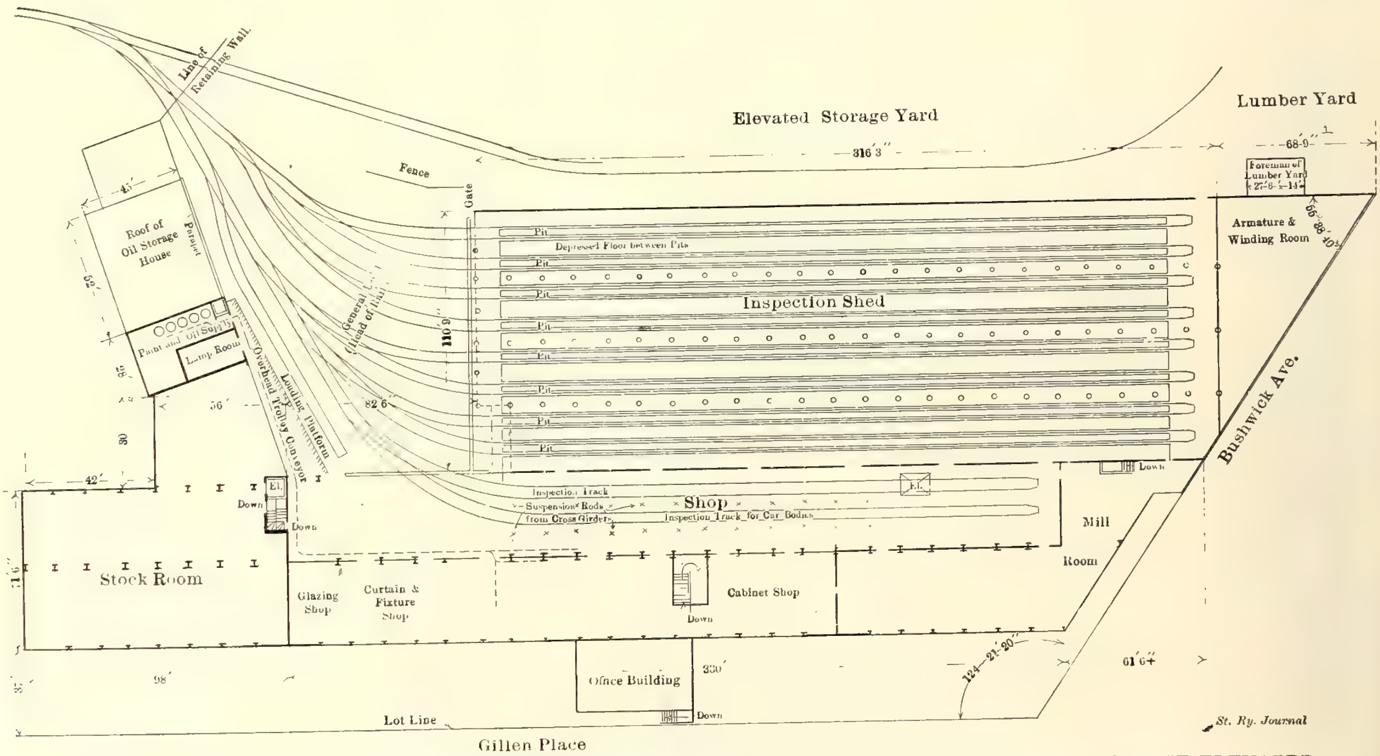


FIG. 6.—SECOND-FLOOR PLAN OF THE EAST NEW YORK SHOP AND STORAGE BUILDINGS, AND OF THE ELEVATED RAILWAY TRACKS

level throughout, while leaving the remainder for the surface-car storage flush with Broadway. This wall runs for 771 ft., extending almost the entire length of the yard, and then turns northeast for about 165 ft. and northwest for 389 ft. to form one of the walls of the inspection shop. The yard portion of this wall has its coping about 18 ft. above the footing. It is 9 ft. wide at the base and about 2 ft. 3 ins. at the top. There is a second retaining wall along Broadway, which is 475 ft. long, about 4 ft. high and 2 ft. 6 ins. thick at the base and 1 ft. 6 ins. at the top.

TRACK ARRANGEMENT

Fig. 3 also shows the complete track layout, the surface lines in the yard being indicated by dotted lines and the elevated railway tracks by full lines. The surface connection to the street is made at the corner of Fulton Street and Broadway, with the spur tracks leading to the Broadway surface line. In all, there are fourteen surface-car storage tracks, with a total capacity of 327 40-ft. cars. There is also one surface track running along Gillen Place with short branches to the stock rooms. This track is used for shop purposes only.

The entrance and exit of all elevated trains from the Broadway and Fulton Street lines is effected by a double Y track connection, which passes over the main retaining wall. From the right of this Y a branch leads to the eight tracks in the inspection shed. The regular elevated storage tracks, which are on the left, number twenty-six, with a total capacity of 264 standard elevated cars. There are eight inspection tracks with a capacity of 48 cars and one delivery track running alongside the inspection shed to the lumber storage yard on Bushwick Avenue. An interesting

feature is presented in the arrangement of the elevated storage tracks, as on them inspected outgoing trains can wait until required by the operating department. As the inspection shop can accommodate eight six-car trains at a time, its large capacity makes it quite an exception to keep uninspected cars on the storage tracks.

ARRANGEMENT OF BUILDINGS

The shop building, proper, is a two-story structure 37 ft. from Gillen Place and parallel thereto. It is built in two bays, each about 35 ft. wide and 330 ft. long. In the east bay of the upper floor, on the same level with the elevated railway tracks, are located all of the departments doing work on car bodies, such as the carpenter, paint, glazing and mill shops; the west bay is occupied by two tracks, one of which leads to the elevator to the floor below. The truck-overhauling shop is on the west side, and the machine and blacksmith sections on the east side of the lower floor. The blacksmith shop is directly under the mill room, and both of these departments are separated from the rest of the building by a brick fire-wall. Between the floors is a mezzanine gallery 15 ft. above the machine-shop level for the main lavatories and toilet. This gallery projects 32 ft. 6 ins. from the shop building proper, and form a room under the offices for the employees' lockers. As this projecting wing rests on steel columns it does not interfere with the supply surface track running alongside the shop building. Access to the offices from the street or Gillen Place is obtained by an outside stairway. The interior iron stairway of this building is of the two-way type.

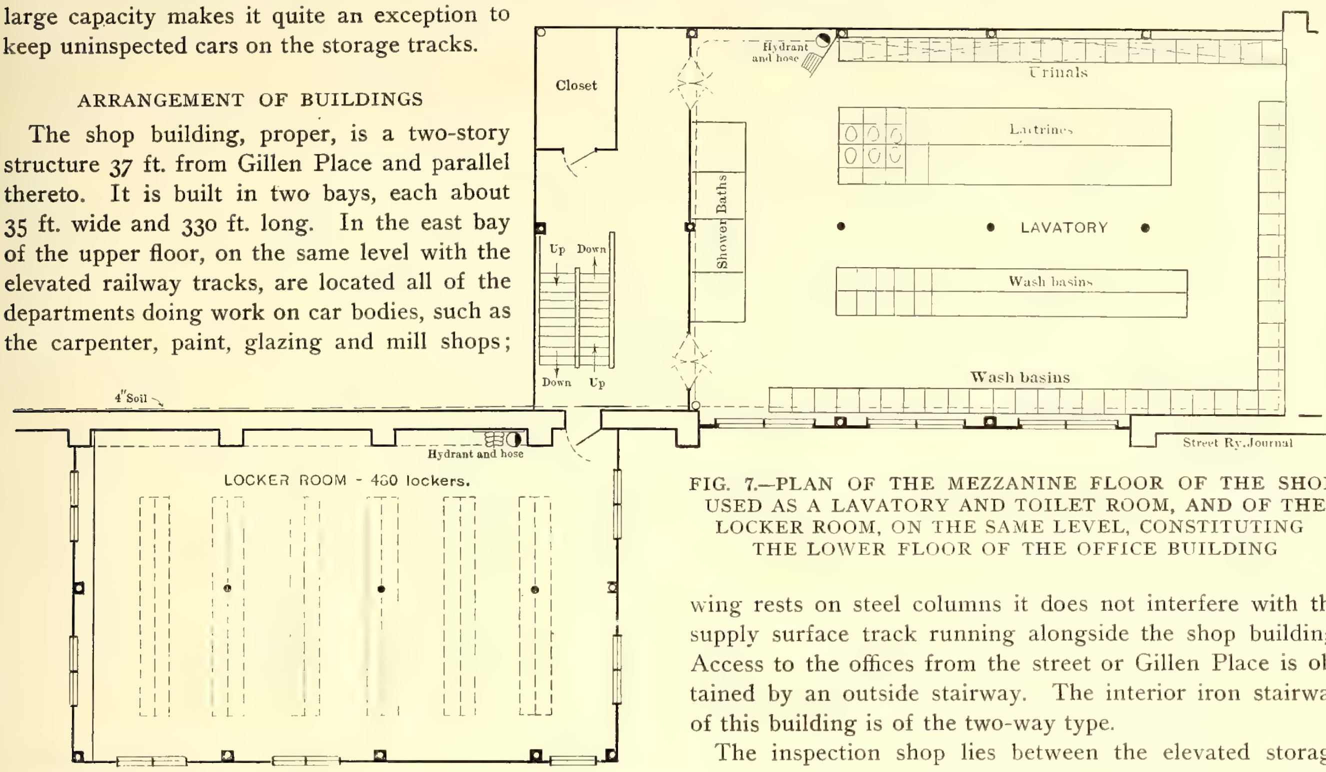


FIG. 7.—PLAN OF THE MEZZANINE FLOOR OF THE SHOP, USED AS A LAVATORY AND TOILET ROOM, AND OF THE LOCKER ROOM, ON THE SAME LEVEL, CONSTITUTING THE LOWER FLOOR OF THE OFFICE BUILDING

The inspection shop lies between the elevated storage yard and the second floor of the main shop building. The triangular portion between the rear of this shop and the Bushwick Avenue side serves as a room for coil baking and winding. Adjoining this room is the lumber storage shed and yard, which is bounded by the last fire-wall of the elevated car-storage yard.

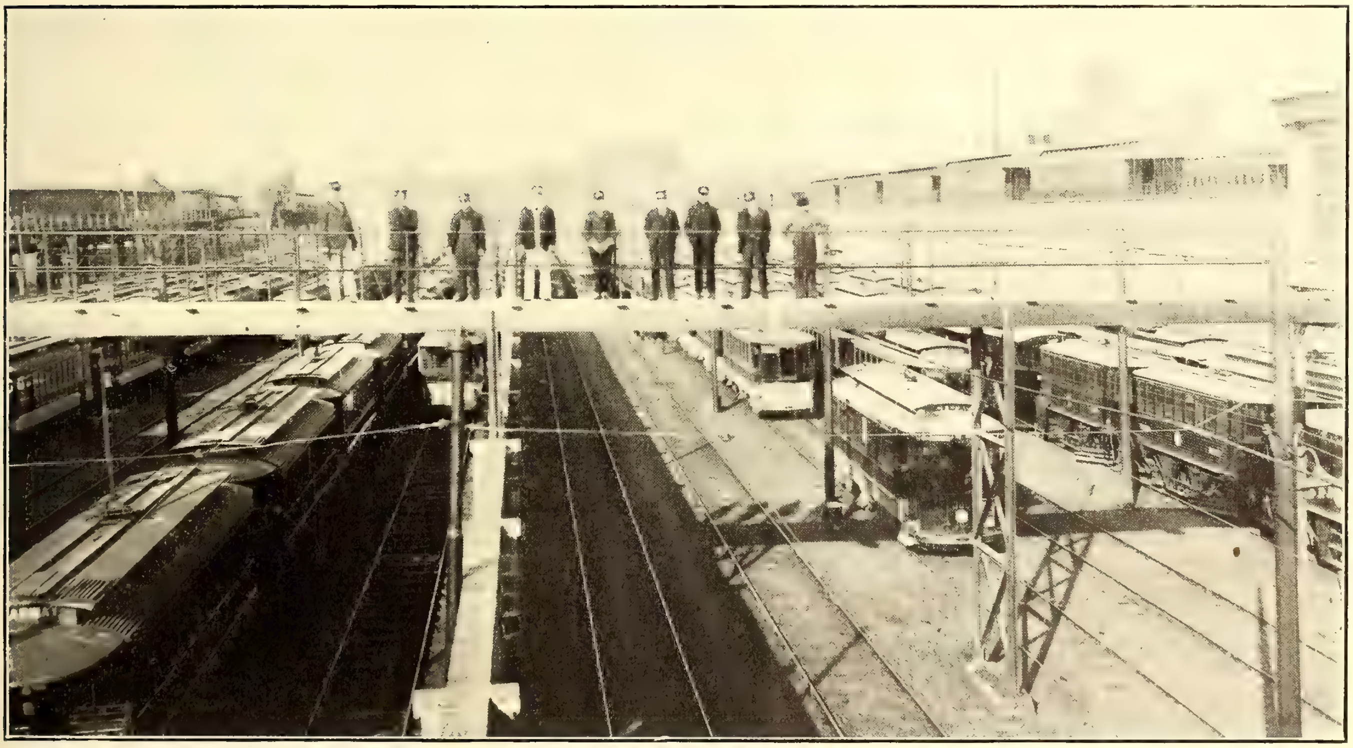


FIG. 8.—BRIDGE FROM THE ELEVATED TRAIN DISPATCHER'S BUILDING, CROSSING THE SURFACE-CAR STORAGE YARD TO THE ELEVATED CAR STORAGE YARD AND TRACKS TO INSPECTION BUILDING

In line with the main shop building is a two-story stock

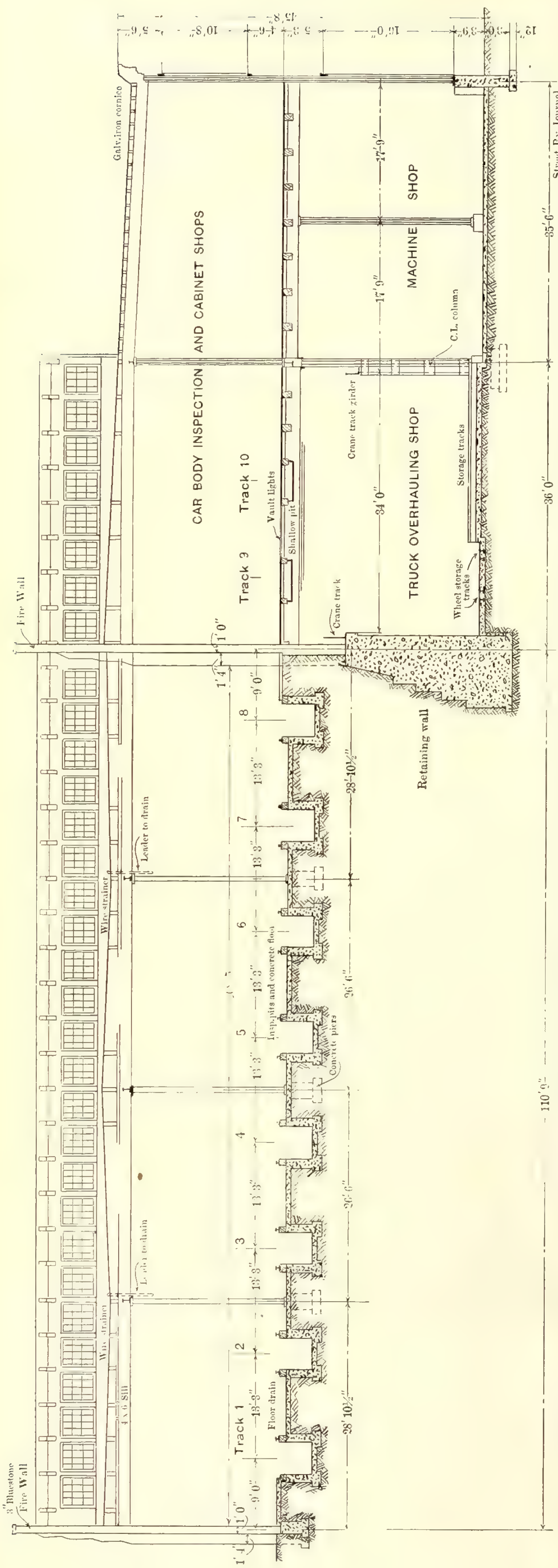


FIG. 9.—TRANSVERSE SECTION THROUGH THE INSPECTION AND MAIN SHOP BUILDINGS, SHOWING THE GENERAL CHARACTER OF CONSTRUCTION, FLOOR LEVELS, TRACK LAYOUTS, ETC. THE MEZZANINE FLOOR OF THE SHOP BUILDING IS NOT SHOWN ON THIS SECTION

room 98 ft. long, in addition to the other store rooms alongside of the tracks, leading to the inspection shed and the coal and iron store rooms on the Gillen Place side near the blacksmith shop. The office of the foreman of the inspection shop is directly before the oil room and in front of the inspection shed. This location makes it easy for him to view everything going on in the yard, besides enabling his clerks to check cars in and out of the shops with the least labor.

The remaining buildings on this plot, aside from the club house of the Brooklyn Rapid Transit Employees' Benefit Association, embrace a despatcher's office and a signal tower at the double Y elevated connection in addition to a new sub-station in the rear of the first four storage tracks.

CONSTRUCTION OF BUILDINGS

A notable feature of this installation is the fact that not a single building of the shop group is of wooden construction, the club house over 37 ft. distant from the main shop building constituting the only adjacent fire risk. All of the main foundation walls and building piers are of concrete. The walls of the main shop, except the retaining wall separating it from the inspection shop, are constructed of steel columns built up of angle-iron frames in cement to form a 2-in. curtain wall. The windows are on the Gillen Place and Bushwick Avenue sides. They have metal frames and sash made by the A. E. Rendle Company, of New York. Each set of windows is opened by turning a hand wheel connected to a rod having a worm at its middle and top portions to mesh with half gears controlling the degree of opening.

The shop, the inspection shed and the armature room have a roof of the saw-tooth type with wood and steel framing. This roof is covered on the steep portions with Johns-Manville asbestos roofiing, and on the flat portions with tar and slag. The main storehouse in line with the shop has the same structural features as the latter, with pivoted side lights. The oil, lamp and paint-storage room has brick walls, concrete floors and a reinforced concrete roof. Between the inspection and storage tracks is placed the yardmaster's office, which is built on steel columns with steel and cement walls.

The trainmaster's building is two stories high, having its lower floor level with the elevated track. It rests on steel columns and has walls of the same construction as the main shop. This building contains offices for the superintendent of the division, signal engineer, the roadmaster of the elevated lines, trainmen's quarters and locker rooms. It is connected by a steel foot bridge with the elevated yard. The signal tower for this elevated yard is a steel concrete structure, from which all trains are controlled through an all-electric interlocking plant, installed by the Union Switch & Signal Company.

FIRE WALLS AND OTHER FIRE PROTECTION

It is apparent from what has been said about the general type of building construction prevalent at the East New York plant, that the fire risk has been greatly minimized. In fact, careful study was given to this question by the company with such success that the insurance premiums in force here are probably the lowest in this country for an electric railway shop installation.

Fire protection in the storage yard was given equal attention as is shown by the construction of fire walls in both the elevated and surface-car yards to isolate the cars in smaller groups and thus prevent a fire in one section doing

damage to the cars in the others. The tracks in the surface yard are divided by a hollow-tile fire wall 8 ins. thick, constructed with 12-in. square buttressed piers every 20 ft. to a height of 15 ft. The elevated-car yard is divided into three divisions. One of the fire walls is 6 ft. high and is built on top of the main retaining wall, thus effectually preventing a fire in one yard being carried over to the other. The fire wall in the rear of the "L" car-storage yard separates this yard from the lumber storage shed and yard along Bushwick Avenue. These fire walls are similar to the one in the surface yard. The entire westerly wall of the inspection shed also serves as a fire barrier between the main elevated and storage yard and the inspection shop.

The fire protection of the buildings is by no means confined to the larger methods of construction. All wall openings are protected by double, automatic fire doors. There are also fire dampers in the pipes of the heating system, which close automatically in case of fire and so prevent fire drafts being carried through the different pipes. Danger from the oil tanks is obviated by keeping them 3 ft. under the ground on the Gillen Place side, outside of the building. The brick oil building, next to the main store room, has cement floors and ceilings and is an absolutely fireproof structure with no interior lighting.

Every precaution has been taken also to make an immediately effective fight against the spread of a fire. The human element for this purpose is embodied in the company's own fire brigade, organized for this shop. This brigade consists of a chief, an assistant and about twenty-five men, who are ready for service any time during the day. These men are drilled semi-monthly in the use of ax, hose, pails, fire extinguishers, etc. The fire apparatus installed throughout the plant consists of standpipes, extinguishers and pails. In addition there are a number of "Manhattan" fire-alarm boxes in different parts of the buildings, all connected to the city fire-alarm box outside the office building.

THE HEATING SYSTEM

Without question, the utilization of an incinerator plant for shop heating purposes is a unique development among American electric railways for which the Brooklyn Rapid Transit Company's engineers deserve great credit. The rubbish incinerator plant, thus exploited, is operated by the American Railways Traffic Company, which is a subsidiary corporation having a contract with the city to remove ashes, rubbish and other material. As much of this matter is burnable the company hit upon the sensible scheme of erecting an incinerator plant to furnish at a very low cost all the steam required for heating the shops. A 400-hp plant was therefore installed on the opposite side of Gillen Place on the plot shown in Fig. 3, on page 171.

Steam from this plant is conducted through seven insulated wrought-iron pipes in a concrete-supported trench extending under the street where they divide as follows: One 3-in. pipe 570 ft. long to the club-room heaters; one ¾-in. extra heavy pipe 245 ft. long to the club-room baths; one 5-in. pipe 185 ft. long to the office-building heaters with a 3-in. branch to the blacksmith shop and the inspection-shed heaters located in the armature room; one 2-in. pipe 230 ft. long from the heater discharge tank on the office floor; one 3-in. extra heavy pipe 315 ft. long for conveying live steam to the hammers in the blacksmith shop, and from which a 1-in. branch is led to a copper heating coil placed in the 300-gallon tank supplying hot water to the shower baths and wash basins. The pipes are laid with a slope of ⅛ in. in 12 ins. toward the incinerator. All pipes 2 ins. or more in diameter have flanged fittings, except the return pipes from the heaters, which have fittings. Every pipe is insu-

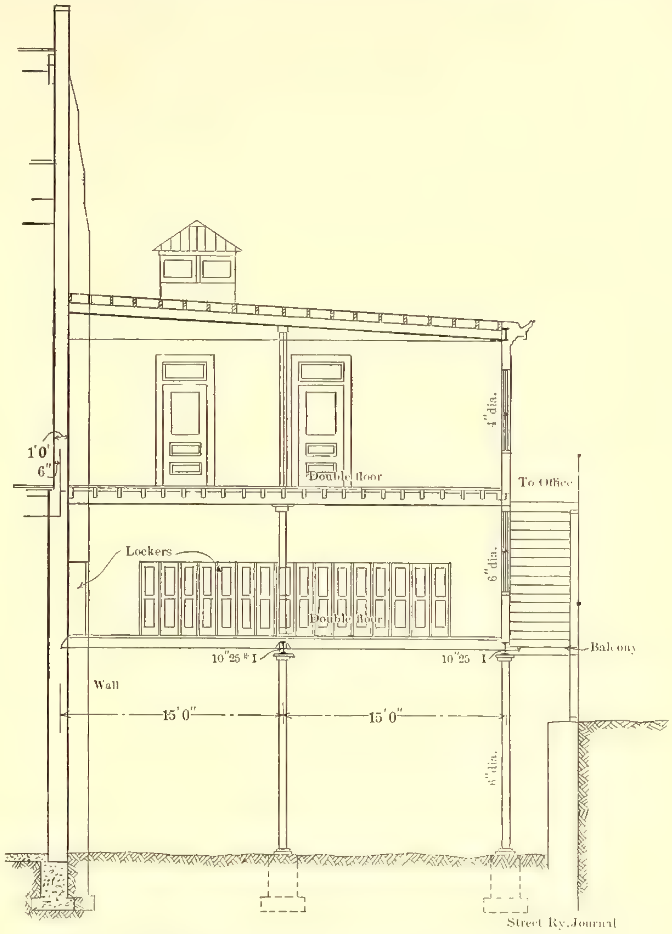


FIG. 10.—TRANSVERSE SECTION OF THE OFFICE BUILDING PROJECTING FROM THE MAIN-SHOP STRUCTURE

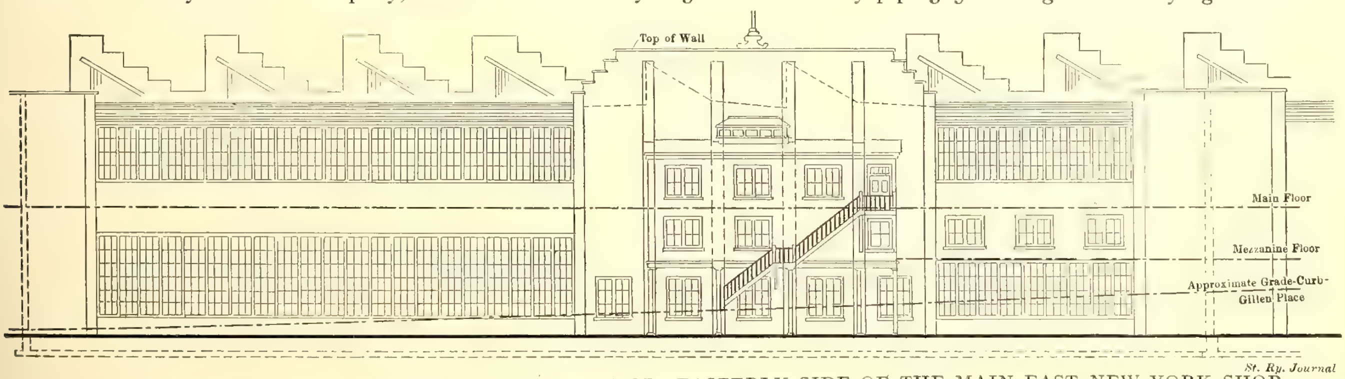
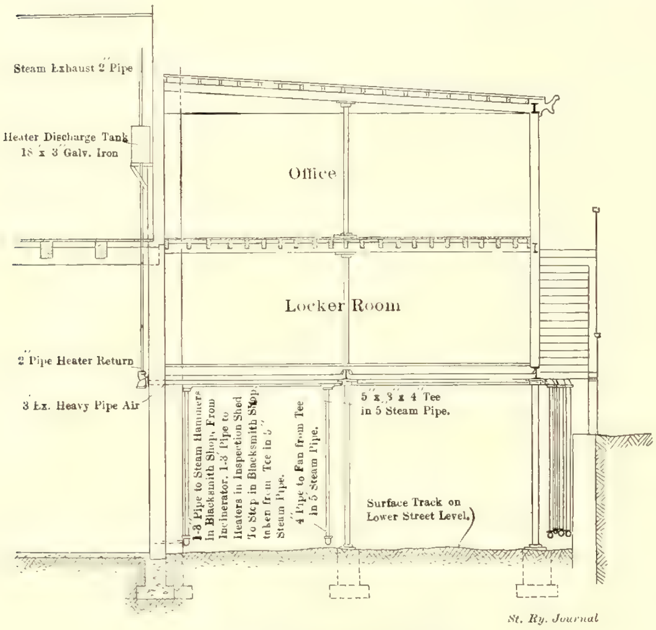


FIG. 11.—PARTIAL ELEVATION ON THE GILLEN PLACE OR EASTERLY SIDE OF THE MAIN EAST NEW YORK SHOP BUILDING, SHOWING THE LARGE WINDOW AREA, AND ALSO THE POSITION OF THE OFFICE BUILDING

lated and has a covering of No. 20 galvanized sheet iron. A partial layout of the piping is shown in Figs. 12 and 13, but further details will be given when describing the heating arrangements of the inspection building.

The heater system proper, as installed by the New York Blower Company, of Bucyrus, Wis., is a hot-air blast taken from the group of steam coils outside of the building under



Section A-A Through Office Building

FIG. 12.—SECTION THROUGH OFFICE BUILDING, SHOWING THE HEATING PIPES UNDER THE LOCKER ROOM

the locker room. The blast is produced by an 8-ft. exhaust fan, driven by a 30-hp variable-speed Northern Electric motor and is carried through galvanized-iron pipes to different parts of the buildings directly under the upper floor, thus keeping entirely out of the way of machines, etc., with outlets located at convenient intervals to diffuse hot air in different parts of the shop and offices. This method is also very convenient for the diffusion of cold air in summer, thus ensuring good working conditions all through the year.

Despite the length of distributing lines, the steam supply from the incinerator has proved more than sufficient to supply all of the needs of the shops and club house. The company, however, was fortunate enough to find a profitable market for its surplus produce by selling steam to a neighbor—Trommer's Brewery. This outside pipe is 5 ins. in diameter and about 1800 ft. long.

LIGHTING SYSTEM

Although the shops and inspection shed enjoy far more daylight than is found in most plants of this character, equal care was given to provide them with plenty of artificial light, not only for auxiliary use on dark days, but for good night work, too. Current is received through a 600-volt direct-current feeder leading to the main switchboard in the machine shop, and is carried from thence through cables to smaller switchboards located in different departments. Both arc and incandescent lamps are used, the latter being usually arranged in a series circuit making up clusters of five 16-cp lamps.

The machine shop is lighted with arc lamps. Directly over the work benches, on the Gillen Place side of the shop, five-light clusters of incandescent lamps are suspended from iron brackets in addition to similar clusters attached to either side of the posts throughout the shop.

In the truck-overhauling shop the arc lamps are suspended from the ceiling above the run of the principal crane. In addition to these arc lamps there are incandescent lamp clusters located over the truck-overhauling stub tracks. Sockets are also placed in different positions throughout the shop for attaching drop-lights, which can be carried to different machines as the operator desires. In the blacksmith shop there are arc lamps suspended from the ceilings and five-light clusters of incandescent lamps at the different machines. On the upper floor of the main shop building, arc lamps are also installed, together with five-light incandescent clusters over each bench.

The storeroom is furnished with drop-lights suspended

Location Plan

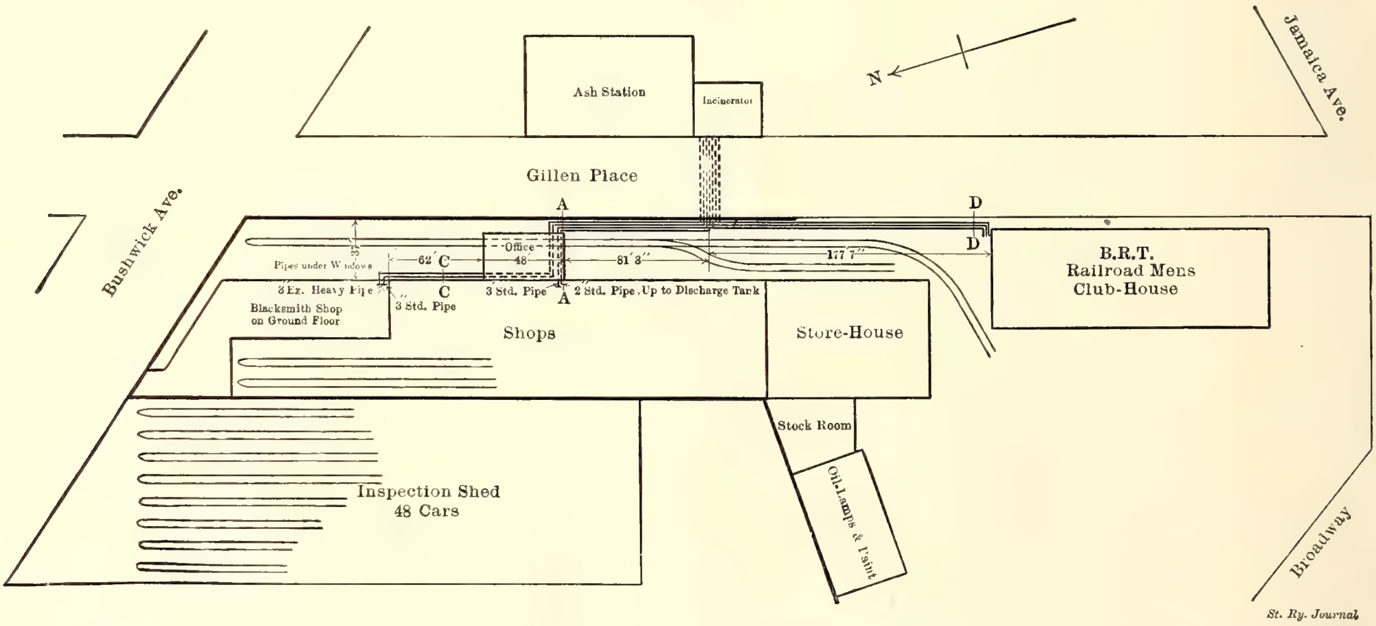


FIG. 13.—PLAN OF THE EAST NEW YORK SHOP AND YARD PLANT, SHOWING PARTIAL LAYOUT OF THE HEATING SYSTEM FROM THE INCINERATOR PLANT

from the ceilings and in sufficient number to illuminate any portion. For fire protection there are no lights at all in the mechanical department's paint and oil room, but an arc lamp placed just outside the door gives enough light to those working inside the room.

On both sides of the elevator shaft between the upper floor and the truck overhauling shop there are two 16-cp lamps with reflectors, which throw the light directly on the truck to be taken down. This makes it easier at this point to couple or uncouple the motor leads.

The inspection shed has five-light incandescent lamp clusters suspended above the floor between the tracks, in addition to the pit lighting described elsewhere. The office is illuminated by four-light ceiling clusters, the fifth socket serving for a connection to a desk light.

WINTER SPORTS AT A NEWBURGH SUMMER RESORT

The success which the Orange County Traction Company, of Newburgh, N. Y., is meeting with in the development of winter pleasure traffic is worth the attention of

NEWSPAPER ADVERTISING OF WINTER PARK SPORTS BY THE ORANGE COUNTY TRACTION COMPANY

other railway companies with aquatic park resorts who have not endeavored to exploit them during the cold months of the year. As noted in the Dec. 22, 1906, issue of this paper, the company is encouraging the visits of ice skaters to Orange Lake by heating the summer lunch pavilion after enclosing it with glass, and also illuminating the lake electrically to attract the large number of people unable to come during the day. The company also arranges skating carnivals, fireworks, horse racing and other attractions from time to time announced in the local papers by newsy advertisements. The accompanying illustration is a fac-simile of a column advertisement except that the lower half has been placed on the right for convenience in reproduction. The plans for the company's winter attractions are being carried out by general manager E. C. Boynton, who has also instituted a fare reduction of 25 cents to 15 cents for the round trip to Orange Lake on gala days.

REPORT ON THE STRENGTH OF ELM, OAK AND LOCUST INSULATOR PINS FROM TESTS MADE BY THE FOREST SERVICE OF THE UNITED STATES DEPARTMENT OF AGRICULTURE

At the request of certain consumers, the Forest Service of the United States Department of Agriculture recently made tests on fifty-three insulator pins of rock elm, live oak, and black locust. The tests were made at the timber-testing station of the Forest Service at Perdue University, Lafayette, Ind. The results indicate the relative strength of the pins tested. They depend upon too small a number of tests, however, to show in an authoritative way the relative value of these woods.

The pins were of standard size, 1¼ in. by 8 ins. The oak pins were from ⅛ in. to ¼ in. shorter than the others, and of slightly smaller diameter at the shoulder. Their lever arm was also about ½ in. shorter than in the cases of the other two species.

In testing the pins an iron block was clamped to the fixed upper head of a small screw-testing machine. The pins were inserted to a tight fit in a hole in this iron block, and projected horizontally over the pulling head of the machine. The glass insulator was unable to bear the strain of the wire, so an iron model of the ordinary glass insulator was screwed on the pin and connected by means of a heavy wire to the pulling head of the machine. When a strain was put on this wire, the pin acted as a beam fixed at one end and loaded at the other, which is practically the condition met with in practice. The breaking moment (maximum load times lever arm) is taken as a measure of the strength of the pins. The iron block mentioned was used in preference to a wooden cross-arm for supporting the pins, for the reason that this iron block forced the pins to break under the test. Furthermore, it furnished uniform conditions for all pins. Thus, the results of the tests do not show the strength of a combination of pins and cross-arm, but they show the bending strength of the pin itself.

The following table gives the results of the tests:

SPECIES.	No. of Tests.	Weight of Pin.	Rings per Radial Inch.	Breaking Moment (Maximum Load by Lever Arm).
		Grams.		Inch Lbs.
Black locust from Boston, Mass...	23	Avg. 106.3	12	3,970
		Max. 119.3	25	5,380
		Min. 86.6	3	2,520
Black locust from Nashville, Tenn.	7	Avg. 125.9	8	4,087
		Max. 147.1	11	4,930
		Min. 111.8	4	3,010
Rock elm from Nashville, Tenn...	8	Avg. 93.8	42	2,512
		Max. 108.7	48	3,150
		Min. 77.5	33	1,450
Live oak from Houston, Texas....	12	Avg. 127.1	Not distinguishable.	3,025
		Max. 141.0		4,590
		Min. 110.4		1,990

From the table it appears that the breaking strength of the two shipments of black locust pins was practically the same, and may be taken as 4000 lbs. Live oak pins came next in order for strength, with a breaking moment of about 3000 lbs. Rock elm pins were the weakest, having a breaking strength of 2500 lbs. The oak pins were the heaviest the locust next, and the elm the lightest.

The locust and elm pins failed mostly by a splitting from the threads to the shoulder, or by tension at the shoulder. Occasionally the portion of the pin inserted in the block failed by shearing horizontally. The oak pins nearly all failed by tension at the shoulder.

NEW CAR HOUSES IN BALTIMORE

The extensive property loss in Baltimore during the recent conflagration in that city has directed the attention of the engineers and architects in Baltimore to the subject of fireproof construction for buildings to a greater extent than perhaps in any other city. It is not surprising, therefore, that in arranging its plans for a series of new car houses the United Railways & Electric Company, of that city, should decide to pay especial attention to methods of fire protection.

The erection of these car houses was made necessary by the track extensions and cars which have been added to the Baltimore system during the last few years. For some time the use of open terminals was considered, but the resulting depreciation of rolling stock and equipment and the additional power required to start cars cold on winter mornings settled the question in favor of closed storage. The territory of the company was then divided into eight divisions, each operating about 104 cars, and for each of these divisions a modern fireproof terminal or car house was decided upon. All of the car houses follow a typical plan, although the details of their arrangement is varied somewhat according to the shape, grade and other conditions of the site, and also according to the building material used.

The following is a list of the eight car houses which will serve the eight divisions into which the Baltimore system is divided. Of these, one, that at Light Street, is remodeled, three are under way and the others are still in the hands of the engineers and architects.

1. The Edmondson Avenue and Calverton Road car house. This building has the first three sections nearly completed. It is constructed of reinforced concrete throughout, with a slag roof.

2. Electric Park car house. Owing to its location opposite the entrance to Electric Park an ornate facade of brick with terra cotta trimmings has been adopted for this car house. The exterior division walls are of brick. The slag roof is carried on reinforced concrete girders which are supported on concrete posts enclosed within the division walls.

3. Waverly car house, located on York Road near Arlington Avenue. The division and exterior walls of this car house are of concrete block. The columns and roof girders are of reinforced concrete supporting a slag roof.

4. Car house at North Avenue and Gay Street. This building, like the Edmondson Avenue car house, will be of reinforced concrete throughout.

5. Light Street car house. This is an old car house remodeled, as will be described later. It has brick walls with concrete posts and girders supporting a slag roof.

6. Highland town car house, located at the corner of Lombard and Seventh Street. The type of construction has not been decided.

7. Hartford Avenue car house; construction and actual location undecided.

8. Park terminal car house, located at Fulton and Druid Hill Avenues; construction undecided.

This article will describe Nos. 1, 2 and 5 in the list given above, but it will be understood that in their main features the other car houses will follow the general lines adopted for Nos. 1 and 2.

EDMONDSON AVENUE CAR HOUSE, WALLS, FLOORING AND ROOF

An exterior view of the Edmondson Avenue car house, produced from the architects' drawing, is presented in Fig. 1; the plan is shown in Fig. 2 and longitudinal and cross-sections in Figs. 3 to 5. Owing to the grades of the lot on which this car house is being built the interior is on six levels with four tracks on each level.

FIG. 1.—EDMONDSON AVENUE CAR HOUSE

The concrete foundations for the interior columns is carried down 3 ft. below the present ground elevation, and those for the exterior walls and roof columns' foundations to 3 ft. below the newly-established grade elevation. The reinforced concrete system used is the Armoured Concrete Construction Company's construction, consisting of round rod reinforcement. The concrete girders and beams are calculated on a basis of 400 lbs. per square inch, and the columns for 350 lbs. per square inch of compression. The reinforcing steel used is calculated at 16,000 lbs. per square inch as a safe working stress. All sash are in metal frames and are glazed with wire glass. A slag roofing is employed.

The floors of the pit and the entire ground floor of the building are of concrete 4 ins. thick, resting on a 4-in. layer of broken stone or cinders. After being laid, this floor is surfaced with a granolithic finish of Portland cement, 1 in. thick. Slag blocks are laid next to all rails in the concrete floor to prevent cracking.

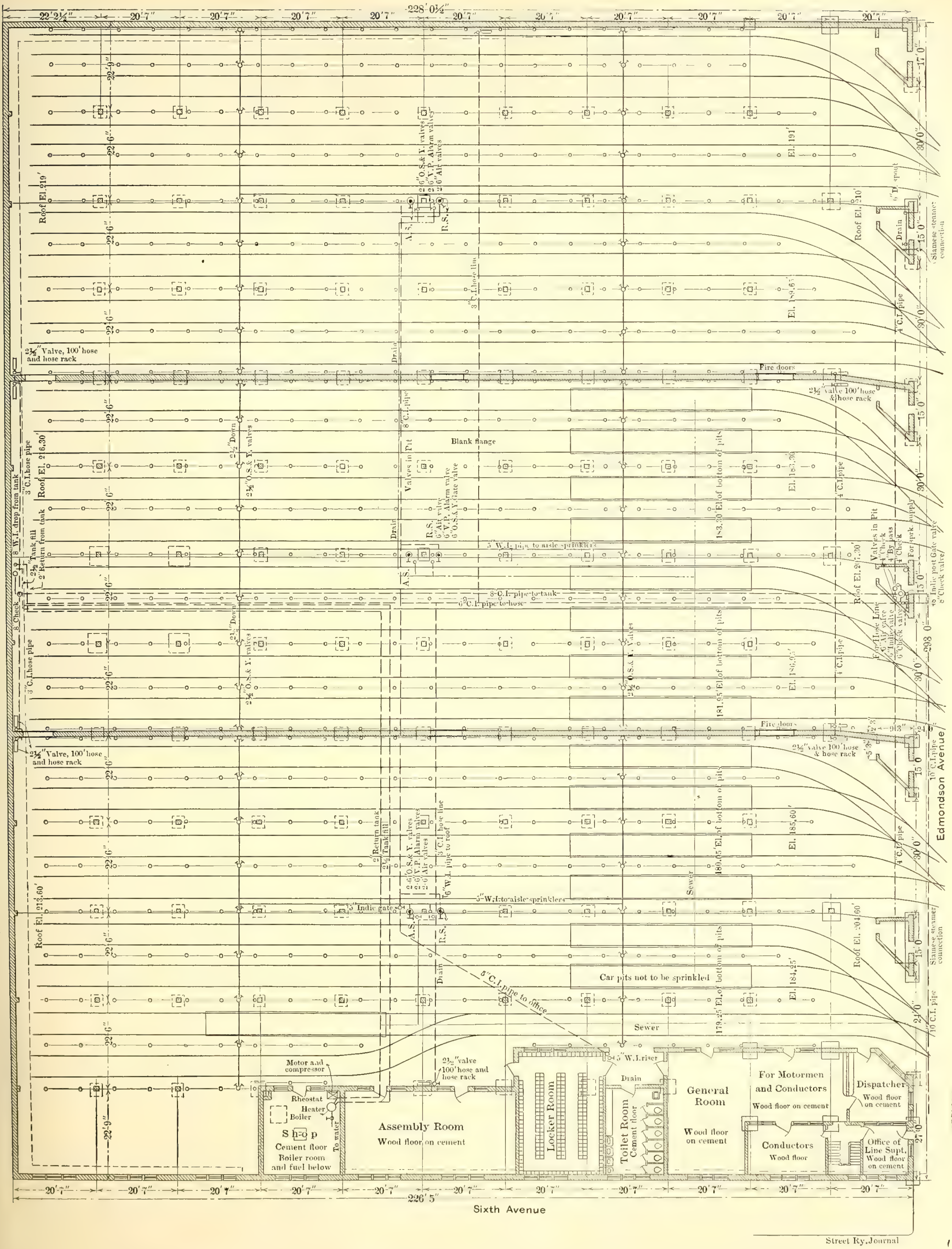


FIG. 2.—GENERAL PLAN OF EDMONDSON AVENUE CAR HOUSE, SHOWING AISLE SPRINKLERS

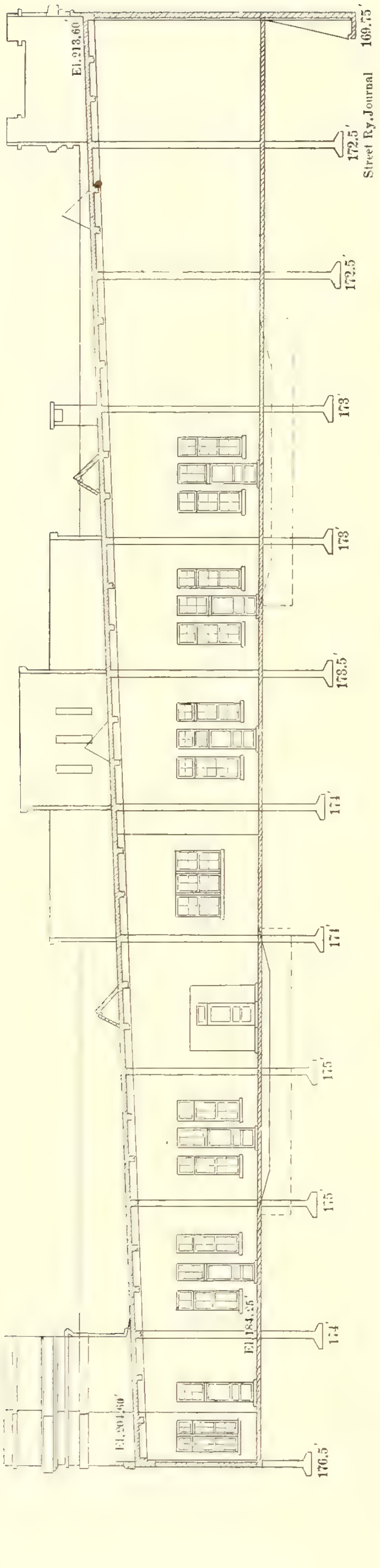


FIG. 3.—LONGITUDINAL SECTION LOOKING EAST; EDMONDSON AVENUE CAR HOUSE

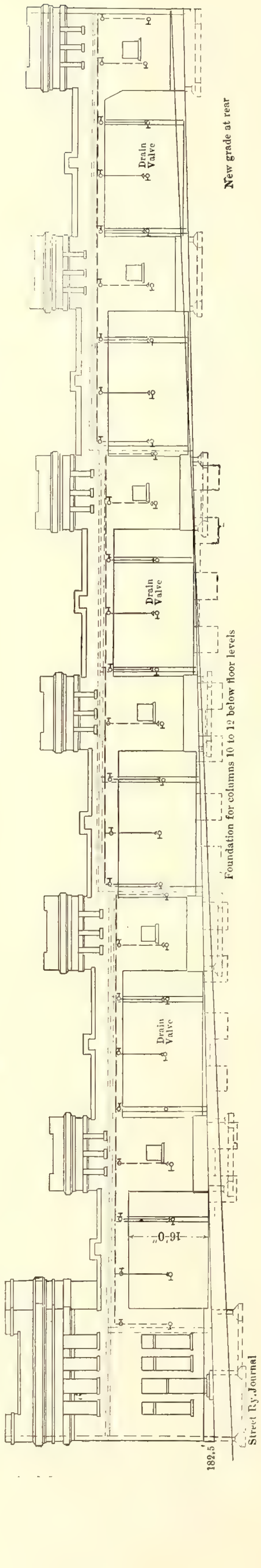


FIG. 4.—FRONT ELEVATION OF EDMONDSON AVENUE CAR HOUSE, SHOWING AISLE SPRINKLER

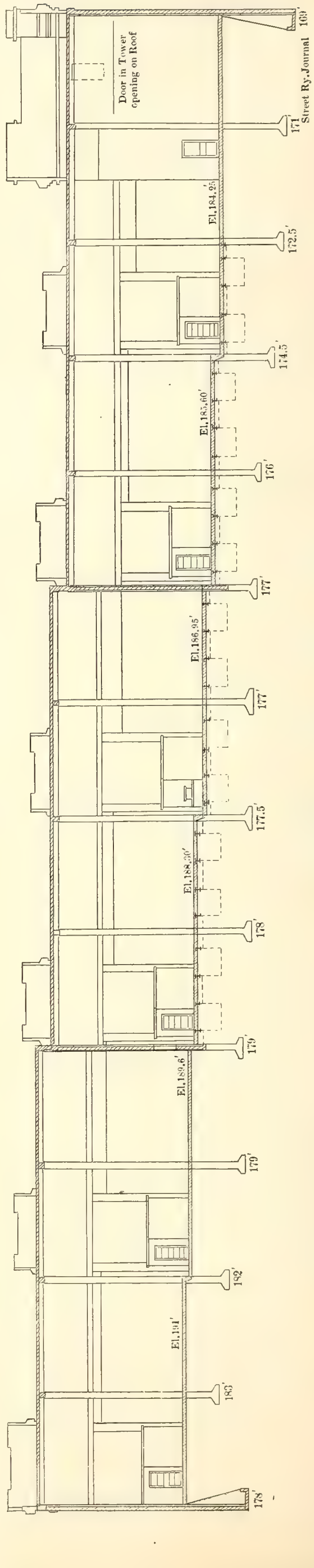


FIG. 5.—TRANSVERSE SECTION, LOOKING NORTH

GENERAL ARRANGEMENT

The storage portion of the car house is divided into two bays separated by a 6-in. fire wall. The communicating openings are provided with double automatic fire doors with the usual fire link. There are fifteen tracks extending the entire length of the building, and as the building is 226 ft. long each track will accommodate five of the standard 42-ft. to 43-ft. semi-convertible cars of the company. Fourteen of these tracks are provided with pits 45 ft. long. The gage of the tracks in Baltimore is 5 ft. 4½ ins. The space between track centers, where there are columns or walls, is 12 ft., and where there are no columns or walls the tracks are on 10-ft. 6-in. centers.

Adjoining the four entrances to the car house are four triangular compartments with 6-in. interior walls of reinforced concrete. These compartments are to be used respectively for oil storage in barrels, sand storage, car cleaners' waste, and the storage of oil for daily use. The position of these store rooms so near the entrance has been chosen as being especially convenient. The main entrance to the compartment for the storage of oil in barrels is on the outside of the building. The entrances on the inside of the car house to that compartment and to the other two containing inflammable material are provided with self-closing fire doors. The oil for daily use is not kept in barrels but in a steel tank buried below frost line outside of the building and connected with the oil compartment by two pumps. This tank can be filled from the outside, thereby avoiding any possible chance of fire. The walls of the sand room are carried to a height of only 8 ft. The roof is a concrete slab 4 ins. thick and provided with an opening through which sand can be shoveled directly from a gondola car of the company, which brings sand to the car house. The sand will then fall out through an opening near the floor, from which the car sand boxes can be filled.

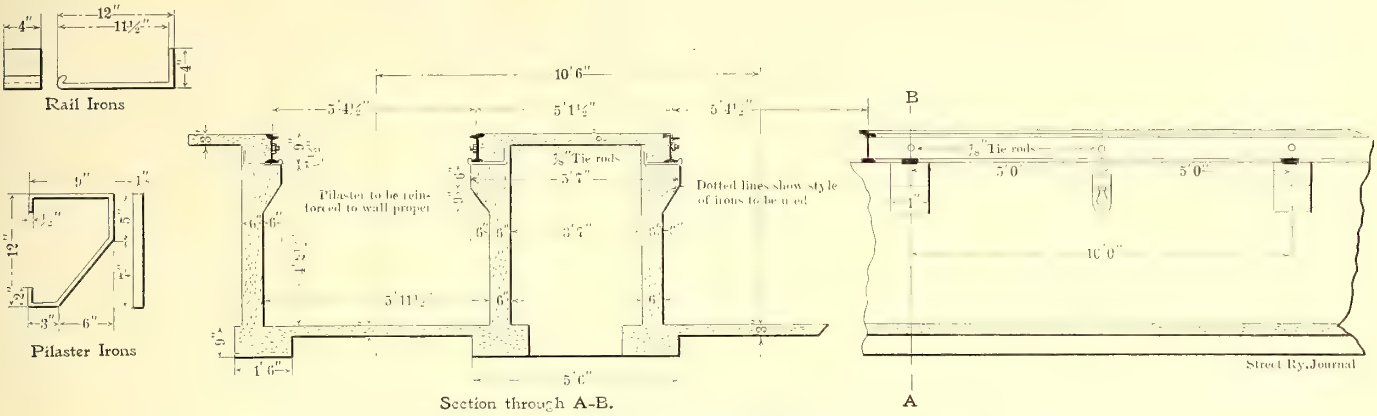


FIG. 7.—SECTION AND DETAILS OF PITS WITH FLUSH AISLES

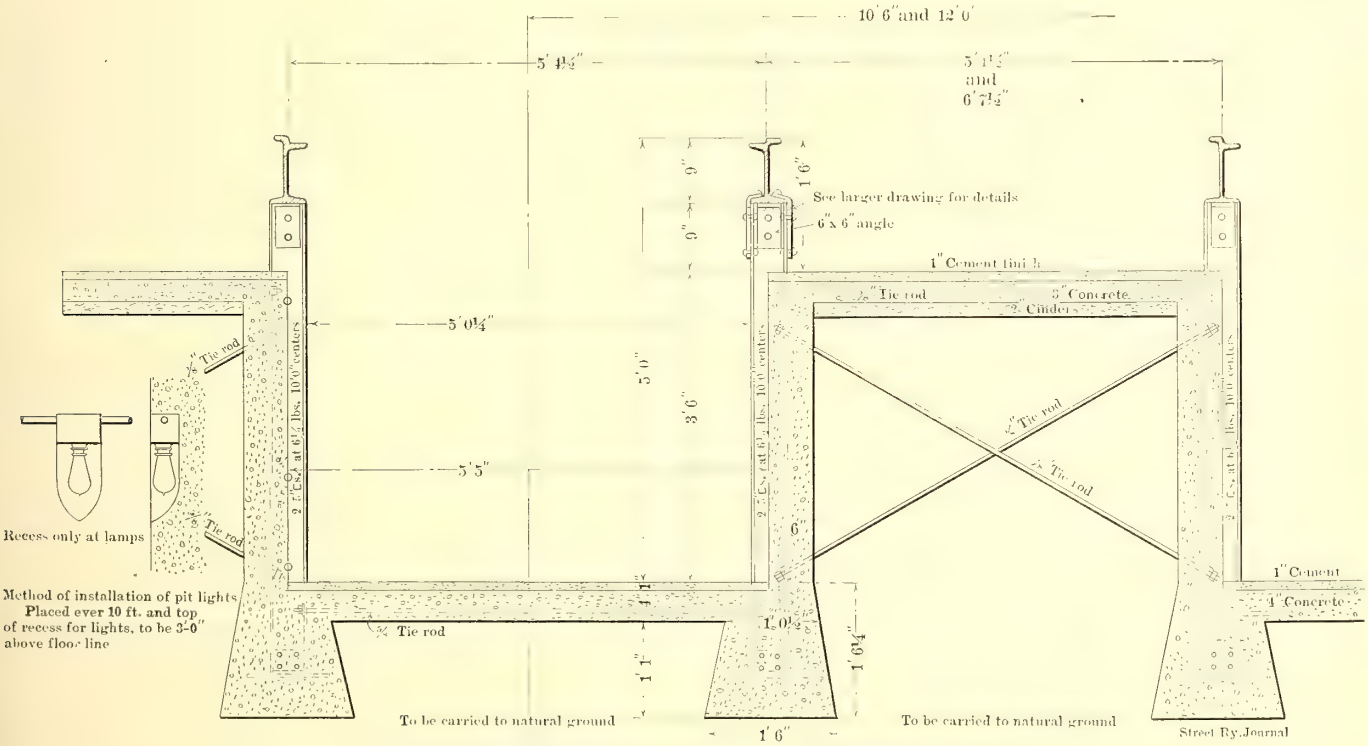


FIG. 6.—SECTION THROUGH PIT WITH DEPRESSED AISLES

PIT CONSTRUCTION

All of the pits except one in each car house have depressed aisles. The latter, of course, are better adapted for work on the journals, compressors or other parts of the equipment below the car, while the flush aisles are much more convenient for the men when putting in armatures. The type of depressed aisle pit used is illustrated in Figs. 6 and 8. The rail throughout is of the 9-in. girder type. As shown

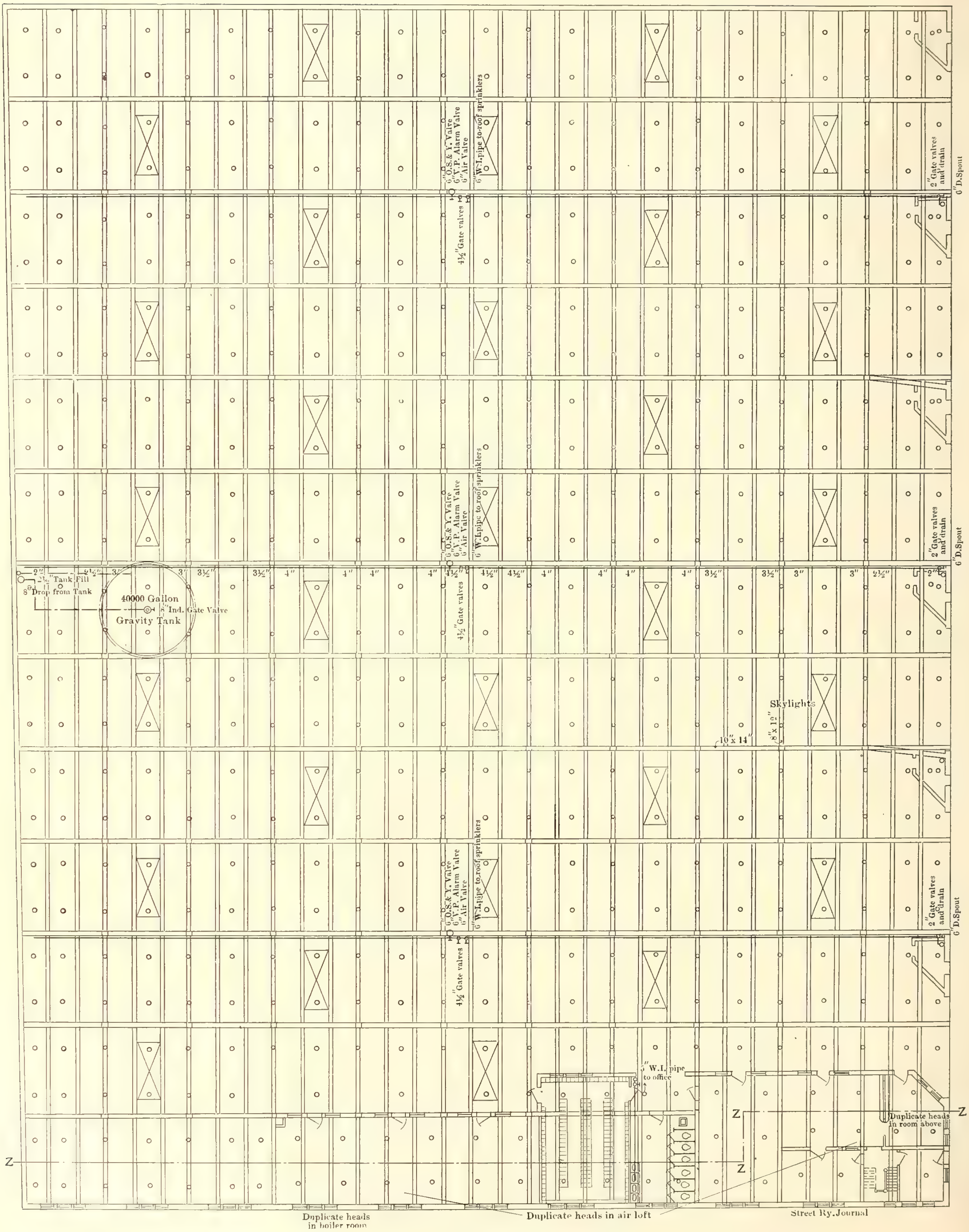


FIG. 9.—PLAN OF EDMONDSON AVENUE CAR HOUSE, SHOWING LOCATION OF ROOF SPRINKLERS

in the engravings, this rail is supported on channel columns spaced 10 ft. centers. The rail is riveted to these channels through forgings at the side and a 6-in. x 6-in. angle between channels under its base. The floor of the depressed aisle is 18 ins. below the head of the rail, or 9 ins. below the base of the rail, allowing a man while at work to sit on the floor of the aisle with his legs hanging over into the pit. The pits are lighted by 16-cp lamps placed in recesses in the concrete, so they cannot be broken. These lamps are spaced 10 ft. apart and are located 3 ft. above the floor line of the pit. The conduits for the lamp wires are embedded in the concrete sides of the pit.

Fig. 7 shows a section through a flush aisle pit. Here the rail is supported on concrete pilasters, which are spaced 10 ft. apart and are reinforced by wrought-iron brackets of the form illustrated. The rails are held in place by 4-in. x 4-in. x 11½-in. angles embedded in the concrete, and the outside rails of the two tracks are held to gage by tie-rods.

The spacing between outside rails, where there are no columns, is 5 ft. 1½ ins. This gives 25 ins. between adjoining cars, or plenty of room for two men to work from the aisles on the cars in adjoining pits and still allow space for passage between. Where there are columns in the aisles this spacing is increased to 6 ft. 7½ ins. In some cases the pit track has a depressed aisle on one side and a flush aisle on the other.

ACCOMMODATION OF EMPLOYEES

It is part of the system of the company to provide good accommodations at each car house for all the crews working from that point. The rooms in all the new car houses are at the side of the building as shown in the plan. The dispatcher's room is in the front of the building and is provided with windows through which he can view practically the entire bay adjoining his office, as well as see all of the entrance tracks and the tracks in front of the car house. The line superintendent occupies the other half of the front of the building and his office adjoins that of the dispatcher. A large waiting room, intended for the motormen and conductors, adjoins the office of the dispatcher, to which it is connected by a passageway. A portion of this room is partitioned off from the main room and will be used by the conductors for the purpose of making up their reports. In the rear of these rooms are the toilet accommodations, together with a spacious well-ventilated and well-lighted locker room, where each employee has his own metal locker.

In the rear of the locker room the company has supplied what it calls its assembly room. Here the men have greater freedom than in the general room for conductors and motormen, and may read, play games, smoke and amuse themselves when off duty. It is proposed to install in each room of this kind pool tables and other games, reading tables and other means of passing the time. In the rear of the assembly room is a small shop for minor repairs to cars, and the boiler room for the accommodation of the heating apparatus is below the shop in a basement. As the company has a very extensive repair shop at Carroll Park, the equipment of this shop will probably be confined to hand tools, with possibly a post drill. The heating plant will provide heat for the offices and rooms mentioned above and for the pits in one bay only.

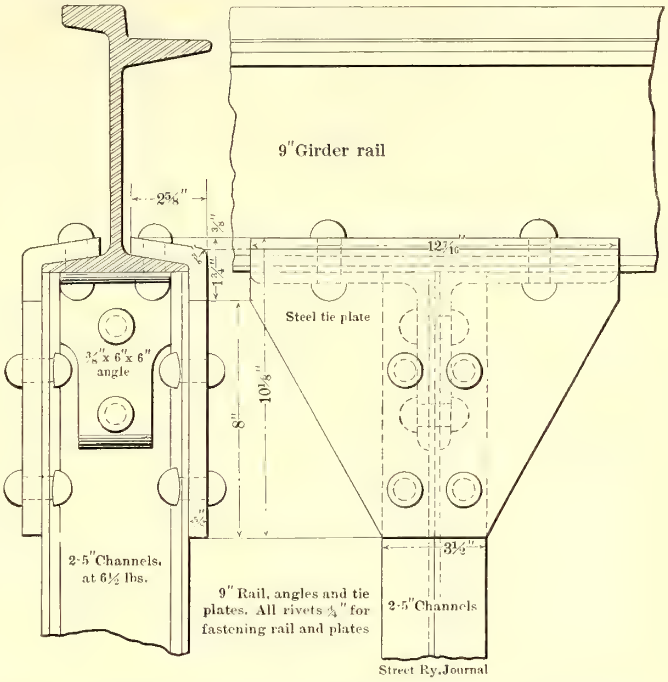


FIG. 8.—DETAIL SHOWING METHOD OF SUPPORTING RAIL ON COLUMNS IN PITS WITH DEPRESSED AISLES

AUTOMATIC SPRINKLER SYSTEM

The automatic sprinkling system at Edmondson Avenue car house is being installed by the General Fire Extinguisher Company, of Providence, R. I., and consists of both aisle and ceiling sprinklers, operated on the standard dry-pipe system of the company. The aisle sprinklers are carried at a height of 8 ft. above the floor, or about 3 ins. below the tops of the car windows, and are spaced 7 ft. centers. The roof sprinklers are carried in a line over the center of each track and each aisle. They are distributed according to the area to be protected, but are usually 10 ft. apart, that is, eleven sprinklers are installed to cover 1000 sq. ft. All sprinklers are supplied with water through 2½-in., 3-in., 4-in. and 4½-in. pipes to 6-in. mains, which are

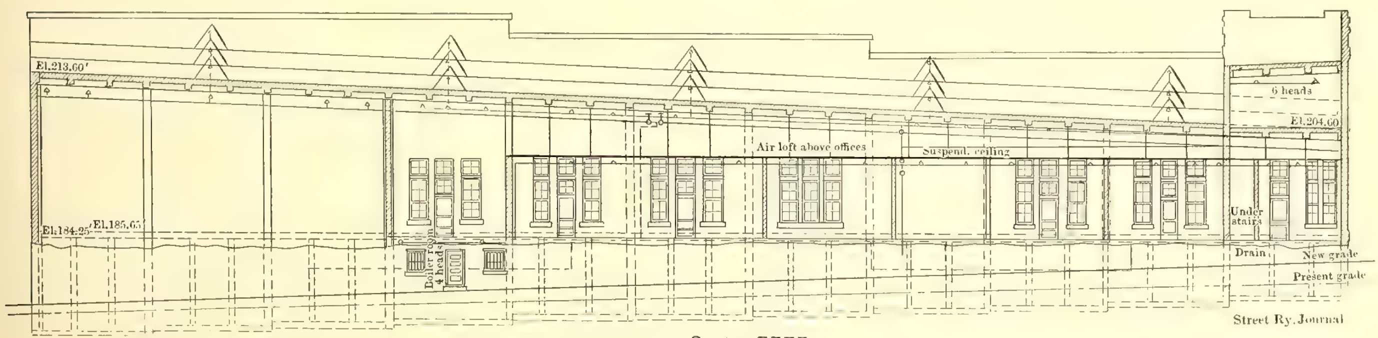


FIG. 10.—LONGITUDINAL SECTION OF EDMONDSON AVENUE CAR HOUSE ON LINE ZZZZ (SEE PAGE 182), SHOWING ROOF SPRINKLERS

connected to a 40,000-gal. gravity tank whose base is 20 ft. above the highest point of the roof. This tank is supported on reinforced concrete piers as shown. The general plan of the Edmondson Avenue car house given in Fig. 2 shows the location of the roof sprinklers as well as the other features already mentioned.

Every care has been taken to prevent any interference between trolley poles of the cars and the aisle sprinkler pipes. The latter are discontinued before the special work begins and they are also arranged so that there are openings frequently which if necessary will permit the trolleys to be turned. The aisle sprinkler pipes are supported on hangers which are shaped in the form of Y's and are placed 24 ft. apart. Between these supports the pipes are supported by truss rods from the hangers. These permit additional overhead clearance. A large proportion of the cars are double-truck cars on which there are two trolleys, so that the trolley poles do not ever have to be turned. The single-truck cars on which there is only one trolley can, if necessary, be run back until the cars are clear of the aisle sprinklers, when the trolley may be reversed. In addition the aisle sprinkler pipes are insulated by means of special mica collars which are placed within the joints. These joints prevent danger from grounding throughout the building in case of accidental contact with the trolley wire in any way.

All exterior doors are of the rolling type, either Kinnear or Wilson, and have steel thresholds. All fire-door openings have channel-iron frames around the entire opening.

ELECTRIC PARK CAR HOUSE

Plan views and a front elevation of the Electric Park car house, which is the next farthest along, are given in Figs 12 and 13. As already stated, thic car house consists of a reinforced concrete skeleton frame with brick walls on the outside as well as on the inside. The building has a width of 214 ft. and a depth of 314 ft., and is subdivided into five sections. Each section is separated from the next by a brick fire wall with the usual self-closing fire doors. The general arrangement of this building is similar to that of the Edmondson Avenue car house, except that the pits are 90 ft. long and are placed further back in the car house This will allow one car to stand between the pit and the entrance curve. The pit on one track, or that nearest the shop, is located one car length from the rear wall. There is also a slight difference in the arrangement of the oil storage triangular compartment, the entrance to which is from the outside and entirely separated by fire walls from the car house proper. Sand pits and car cleaners' rooms as well as a room set apart for the daily use of oil are provided, as at Edmondson Avenue, and are closed by brick fire walls, having standard underwriters' fire doors.

Aisle and ceiling sprinklers are used in this car house as at Edmondson Avenue, but the equipment is being installed by the Phœnix Fire Extinguisher Company, of Chicago. Owing to local conditions connected with the water supply, it is considered desirable to install in this car house two tanks of 40,000 gals. each instead of one tank.

The pits are drained by an electrically-driven centrifugal pump with a capacity of 75 gals. per minute, with automatic start consisting of a ball float and a Whittingham solenoid automatic motor start.

The Edmondson Avenue and Electric Park car houses were designed by Simonson & Pietsch, of Baltimore, architects, J. Henry Miller being the contractor for the former and the Charles McCaul Company, of Philadelphia, for the latter. Simonson & Pietsch are also the architects for the Gay Street car house, and Baldwin & Pennington for the new York Road and Park Terminal car houses. The Noel Construction Company is the contractor for the York Road car house. Both architects have been working under the supervision of the company's engineers.

FIG. 11.—ELECTRIC PARK CAR HOUSE

OWNERS

Although to be used by the United Railways & Electric Company, the buildings will be owned by the Maryland Electric Railway Company, and their sites by the Maryland Realty Company. These corporations, as mentioned in a recent issue of this paper, have been organized as a part of the financial scheme of the United Railways & Electric Company to assist it in carrying out important and necessary extensions and improvements. These companies operate very much like the car trust companies with the steam roads, and receive as a lease 6 per cent on the money invested by them. The expenditure is then retired by amortization. The rela-

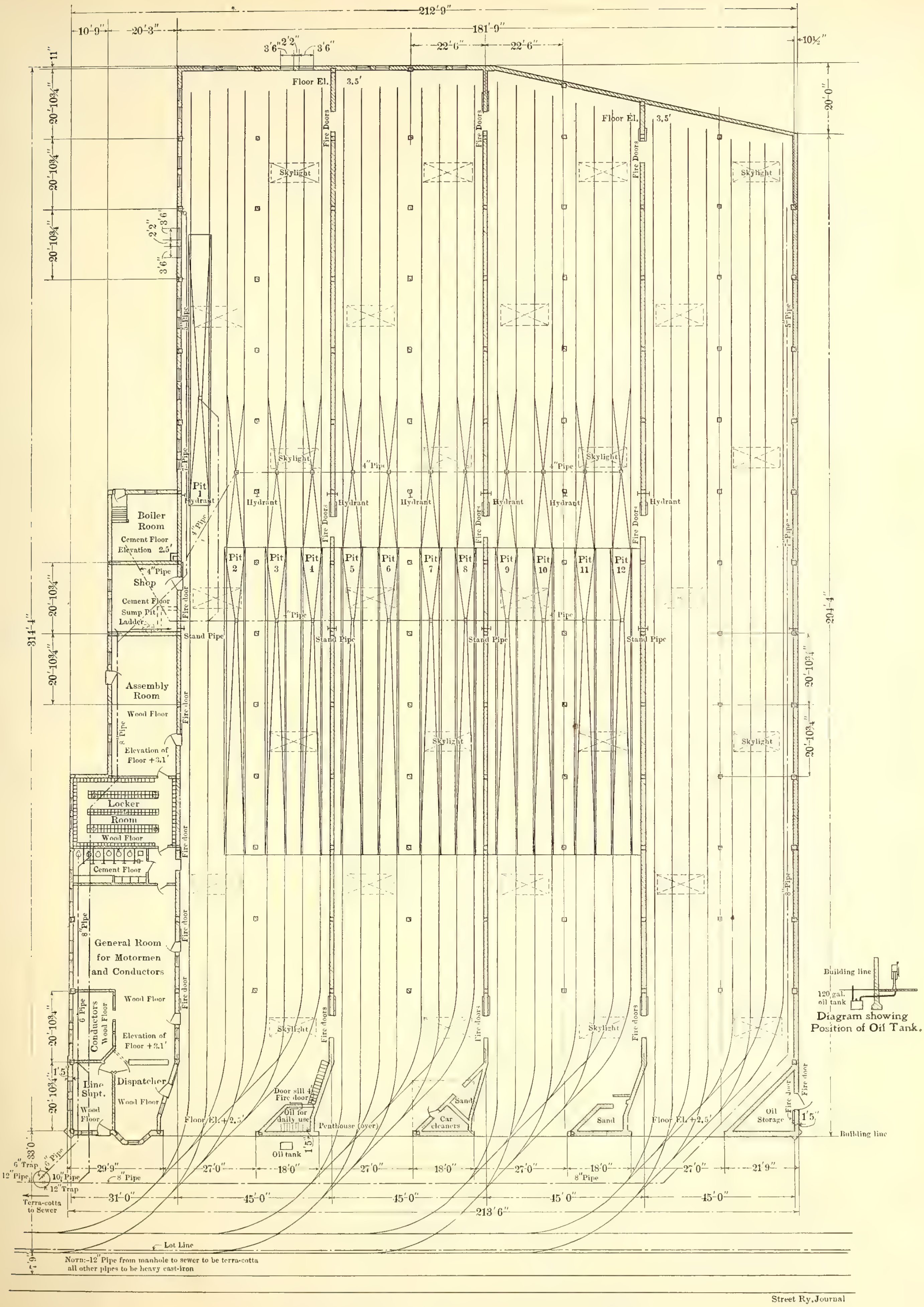


FIG. 12.—PLAN OF ELECTRIC PARK CAR HOUSE

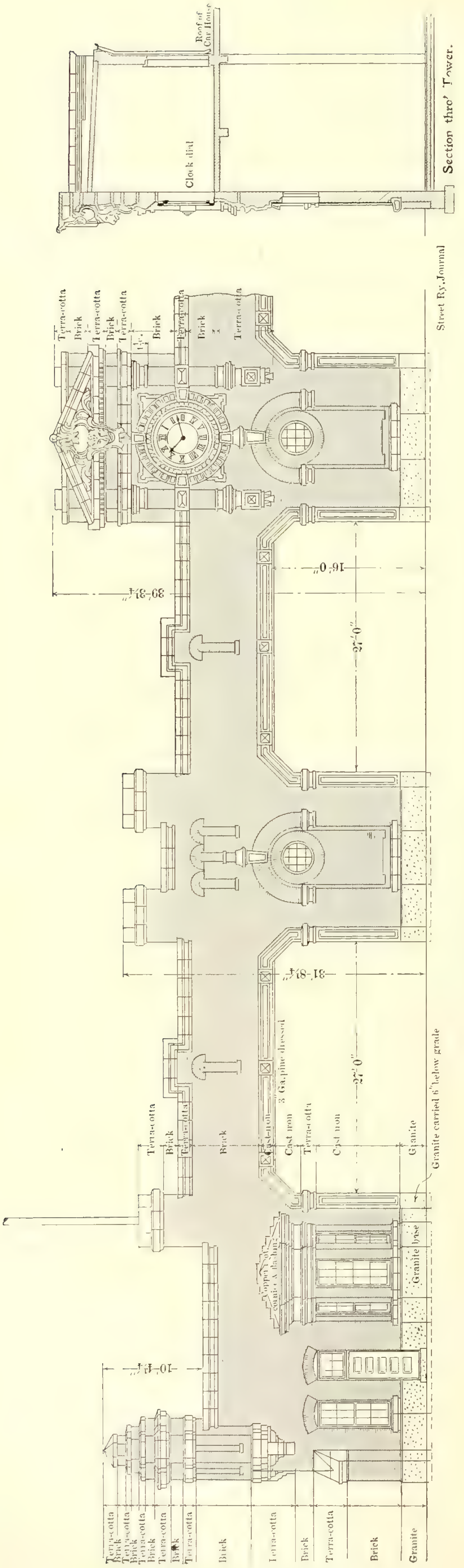


FIG. 13.—FRONT ELEVATION OF ELECTRIC PARK CAR HOUSE

tions of these companies to the United Railways & Electric Company is not confined to car houses, but extends to rolling stock as well, which is purchased on the same basis. The important power station reconstruction now being carried on in Baltimore under the direction of Mr. Stillwell for

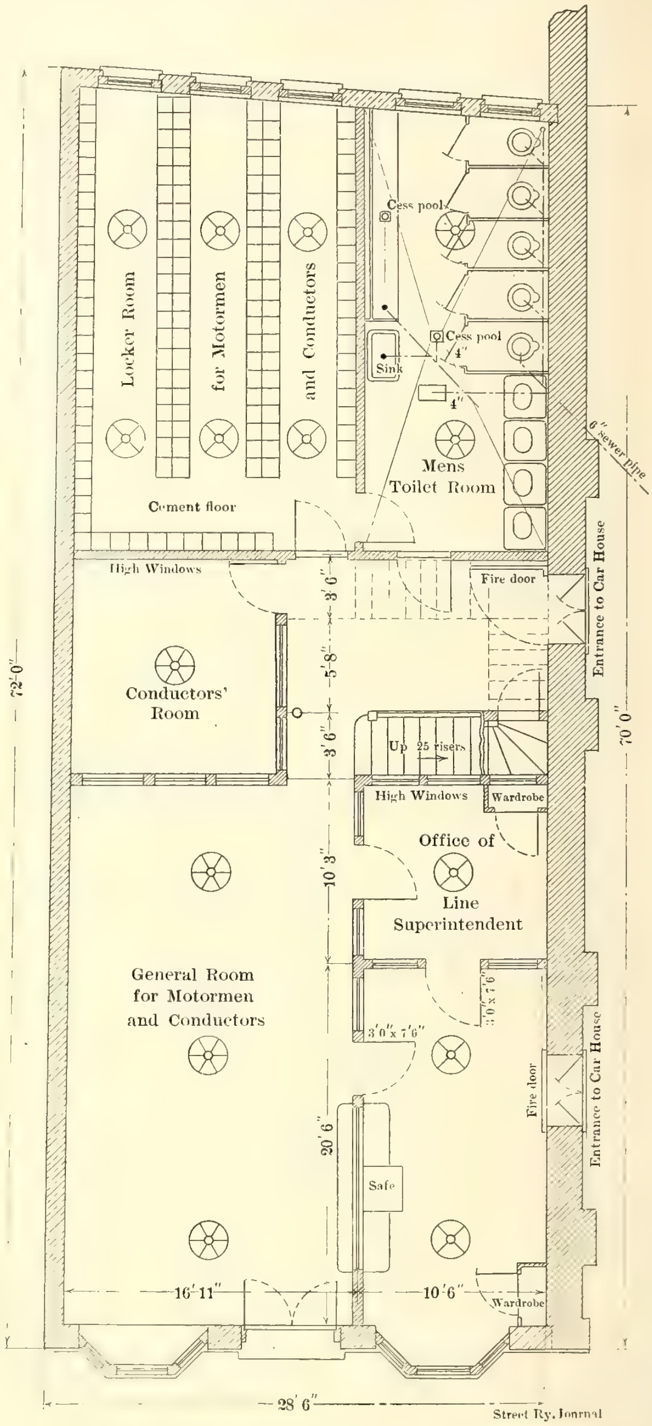


FIG. 14.—PLAN OF GROUND FLOOR OF SERVICE BUILDING AT LIGHT STREET

the United Railways & Electric Company is being financed in the same way.

THE LIGHT STREET CAR HOUSE AND SERVICE BUILDING

In connection with this article on car houses at Baltimore, a short account should be given of the reconstruction carried on at the old Light Street car house of the United Railways & Electric Company and the service building which has been fitted up adjoining thereto. The Light Street car house was the best of the former car houses of the company, but was

built with brick walls and had a wooden roof. The old car house was extended to the rear and another building added on the south side directly in the rear of the power house; the entrance to this last addition is made through an opening in the wall of the main car house. This opening is protected by large fire doors. The addition of a slag roof supported on concrete slabs and girders, which has recently been completed, has converted this old portion of the building into a much better fire-resisting structure. The concrete girders are supported on concrete posts erected for the purpose, adjoining the present brick walls. This house has accommodation for about seventy-five cars.

In furtherance of its liberal policy toward its employees already described, the company has purchased the lot adjoining this car house and has erected there a two-story building for its motormen and conductors. A plan of the first floor of this "service" house is presented in Fig. 14. The office of the dispatcher is placed in front, so that he can have a good view up and down the track. Next is the general room, 17 ft. x 30 ft. 9 in., for motormen and conductors, with a smaller room partitioned off as in the other car houses, where the conductors can make up their reports.

The floor above the first floor, shown in Fig. 14, is devoted to an assembly room, which is approximately 71 ft. long by 28½ ft. wide. This room is provided with a pool table and is furnished with arm chairs, desks and reading tables on which the latest copies of the technical and popular magazines are displayed. This building is well lighted and attractively furnished throughout.

DOWNTOWN SERVICE BUILDING

This broad policy of the United Railways & Electric Company to provide attractive accommodations for its employees is strikingly illustrated not only in the rooms which, as has already been mentioned, are being provided in connection with all of the car houses, but also in a service building not connected with any car house located in the business district. The fact that most of the car houses are away from the center of the city suggested the idea that if the men had a meeting or club room near the business district it would often prove convenient as a lounging or waiting room while off duty. Acting upon this suggestion, the company secured a building, about 35 ft. x 100 ft., on the corner of Franklin and Howard Streets, directly in the shopping district. The lower floor is devoted to a waiting room for its suburban passengers where packages can be checked, and to a lost and found department. The second floor contains three rooms, two of which are for the employees, and a smaller room for the division superintendents. The latter room contains a desk which can be used by any superintendent, and sufficient drawers so that each division superintendent can keep his papers locked in a separate drawer. One of the rooms for the men has been supplied with two pool tables, while the other, like the assembly room at the car houses, has reading tables, checkers, and opportunity for other pastimes. The rule that no card playing is allowed is practically the only restriction in the use of the rooms, and no charge is made for the pool tables. The conductors and motormen are given tickets which admit them to the room when not in uniform, so that there is no danger of the privileges of the club being abused by those who have no right to use them.

The New Orleans Railway & Light Company's report for 1906 shows that the car business on Sunday is from 15 to 25 per cent greater than on week days. This increase is attributed to the excellent facilities for pleasure riding.

CONVERTED STEAM RAILWAY IN SWEDEN

BY V. FABER MADSEN

An undertaking of interest more on account of its character than its size has recently been completed in Sweden, in the electrification of the light railway connecting Helsinborg with Raa and Ramlösa. Helsinborg is a thrifty seaport of about 35,000 inhabitants, in the south of Sweden and is opposite the Danish town of Helsingoer. Raa is a fishing and residential town and Ramlösa is a seaside resort, well patronized during the summer by Swedes and Danes. The railway connecting the three places mentioned was built several years ago on what is known as the Decauville system, and was worked by steam locomotives. The gage was 60 cm (24 ins.). The conversion to electric traction was completed in December, 1906. The distance from Helsingborg to Raa, about 4 miles, will be operated throughout the year, that to Ramlösa only in Summer.

The railway is about 11.8 miles, most of which is double track. The track has been relaid to standard gage with 45-lb. rail. Figure 8 trolley wire is employed on both span and bracket construction.

The plant includes three gas engines, supplied by Nydquist & Holm, of Höganaes, Sweden, direct-coupled to three 60-kw generators. The gas engines are supplied from suction gas generators.

The motor cars are painted the Swedish national colors (blue and yellow), are mounted on double trucks and seat 70 passengers. Christensen air brakes are used. Each car has two 35-hp motors. It is also the intention to haul 200-ton freight trains.

An hourly service, equal to seventeen trains each way per day, is given. When the line was worked by steam locomotives the number of trains each way per day was nine.

The installation was carried out by the Allmaenna Elektriska Aktie Bolaget, Westeraas, Sweden (who also supplied the cars and will supply the locomotives), under the supervision of its engineer, Thure Paulsen, to whom the writer is indebted for much of the information given.

THE CHICAGO, SOUTH BEND & NORTHERN INDIANA COMPANY AND ITS PLANS

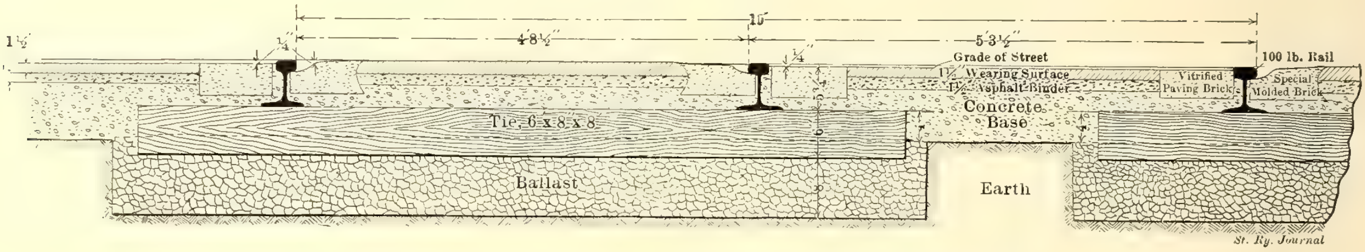
The Chicago, South Bend & Northern Indiana Railway Company has filed articles of incorporation with the Secretary of State of Indiana. The capital stock of the company is $7,500,000 and the incorporators are: C. F. Dieterich and A. E. Dieterich, of New York; James Murdock, Samuel T. Murdock and C. M. Murdock, of Lafayette; Hugh J. McGowan, J. A. McGowan and R. I. Todd, of Indianapolis; ex-Governor Durbin, of Anderson; H. B. Smith, of Hartford City, and A. L. Kitselman, of Muncie. The articles of incorporation disclose the following additional names as stockholders: Randall Morgan and J. W. Vandke, of Philadelphia; Joseph B. Mayor, of New York; Thomas D. Krutz, of Chicago, and Henry Marshall and W. V. Stuart, of Lafayette.

This is regarded as an official announcement of the purchase of the Northern Indiana Railway, involving an expenditure of $4,000,000. The purchasing company will build an electric railway from Michigan City to Chicago immediately and expend $1,000,000 in improving the acquired lines. At Logansport, through which the company will operate, connection will be made with the Lafayette line and the Indiana Traction Company's line to Indianapolis.

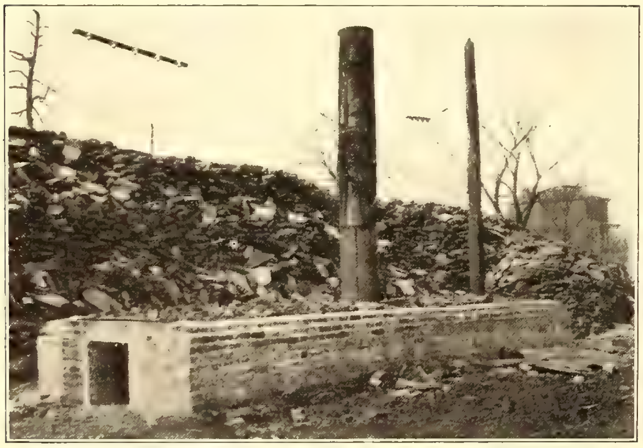
TRACK CONSTRUCTION AND ASPHALT WORK IN KANSAS CITY

For several years past the Metropolitan Street Railway, of Kansas City, has been continually reconstructing and extending its tracks. Several features in connection with this work in paved streets are especially interesting, and through the courtesy of Charles N. Black, general manager of the system, this publication now is enabled to give some of the details in connection with it.

In the downtown districts Trilby rails are employed, but in other portions of the city T-rails of standard A. S. C. E. section and weighing 80 lbs. and 100 lbs. per yard are used. The ties rest on rock ballast instead of the concrete bed often used in other cities. One reason why ballast is considered preferable is that should the tracks ever be taken up the work would be much easier. The concrete base for the asphalt surface extends to within 2 ins. of the bottom of the ties. A specially formed brick with a nose fitting in under the rail is used on the gage side of the rail. The latter is filled on the outside with a grouting of two parts sand to one of cement, and against this an ordinary vitrified paving brick is placed. Attempts to extend the asphalt paving up to the rail in Kansas City have resulted in failure due to the disintegration of the asphalt.



CROSS-SECTION OF STANDARD T-RAIL CONSTRUCTION IN KANSAS CITY



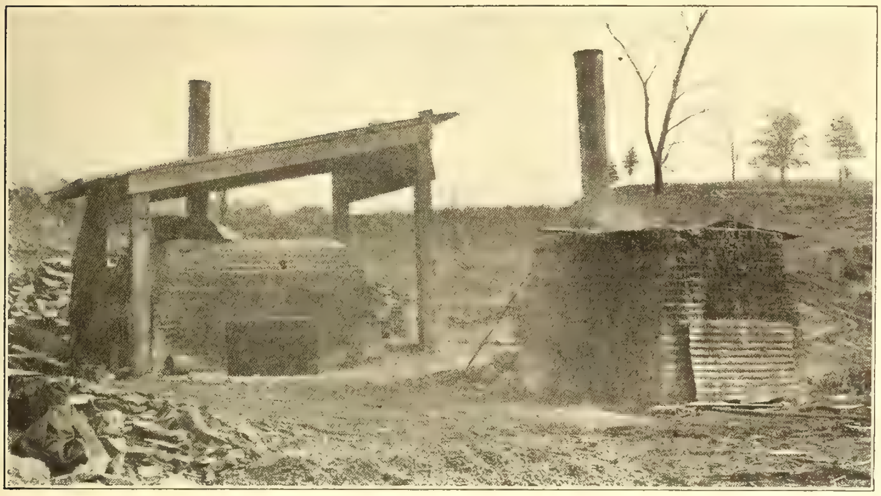
ONE OF THE FURNACES, WITH PANS FILLED READY FOR FIRING. A PILE OF OLD ASPHALT FORMS THE BACKGROUND

The railway company is required to keep up the paving between the tracks and for 18 ins. on either side of the outside rails. For several years the company contracted for the asphalt resurfacing, but for the last two years this work has been done by the company itself at a much reduced cost. The old asphalt is brought from the city, reheated, strengthened with new asphalt and relaid.

The accompanying illustrations show the plant located in the outskirts of the city for working over the asphalt. The equipment for this purpose consists essentially of furnaces and pans for heating the old asphalt and of tanks in which new binding material is melted. The heating pans are of ¼-in. boiler iron, 10 ft. long, 5 ft. wide and 10 ins. deep in the middle. The bottom is a portion of a circle sloping down gradually from the sides. This shape permits the stirring irons to be used to best advantage. At their middle point the pans are strengthened by a cross-brace. After considerable experiment this shape of pan was found to be the best adapted for the work. Deeper pans have been abandoned because of the difficulty of stirring the material. Two of these pans are placed end to end over a brick furnace with their adjacent ends just far enough apart to permit the furnace stack to extend up between them. The old material is broken up in pieces about 5 ins. square and the pans are filled level full. A fire is built in the furnace and the material allowed to heat for about two hours. In the meantime it is continually stirred with bars in such a manner that the material is thrown up from the bottom. This stirring not only prevents the asphalt from burning, but also throws gravel and other impurities to the top where they can be raked off. A few buckets of water are added from time to time during the heating process. After the material has become well heated, from 75 lbs. to 200 lbs. of fresh asphalt, which is kept melted in adjacent tanks, is mixed with it. From the pans the hot asphalt is loaded directly into wagons in which it is hauled to the point to be used. The two pans over each furnace hold just one wagon load, and this amount covers about 25 sq. yds. when spread 2 ins. thick. Usually four double pans are operated and from sixteen to

STIRRING THE ASPHALT DURING THE HEATING PROCESS

eighteen wagon loads are heated per day. The labor required at the pans is about one man per wagon load per day. Work is started very early in the morning and is discontinued at about 4 o'clock in the afternoon to permit the last material heated to be laid in the street before dark.



THE TWO FURNACES FOR HEATING THE NEW ASPHALT

The old material is purchased from the city at $0.75 per wagon load, equivalent to 1½ cu. yds. Old ties are used for fuel. The asphalting plant, with a capacity of 400 yds. per day, cost approximately $400. As the contract price for asphalting was never less than $1.12 per yard, and the cost under the present system is about 40 cents, it may readily be seen that the installation and operation of the plant is a very economical venture. It is estimated that the repeated asphalt will last as long as new material. Some that has been in use for two years shows every evidence of substantiating this belief. The track work and asphalt plant is under the direct supervision of E. Butts, civil engineer for the company.

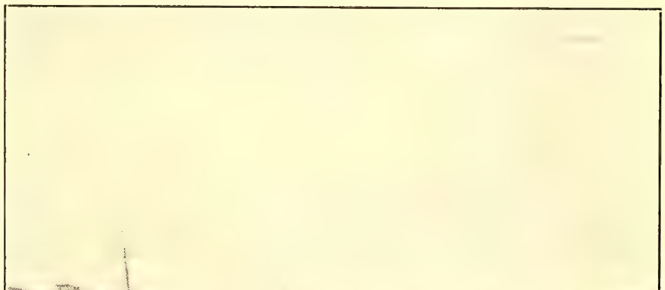
THE PENNSYLVANIA STANDARD ROADBED

The standard track construction of the Pennsylvania Railroad and the modifications made upon the initiation of President Cassatt in the summer of 1905 are mentioned so frequently in track circles that an explicit statement in regard to what is known as "the Pennsylvania standard" and the changes which are being proposed will be of interest. The Pennsylvania standard track construction is shown in the series on the next page. For four tracks, in a cut without sidings, the Pennsylvania Railroad requires a ditch 10 ft. 6 ins. wide from gage of rail and 3 ft. below top of tie at lowest point, the ditch to slope regularly from edge of ballast border, which is 5 ft. out from rail, and 19 ins. below top of tie to the lowest point of ditch. There may be a dry toe wall rising from the back edge of the ditch almost perpendicularly, instead of the turf coming down all the way. The ballast roadbed itself is 53 ft. 8½ ins. wide, 13 ins. deep at the center line and 18 ins. deep at the outside edge of the outside track from top of tie. The bottom surface of the ballast bed has a slope toward the side of ¼ in. to 1 ft. The ties are 8 ft. 6 ins. long, 7 ins. high and are laid sixteen to every 33 ft. of main track. The tracks are 13 ft. apart, center to center.

In cities or towns where there is an industrial siding beside the four main tracks, the distance from the center line of the bed to the bottom point of the ditch is 48 ft. 4¼ ins., the siding having a small bed of its own, separated from and lower than the main four-track bed. While the ballast of the main bed is of stone, the sidetrack bed may be of gravel or cinders. The ditch is made 1 ft. wider on account of the extra track. If necessary, 6-in. cast-iron pipes are run parallel to the ties and through the ballast of the siding.

The changes suggested by President Cassatt, to which reference has been made, were to reduce the expenses of maintenance of way and also to make travel safer and more agreeable. The task of making the plans was given to a committee of engineers, and their object from the first was to design a roadbed with drainage facilities as nearly perfect as possible.

Fifteen miles of new roadbed is the result of the committee's report. Four sections of the main line have been built to conform to the engineers' ideal of a perfect roadbed. One of the two five-mile stretches of standard roadbed is near Lancaster, on the Philadelphia Division, and the other near Newport, on the Middle Division. The two 2½-mile stretches are on the Pittsburg Division, one near Cresson, on the western slope of the Alleghenies, and the other about 50 miles east of Pittsburg, at Hillside.

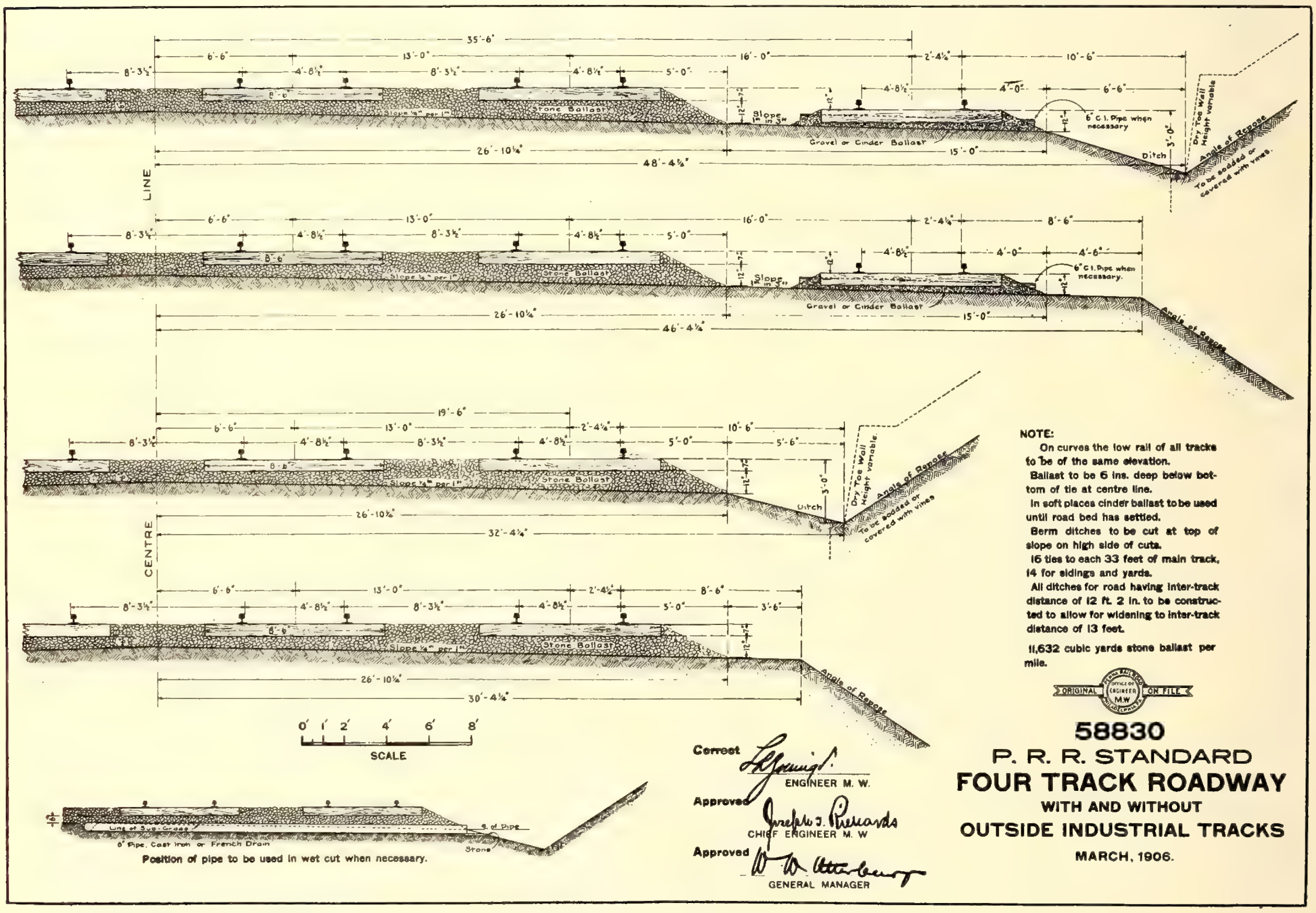


SECTION OF PENNSYLVANIA RAILROAD TRACK, WITH EXTRA AMOUNT OF BALLAST

The improvements consist partly in the addition of more ballast, that is, 16,965 cu. yds of ballast were used per mile of four-track line instead of 11,632 cu. yds. as in the standard construction. This ballast was not to make the track more steady—the supply already in place was sufficient for that—but for purposes of drainage. The other principal change was in sodding the banks. The grass keeps the banks firm and prevents the washing down of material. The standard ditch on the side is of ordinary soil, but the company has tried the experiment of sprinkling it with oil. This keeps the dust down and weeds from growing. The experiment with the first fifteen miles has proven so successful that the Pennsylvania has already made plans to improve as much more of the main line in the same way.

There are standards for single-track and double-track as well as four-track lines. In the case of two tracks in a cut, the distance from the bottom of the side ditch to the center line of the roadbed is 18 ft. 4½ ins., the stone ballast is 13 ins. deep at the center line and 17 ins. deep on the side. The tracks are 13 ft. apart, center to center, and ditch is 9 ft. 6 ins. wide in case there is no dry toe wall. There are 5127 cu. yds. of stone ballast for every mile of double track. For a single track in a cut the ballast is 15 ins. deep in the middle and 17 ins. deep on the side. The width of the ditch varies according to the weight of traffic on the single track, being narrow for light traffic. Its maximum width is 9 ft. 6 ins. and its minimum width 7 ft. 6 ins. The ballast may be stone or gravel. The allowance of stone ballast to the mile is 2629 cu. yds.

The drainage pipes beneath the ballast are 6 ins. in diameter, of cast iron, and slope from the center line of the road, parallel with the ties, to the ditches on each side. The plans also provide that berm ditches be cut at the top of the slope on the high side of cuts; that for siding and yards the number of ties be fourteen to 33 ft. of track, and that all ditches for a road with present inter-track distance of 12 ft. 2 ins. be constructed so as to allow for widening the inter-track distance to 13 ft. In soft places cinder ballast must be used, instead of stone, until the roadbed has settled. On curves the low rails of all tracks must be of the same elevation.



PENNSYLVANIA RAILROAD STANDARD FOUR-TRACK CONSTRUCTION, SHOWING ALSO SPECIFICATIONS COVERING CURVE, BALLAST, DRAINAGE AND TIE PRACTICE

AUXILIARY SANDING DEVICE

According to the London "Electrical Engineer," twenty cars belonging to the Liverpool City System are to be equipped with emergency sanding boxes. Auxiliary hoppers are used close to the regular hoppers and deliver their sand at practically the same point on the rail, but they are arranged with a valve which promotes a continuous flow of sand when the valve is opened. The platform treadle is arranged with a stop so that under ordinary working conditions the service hopper only is used. In case of emergency, however, the stop can be kicked aside with the foot and both hoppers will discharge on the track, the discharge from the emergency hopper being a continuous stream. By a simple connection the platform treadle is also arranged so that if kicked in the opposite direction it will open both emergency and service sand boxes at the rear of the car. This is to prevent the car sliding backward at stops on grades.

ON THE SUBSTITUTION OF THE ELECTRIC MOTOR FOR THE STEAM LOCOMOTIVE *

BY LEWIS B. STILLWELL AND HENRY ST. CLAIR PUTNAM

Few subjects which are to-day engaging the attention of the engineering world are comparable either in scientific interest or in practical importance to the substitution of the electric motor for the steam locomotive engine. On the Valtellina line and through the Simplon tunnel 70-ton electric locomotives with three-phase motor equipment, capable of developing a draw-bar pull of 28,000 lbs., have displaced the steam locomotive, with results showing both marked improvement in service and substantial economy in operating costs. In the New York subway, eight-car trains weighing 320 tons are in operation, equipped with motors developing during acceleration a tractive effort equivalent to a draw-bar pull of 55,000 lbs. The heaviest passenger locomotive used on the Erie system weighs, exclusive of tender, 206,000 lbs., of which 55.8 per cent, or 115,000 lbs., is effective on drivers. Assuming the adhesion to be 20 per cent, such a locomotive exerts a draw-bar pull of 23,000 lbs. The motors of the eight-car electric train of the New York subway, therefore, exert a tractive effort equivalent to more than twice the draw-bar pull of this locomotive.

PASSENGER-SERVICE FACTORS CONTRIBUTING TO INCREASED EARNING POWER

The more important considerations which affect gross earnings are:

1. Frequency of service.
2. Speed.
3. General comfort of passengers.
4. Safety.
5. Reliability of service.
6. Increased capacity of line.
7. Frequency of stops.
8. Convenient establishment of feeder lines.

1. Frequency of Service. In comparing results attained by the competing systems in such cases, it is impossible, of course, to state in terms of precision how far frequency of service is responsible for the remarkable results observed in the creation of new business, since to these results a number of other causes also contribute. But without attempting to differentiate between these various factors, it is sufficient here to say that of the several causes contributing to the marked success of lines using electricity, the operation of train units or of single cars upon close headway is recognized to be especially attractive. The advantages resulting from frequency of service become relatively less as the length of run is increased.

2. Speed: The possibilities of operating by electricity at speeds exceeding the maximum which can be obtained safely in steam operation, owing to the elimination of unbalanced reciprocating parts of the locomotive, is well known. It is strikingly illustrated in the Berlin-Zossen trials by the attainment of a speed exceeding 130 miles an hour. Even at speeds at which steam locomotives may be operated without great danger of leaving the track, as a result of the effect of unbalanced reciprocating parts, electric engines are far better able to maintain speed while drawing heavy trains. At speeds of 80 or 90 miles per hour, for example, it is extremely difficult to operate with satisfactory results two steam locomotives at the head of the train; while multiple-unit control places any necessary number of locomotive units absolutely and instantly responsive to the will and touch of a single operator. At high speeds, also, the economy of the steam locomotive falls off rapidly while that of its competitor remains practically constant.

3. General Comfort of Passengers: The great advantages of electric traction in respect to comfort of passengers are well known. Cleanliness and improved ventilation made possible by the elimination of smoke and cinders; lighting practically without heat and at low cost by a system which makes it easy to place lamps in any desired location, and heating apparatus effectively and conveniently controlled, are factors of very great importance in building up passenger business under conditions of competition. In operating through tunnels, ventilated with difficulty, the electric motor, in eliminating smoke and the gases of combustion, possesses an advantage which is frequently controlling.

4. Safety: The more important of the considerations of safety are:

a. The fact that in case of a rear-end collision, which is perhaps the most frequent form of accident experienced in the operation of our railway system, the energy which propels the electric train can be shut off generally with great promptness. On the other hand, the steam locomotive carrying in its fire-box from 1500 to 2000 lbs. of coal heated to incandescence, almost invariably sets fire to any broken cars, or other combustible material with which it comes in contact. Where the electric supply to trains is obtained at low potential from a third rail, the risk of short circuit, which may result in fire if the cars be not fireproof, is greater than it is in the case of overhead construction, even when the voltage employed in the latter case is very high. In fact, in the latter case it may be said that risk from the physiological effects of the current or from fire resulting from short circuit is practically eliminated, except perhaps in tunnels of very limited clearance.

b. The elimination of the boiler carrying steam at high pressure also means the removal of an element of risk which in many railroad accidents has destroyed life.

c. The absence of smoke in tunnels, and consequent ability to see signals clearly at all times, constitutes an advantage of the utmost importance for electric operation.

d. The substitution of the electric heater for the stove or steam pipes affords opportunity not only for ideal control of temperature of the cars but almost absolutely eliminates risk of fire.

e. The use of electric lighting also implies a material gain in safety.

f. The danger of derailment in the case of the electric locomotive is far less than in case of the steam locomotive, by reason of the elimination of unbalanced reciprocating parts which tend to lift the steam locomotive from the tracks. The hammer-blow also, in the case of the steam locomotive, is responsible not infrequently in cold weather for broken rails, as a direct result of which many serious accidents have occurred.

g. The electrification of railways where high-speed passenger traffic is involved, affords opportunity for improved methods of protecting trains by signal systems, automatic or other.

h. The ability to cut off power at will from a given section and therefore from trains operating upon that section under certain conditions, which arise not infrequently in railway service, may be availed of to prevent accidents.

As against the considerations above referred to, all of which tend to make electric operation safer than operation

* Abstract of paper presented before the American Institute of Electrical Engineers, Jan. 25, 1907.

by steam locomotive, the addition to the permanent way equipment of an electric conductor conveying power to trains imposes in the former case a material risk not involved in the latter. If the power be supplied through a third rail, a guard should be used whenever possible to prevent accidental contact with the rail by employees or by others walking upon or crossing the track. Several effective forms of guard are available, of which at least one has been in service upon a convincing scale for five years.

5. Reliability of Train Service: Interesting evidence in respect to the relative reliability of steam locomotives and of electric motors carried upon cars and controlled by the multiple-unit system of train control is derived from the official records of the transportation department of the Manhattan Division of the Interborough Rapid Transit system, of New York. The steam locomotives were operated under exceptionally favorable conditions, were not overloaded, were of simple construction, and admirably maintained. The electric equipment that succeeded them is operating trains which average 5.3 cars, as against 3.8 cars in the days of steam operation. The average speed is materially higher. The tractive effort during acceleration of a six-car train is 30,000 lbs., as against a maximum drawbar pull of approximately 7000 lbs. exerted by the steam locomotive. The results for the months November, 1900, to March, 1901, when steam was used, show an aggregate car-mileage of 18,527,773 miles, and aggregate delay of 8258 train minutes. The car-mileage per train-minute delay was 2243. For the corresponding period of electric operation, five years later, the car-mileage was 25,482,081, the aggregate train-minutes' delay 5970, and the car-mileage per train-minute delay was 4268. It will be noted that the months involved in the above comparison are those in which the difficulties of operation, owing to weather conditions and number of passengers transported, are at a maximum. Snow and sleet are among the greatest difficulties to be overcome in the operation of a third-rail system, when, as in the case of the Manhattan, the third rail cannot be effectively protected by reason of limitation in space available on the structure. In view of these difficulties and of the increase in density of traffic, the results obtained are remarkable.

6. Increased Capacity of Line: The better acceleration possible with electric traction permits a shorter headway and train interval than is feasible where steam motive power equipment is employed. In the operation of freight trains, if it should ever become practicable to distribute electric locomotives throughout the length of the train and operate them by multiple-unit control, trains of length far beyond present limits could be operated.

7. Frequency of Stops: The interurban electric line competing with the steam railroad for traffic between two cities possesses great advantage in the collection and distribution of passengers, from the ability of its cars to stop at any street intersection or other convenient point, instead of receiving and discharging passengers at a single railway station in each town. As speed between terminals is increased, the tendency to reduce the number of stops made to take on or let off passengers is noticeable in the development of many interurban lines.

8. Convenient Establishment of Feeder Lines: Frequency of stops for convenient collection and distribution of passengers, and high speed between terminals, being considerations which are essentially opposed, the advantages of a four-track system permitting operation of local or collecting train units on two tracks, and express trains on the other two tracks, are obvious. The great expense of such a system, however, can be borne only where traffic is very heavy. A natural development which during the last five years has been very rapid, is found in the use of comparatively short electric trolley lines in connection with steam express service for long-distance runs. This method of utilizing the advantages of local electric lines by the companies operating trunk line systems is eminently wise, and in general should be highly advantageous to the properties concerned while increasing materially the facilities offered to the public. It may be pointed out, however, that were the trunk line systems to utilize electricity for through traffic, the extension and systematic improvement of local feeders would be facilitated for a number of reasons.

The substitution of electric for steam equipment involves a large investment in power plant, and in electric conductors and apparatus for conveying power from the power plant to the moving trains. The distributing system for alternating-current equipment, which is the only class of equipment deserving serious consideration in connection with the general problem which we are discussing, comprises an addition to permanent way equipment in the form of overhead construction and electrical conductors conveying power from the power house to the trolley or conductor which is carried above the track. At the present time, the limit of potential generally adopted in this country in constructing alternating-current dynamos is 11,000 volts. Where this voltage is generated, and the distance from the power house to the section of railroad to be electrified does not exceed 25 or 30 miles, step-up and step-down transformers are necessary For greater distances, higher potentials are used upon the feeder circuits between power house and trolley, transformers for increasing the generated potential being installed in the power house, and transformers for lowering the potential to that selected for the trolley; e. g., 11,000 volts, being located in suitable transformer houses at intervals of from 30 to 50 miles, depending chiefly upon density of traffic.

The cost of the power plant and distributing system are properly chargeable to capital account.

Our estimates are based upon the assumption that single-phase alternating-current equipment is used; that the trolley potential is 11,000 volts; that each power house supplies railway line to a distance of 150 miles in each direction, the feeder potential employed being 60,000 volts; that the overhead construction is first class in every respect, and steel bridges and field poles set in concrete being exclusively used for the support of both trolley conductors and feeders.*

As regards equipment of the rolling stock, it is the general practice of our railways to charge against operating expenses all new equipment purchased to replace that which has been worn out in service. In the adoption of electricity, it would seem that this method might be followed in general by our more important railway systems, the substitution of electric equipment beginning naturally upon those parts of the system where the resulting advantages are maximum. In other words, worn-out locomotives, etc., on such a system might be replaced by electric equipment and the cost of the equipment charged against operation, just as the cost of new steam locomotives otherwise required would be charged against operation. In cases where the

* In assuming the use of the single-phase system we are not condemning other systems. The three-phase system has not received from American engineers in general that degree of consideration which its possibilities and demonstrated advantages justify. Its use, at least on mountain-grade divisions, can be supported by very strong arguments.

initial substitution of electricity is on a large scale, as compared with the total rolling stock equipment of the railroad making the change, it is probable that a part if not all of the cost of electric rolling stock equipment will generally be charged to capital account.

We proceed to compare the cost of electric operation with the cost of operation by steam locomotives, using as our standard of comparison the grand average results in steam operation in the United States for the years 1901-1905, inclusive. These average results are set forth in the following tables compiled from the reports of the Interstate Commerce Commission. Many of the items included in this tabulation vary between wide limits in the practice of different railroads.

MAINTENANCE OF WAY AND STRUCTURES

Under the general heading, "Maintenance of Way and Structures," item No. 1, "Repairs of Roadway," if changed at all should show some reduction under conditions of electric operation, but obviously no material change is to be expected. We assume, therefore, that this item, amounting to 10.818 per cent of total operating expenses, will remain unchanged.

The items, "Renewals of rails," "Renewals of ties," and "Repairs and renewals of bridges and culverts," may be conveniently grouped. In the aggregate, these on the average steam-operated railroad amount to 6.33 per cent of the total cost of operation. If the electric locomotive be substituted for the steam locomotive, it is safe to predict that this group of items of expense will be reduced; but it is practically impossible to state with accuracy what the reduction will amount to. In general, it is obvious that the substitution of electric locomotives developing equal draw-bar pull, with axle-loads reduced at least 25 per cent as compared with steam locomotives, and with wheel-bases not exceeding those of steam locomotives, should favorably affect these items. From the best study which we have been able to make of the detailed factors comprised under these three items of the classification, it would seem that under electric operation they should be reduced about one-fourth; in other words, they should approximate 5 per cent of the total operating expenses. It is not to be imagined, of course, that railroads adopting electric traction would limit themselves to equal draw-bar pull and not increase loads. They would, naturally, take advantage of the possibility of increasing draw-bar pull so far as strength of draft-gear may permit, thereby effecting gains far outweighing the decrease in operating expenses represented by saving in maintenance of roadway, rails, and ties, which would result from a decrease in the weight of locomotives. This argument is valid, not

TABLE I.

Item.	Amount 1905.	Per Cent. 1905.	1903.	1901.	Average Five Years.	Estimated Cost of Operation by Electricity.
MAINTENANCE OF WAY AND STRUCTURES	$274,415,279	19.784	21.185	22.272	21.003	22.354
1. Repairs of roadway	144,161,701	10.393	11.093	10.294	10.818	10.818
2. Renewals of rails	18,259,022	1.316	1.386	1.676	1.439	5.00
3. Renewals of ties	36,856,864	2.657	2.487	3.140	2.728	
4. Repairs and renewals of bridges and culverts	32,166,990	2.319	2.461	2.730	2.466	
5. Repairs and renewals of fences, road-crossings, signs and cattle-guards	6,179,686	0.446	0.527	0.598	0.527	0.527
6. Repairs and renewals of buildings and fixtures	29,320,204	2.114	2.590	2.417	2.366	1.300
7. Repairs and renewals of docks and wharves	2,883,274	0.208	0.235	0.283	0.231	0.231
8. Repairs and renewals of telegraph	2,374,932	0.171	0.165	0.158	0.169	0.169
9. Stationery and printing	383,158	0.028	0.032	0.029	0.030	0.030
10. Other expenses	1,829,448	0.132	0.209	0.317	0.229	0.229
Repairs and renewals of track bonding	......	......	......	......	......	0.800
Repairs and renewals of overhead construction	......	......	......	......	......	3.250
MAINTENANCE OF EQUIPMENT	288,012,604	20.765	19.133	18.629	19.524	12.287
11. Superintendence	7,831,965	0.565	0.559	0.599	0.578	.578
12. Repairs and renewals of locomotives	114,988,428	8.290	7.408	6.695	7.509	2.253
13. Repairs and renewals of passenger cars	27,342,129	1.971	2.044	2.277	2.080	2.080
14. Repairs and renewals of freight cars	113,723,239	8.199	7.442	7.436	7.657	6.000
15. Repairs and renewals of work cars	3,360,390	0.242	0.242	0.233	0.238	0.238
16. Repairs and renewals of marine equipment	2,650,543	0.191	0.177	0.234	0.194	0.194
17. Repairs and renewals of shop machinery and tools	9,186,101	0.663	0.696	0.605	0.662	0.500
18. Stationery and printing	595,571	0.043	0.046	0.043	0.044	0.044
19. Other expenses	8,334,240	0.601	0.519	0.507	0.562	0.400

TABLE I.—Continued

Item.	Amount 1905.	Per Cent. 1905.	1903.	1901.	Average Five Years.	Estimated Cost of Operation by Electricity.
CONDUCTING TRANSPORTATION	769,613,017	55.486	55.893	54.979	55.540	43.454
20. Superintendence	25,007,322	1.803	1.742	1.726	1.752	1.752
21. Engine- and round-house men	130,437,844	9.404	9.562	9.340	9.451	4.710
22. Fuel for locomotives	156,429,245	11.278	11.675	10.602	11.292	5.553
23. Water supply for locomotives	9,147,590	0.660	0.614	0.612	0.634	0.000
24. Oil, tallow and waste for locomotives	5,442,970	0.392	0.389	0.361	0.381	0.250
25. Other supplies for locomotives	3,295,384	0.238	0.232	0.206	0.228	0.228
26. Train service	90,654,520	6.536	6.677	7.011	6.739	6.739
27. Train supplies and expenses	21,963,086	1.583	1.552	1.471	1.537	1.000
28. Switchmen, flagmen and watchmen	60,141,422	4.336	4.313	3.848	4.173	4.173
29. Telegraph expenses	24,823,266	1.790	1.754	1.785	1.780	2.000
30. Station service	89,304,658	6.438	6.664	6.947	6.697	6.697
31. Station supplies	8,961,573	0.646	0.667	0.672	0.669	0.669
32. Switching charges, balance	4,201,050	0.303	0.244	0.319	0 284	0.284
33. Car per diem and mileage, balance	18,835,325	1.358	1.400	1.618	1.423	1.423
34. Hire of equipment, balance	3,040,641	0.219	0 214	0.161	0.194	0.194
35. Loss and damage	19,782,692	1.426	1.094	0.819	1.112	0.750
36. Injuries to persons	16,034,727	1.156	1.120	0.911	1.086	1.000
37. Clearing wrecks	3,594,658	0.259	0.284	0.189	0.246	0.200
38. Operating marine equipment	9,903,479	0.714	0.745	0.862	0.748	0.748
39. Advertising	5,959,380	0.430	0.428	0.428	0.427	0.427
40. Outside agencies	19,688,261	1.419	1.449	1.615	1.495	1.495
41. Commissions	233,987	0.017	0.044	0.089	0.050	0.050
42. Stock yards and elevators	786,850	0.057	0.057	0.075	0.064	0.064
43. Rents of tracks, yards and terminals	23,947,881	1.727	1.544	1.724	1.615	1.615
44. Rents of building and other property	4,814,407	0.347	0.411	0.440	0.404	0.404
45. Stationery and printing	8,772,789	0.632	0.642	0.638	0.634	0.634
46. Other expenses	4,408,010	0.318	0.376	0.510	0.395	0.395
GENERAL EXPENSES	55,022,127	3.965	3.789	4.120	3.933	3.933
47. Salaries of general officers	11,676,616	0.842	0.823	0.984	0.883	0.883
48. Salaries of clerks and attendants	18,582,142	1.340	1.254	1.262	1.283	1.283
49. General office expenses and supplies	3,459,470	0.249	0.234	0.257	0.244	0.244
50. Insurance	6,885,932	0.496	0.432	0.384	0.439	0.439
51. Law expenses	7,096,275	0.512	0.541	0.549	0.549	0.549
52. Stationery and printing (general expenses)	2,439,781	0.176	0.175	0.161	0.170	0.170
53. Other expenses	4,861,911	0.350	0.333	0.447	0.365	0.365
RECAPITULATION OF EXPENSES	......	.....	.....	.....	.....	.....
54. Maintenance of way and structures	274,415,279	19.784	21.185	22.272	21.003	22.354
55. Maintenance of equipment	288,012,604	20.765	19.133	18.629	19.524	12.287
56. Conducting transportation	769,613,017	55.486	55.893	54.979	55.540	43.454
57. General expenses	55,002,127	3.965	3.789	4.120	3.933	3.933
Grand total	$1,387,043,027	100.	100.	100.	100.	82.028

NOTE.—It is customary with some railroads using electric equipment to include under the general heading "Maintenance of Equipment," the maintenance of the power plant and electric transmission systems. Both of these, however, are more conveniently treated by including them in the cost of electric power delivered to the overhead trolley system or third rail.

only with reference to high-speed passenger traffic, in which the hammer-blow of the engine is emphasized, but also in connection with freight traffic, where in recent years there is a marked tendency to employ trains of great length and locomotives of extreme weight.

The cost of track maintenance is increased by reason of the electric bonding of the rails. This bonding, including the cost of special bonds necessary where an automatic track signal system is used, will cost about $500 per mile under average conditions. Its cost of inspection and maintenance should not exceed $50 per mile of single track per annum.

The annual cost of "Renewal of rails," "Renewal of ties," and "Repairs and renewals of bridges and culverts," averages in the United States $400 per mile of track, which, as above stated, is 6.633 per cent of average operating expenses, under steam operation, and for equal trains, as we have estimated, 5 per cent for electric operation. The effect of the cost of track-bonding, therefore, would increase the items under consideration by about one-eighth, which is equivalent to an increase of 0.8 per cent in operating expenses. To avoid possible confusion, we include the cost of "Repairs and renewals of track bonding" as a separate item in the column "Estimated cost of operation by electricity."

Under the general conditions which will govern where electricity is substituted for steam in railway operation there can be no doubt that the substitution will result in a material reduction in the cost of maintenance of rails, ties, bridges, and culverts. In this substitution electric locomotives will be used for freight traffic, while for passenger traffic locomotives will be eliminated ultimately and multiple-unit car equipments employed. For the immediate future, however, locomotives will be employed not only for freight traffic but also in some cases for passenger traffic for the practical reasons which have impelled the Pennsylvania, the New York Central, and the New York, New Haven & Hartford systems in electrifying their New York terminals to adopt electric locomotives for handling their through trains.

Reverting to Table I., item 5 will not be changed by the adoption of electricity.

Item 6, "Repairs and renewals of buildings and fixtures," includes repairs and renewals of engine houses and shops, also water tanks and coal-handling apparatus. Under electric operation, it is evident that this item would be materially reduced. This subject will be further discussed when we come to consider item 12. It is conservative to say that for the operation of a given train-mileage, under the average conditions of railway service in this country, the number of electric locomotives required should not exceed one-half the number of steam locomotives now used. The reduction in the number of locomotives implies, of course, a reduction in the cost of repairs and renewals of engine house and shops, and taking this into account, in connection with the elimination of water tanks and coal-handling apparatus, distributed along the line, it is our opinion that this item will be reduced from 2.366 per cent to about 1.3 per cent of the total annual operating expenses.

Item 7 obviously will not be affected.

Item 8. It is probable that this item will be somewhat increased in general where electric operation is adopted The effect upon the operating expenses, however, is so slight as to be practically negligible.

Item 9 will not be changed.

Item 10 we may assume will not be affected.

Under the general heading "Maintenance of Way and Structures," the classified statement of operating expenses of a railroad electrically equipped includes the following items in addition to the foregoing:

a. "Repairs and renewals of track bonding." This has been referred to in our discussion of items 2, 3, and 4, and it is included in our tabulated statement as a separate item amounting to 0.8 per cent of operatig expenses.

b. "Repairs and renewals of overhead or third-rail construction." From detailed calculations the cost of high-class overhead construction, where two tracks are to be equipped, the cost of overhead construction is approximately $10,300 per mile. This includes trolley conductors equivalent to No. 0000 wire B. & S. gage, insulated for 11,000 volts alternating, and supported by steel cables, carried by substantial steel bridges set in concrete and spanning the tracks. For single-track work using steel poles and brackets and catenary support, the cost closely approximates $4,800 a mile.,

Of the total line mileage of the United States in 1905, amounting to 216,974 miles, approximately 0.4 are in double track, including yards and sidings for single-track lines, and 0.6 are single-track. The grand average cost of overhead steel construction of the type considered, therefore, closely approximates $5,000 per mile of track. In this case, our estimate of the annual cost of "Repairs and renewals of overhead construction" cannot rest directly upon actual experience, since practically no overhead construction of this character is in use under the conditions of railway service; but taking into account all of the factors which appear to affect the problem, it is our judgment that the amount required should not exceed $150 per mile of track per annum. This is equivalent to $210 per mile of line per annum, the average ratio of track-mileage to line-mileage being 1.4 to 1.

It is, of course, possible to erect a much cheaper form of construction if wood poles be used. Though the first cost of such construction is low, it involves repairs and renewals constituting a much larger percentage of its cost than in the case of the steel bridge and pole construction set in concrete. The annual effect upon operating expenses with this type of construction as an average figure may be expected to approximate 2.5 per cent.

MAINTENANCE OF EQUIPMENT

Item 11 will not be changed.

Item 12. "Repairs and renewals of locomotives amounts to 7.509 per cent of the average operating expenses of our steam railroads. This item, according to the classification of operating expenses of the Interstate Commerce Commission, "does not include the expense of cleaning boiler tubes and packing cylinders, nor ordinary regular inspection, this being charged to the item "Engine and Roundhouse Men." It does include "all expenditures for account and repairs and renewals and rebuilding of locomotives, tenders, snow-plows (when attached to locomotives), furniture and loose and movable tools and supplies used in connection therewith. It also includes the cost of locomotives, tenders and appurtenances thereunto belonging, built or purchased to make good the original number charged to construction or equipment. As regards "Repairs and renewals of electric locomotives," actual experience to date is not sufficient to justify us in fixing a figure for this item which can be regarded as established. There is, however, evidence sufficient to justify an estimate which in the average case should be approximately correct. This is given below:

For the year ending June 30, 1901, the car-mileage operated by the Manhattan Railway was 43,860,158. The cost of repairs of locomotives was $173,609, or 0.39 cents per car-mile. For the year ending June 30, 1906, the car-mileage operated by the Manhattan Railway was 61,723,112. The cost of repairs of the electric equipment, including lamps, lamp wiring, and heaters, was $171,927, or 0.28 cents per car-mile.

Had electric locomotives been used instead of the multiple-unit system, the number of parts constituting the electric equipment, as stated, would have been about one-third that now in use. These parts would have been larger and more expensive than the corresponding individual parts constituting the multiple-unit equipment, but the cost of repairs of the aggregate electrical equipment (which is largely labor of inspection) probably would not exceed 60 per cent of the present cost. The results are further influenced unfavorably to electric traction as regards this comparison by the fact that the speed and consequently the power consumption per car has been radically increased, and by the fact that the repairs and renewals of lamps, heaters, and wiring are included.

A careful consideration of the detailed factors involved has led us to the conclusion that had electric locomotives been substituted for steam locomotives, and had the weight and speed of trains not been increased, the cost of repairs of electric equipment would have approximated 0.2 cents per locomotive mile. We estimate also that the cost of repairs to these small locomotives exclusive of their electric equipment operating under the existing conditions would not have exceeded 0.2 cents per locomotive mile, and that the total cost would have approximated one-fourth of the cost of the corresponding item under steam traction. This figure, of course, is available only as a ratio in our consideration of the general railway problem.

The very low cost which was actually obtained in the case of steam locomotives on the Manhattan, viz: 1.57 cents per locomotive mile, is explained by the extremely simple construction of the engines, the fact that they were not overloaded, were operated on an elevated structure, and were admirably maintained. It is also to be noted that the amount expended for repairs was minimized in view of the contemplated adoption of electricity.*

In applying to the general railroad problem evidence afforded by Manhattan experience, it must be noted that the elevation of the tracks places the motors beyond the reach of the dust or cinders which the rush of a train at certain seasons raises from the average railway track. On the other hand, the fact that the average run between stations on the elevated system is only about 2000 ft. exposes both motor and control to the action of brake-shoe dust which is liberated in quantities many times as great as would be the case in average railway service, and this brake-shoe dust is far more injurious to both motors and control than is dust from disintegrated ballast or cinders. In designing electric equipment for general railway service, it is advisable and not difficult to protect the motors effectively against the admission of dust of all kinds, particularly in cases where locomotives rather than multiple-unit equipment is adopted. This would be accomplished naturally by thoroughly enclosing the motor, and ventilating it by forced draft so directed as to prevent admission of dust.

* In this connection it is interesting to note that the cost of maintenance of locomotive and average train under steam operation for the year ending June 30, 1901, was 4.2c. per train-mile while the cost in the case of an equivalent electric train, as shown by records for corresponding months for the year ending June 30, 1906, was 2.1c. per train-mile.

2. INTERBOROUGH RAPID TRANSIT COMPANY, SUBWAY DIVISION

For the year ending June 30, 1906, the car-mileage operated by the New York subway was 31,931,073. The cost of repairs and renewals of electric equipment of rolling stock was 0.38 cents per car-mile. Estimating the probable cost of repairs and renewals of electric equipment, were electric locomotives in use instead of the multiple-unit car equipment, the approximate cost in this case works out at 0.7 cents per train-mile. A locomotive doing the same work as the electric equipment of the average train in the subway (about five cars) must be capable of exerting a draw-bar pull of 30,000 lbs., which with 20 per cent adhesion calls for 75 net tons on drivers. This is about double the weight on drivers of the average steam passenger locomotive, and the figure 0.7 cents per train-mile, obtained in actual service under conditions very severe in respect to maintenance of electric equipment, by reason of the presence of great quantities of brake-shoe dust, is to be compared with the cost of maintenance of steam locomotives exclusive of running-gear, frame, cab, and those other parts common to both electric and steam equipment.

3. WILKESBARRE & HAZLETON RAILROAD

Operation for the year 1905:

Equipment comprises motor cars weighing 43 tons without passengers, and equipped with four 125-hp motors and multiple-unit control.

Effective draw-bar pull (20 per cent adhesion) = 17,000 lbs.

Speed of operation in local service = 30 miles per hour.

Total length of run = 27 miles.

Average number of stops = 6.

Car-mileage operated in 1905 = 262,947.

Cost of repairs and renewals of electric motors = $1,021.70 = 0.39 cents per car-mile.

This road operates in a mountainous country, ranging in elevation from about 500 ft. to 1700 ft. above sea-level. About one-third of the length of the road is on a grade of 3 per cent.

4. LACKAWANNA & WYOMING VALLEY RAILROAD

Operation for a period of four months ending Oct. 31 1906:

Equipment: a, 16 passenger cars, 77,500 lbs. each; b, 14 passenger cars, 64,500 lbs. each; c, 4 freight and express motor cars, 61,300 lbs. each; d, 1 electric locomotive, 94,600 lbs.

Car-mileage operated =527,554.

Repairs and renewals of electric equipment = $4,450.43 = 0.84 cents per car-mile.

5. NIAGARA, BUFFALO & LOCKPORT RAILROAD

Operation for a period of six months ending Nov. 30, 1906:

Equipment: passenger cars weighing about 60,000 lbs. driven by four direct-current motors.

Average speed outside of Buffalo city limits, 20 miles an hour. Approximate number of stops one-way trip: 30 on Buffalo & Niagara Falls division, and 6 on Buffalo & Lockport division.

Length of run outside of Buffalo, approximately 20 miles.

Car-mileage operated, 1,309,682.

Repairs and renewals of electric equipment, 0.79 cents per car-mile.

6. RETE ADRIATICA-VALTELLINA LINE

Perhaps the best instance of electric operation directly comparable with cost of steam operation is afforded by the

records of actual results realized on the Valtellina line where both freight and passenger traffic are operated over a line 66 miles in length, traversing a very rugged country and in the winter exposed to severe climatic conditions. The equipment for the year ending July 1, 1904, comprised ten motor cars and five 70-ton locomotives. The service performed amounted to 61,934,569 ton-kilometers. The average annual mileage of motor cars and locomotives amounted to 54,351 kilometers, while the steam locomotives superseded by electric equipment never exceeded an average of 29,000 kilometers. The total cost of electrical and mechanical repairs to locomotives and motor cars, for the year ending July, 1904, works out at 1.4 cents per locomotive or motor-car mile. The rolling stock used on this line is excellent in design and construction and is particularly well adapted to operate in railway service at low cost of maintenance, by reason of the fact that three-phase motors and water rheostats are employed instead of commutating motors and switch-control. The equipment has not been operating long enough to have reached the point where renewals, as distinguished from repairs, have become necessary:

Summarizing the foregoing we have the following:

	Tractive Effort 20% Adhesion.	Repairs of Electric Equipment of Equivalent Electric Locomotive, Estimated.	
	Lbs.		
Manhattan Railway	22,000	0.5c.	
Subway train	33,000	0.7c.	
Wilkesbarre & Hazleton R. R.	17,000	0.38c.	(Actual.)
Lackawanna & Wyoming Valley R. R.	14,000	0.84c.	(Actual.)
Niagara, Buffalo & Lockport R. R.	12,000	0.79c.	(Actual.)
Rete Adriatic-Valtellina Line	......		Complete cost of maintenance of locomotives and cars.
Freight locomotives	......	1.6c.	
Passenger cars	......		

It may be conceded freely in respect to the foregoing data that they are neither sufficiently comprehensive in scope nor extended in respect to duration of service to justify definite and final conclusions. It must be noted also on the one hand that the cost of maintenance may be expected to decrease by reason of further improvement in the construction of apparatus of comparatively new types, and on the other hand that the costs given are for inspection and repairs rather than renewals, since the time has not arrived when any of this equipment has been thrown aside and replaced by new equipment charged to this item of operating expenses as is usual with steam railways.

The reports of the Interstate Commerce Commission do not show what proportion of the item, "Repairs and renewals of locomotives" is chargeable to renewals, but from inspection of detailed reports of our most important railway systems it seems fair to assume that in the case of the average railway from 4 per cent to 5 per cent of the total cost of repairs and renewals of locomotives represents the cost of renewals.

Taking into account all of the various considerations which must affect the conclusions in the general case, so far as we have been able to gather them, we are of the opinion that for equal draw-bar pull, the repairs and renewals of electric equipment of locomotives, assuming good design and construction according to present standards of the art, should not exceed 1 cent per locomotive-mile, and will probably approximate 0.9 cent per locomotive-mile.

Taking the higher figure, it is evident that the substitution of electric equipment for all parts of a steam locomotive other than frame, wheels, axles, cab, and other parts which are common both to electric and steam locomotive construction, a very great saving is effected. We have been unable to fix with satisfactory exactness a figure representing the average cost of repairs and renewals of these parts, but it would seem liberal to allow 1.5 cents per locomotive-mile, this being equivalent to an allowance of something over $400 per annum per locomotive. Taking this figure and adding the estimated costs of repairs and renewals of electric equipment, we have 2.5 cents per locomotive-mile as the estimated total cost of repairs and renewals of electric locomotives, performing the average work now done by steam locomotives.

In 1904 the aggregate revenue train-mileage operated was about 1,050,000,000. To cover locomotive mileage in switching, operating work-trains, and pushers we assume 1,300,000 locomotive-miles. In 1904 the aggregate repairs and renewals of locomotives was $105,633,752, the average cost per locomotive-mile, therefore, being 8.1 cents. A reduction of 2.5 cents, therefore, is equivalent to a saving of 70 per cent in the cost of this item, or 5.256 per cent of operating expenses, reducing this item to 2.253 per cent of total operating expenses under electric operation.

In the foregoing consideration of the item repairs and renewals of locomotives, we have assumed equal locomotive mileage per day in steam and electric service. The item of expense under consideration will be proportional approximately to the mileage, and therefore we have made the comparison upon this basis.

The relative number of locomotives required for a given service is, however, a question of much importance and may be here appropriately referred to.

According to the report of the Interstate Commerce Commission for 1904, the effective train-mileage, not including work-trains, pushers, or shifting mileage, was 58 miles per locomotive per day. Including these items the daily run of the average locomotive in the United States would be approximately 80 miles. The average freight and passenger locomotive is actually on the road not more than six hours in each twenty-four-hour period. In the case of electric locomotives there is no reason, so far as the mechanism is concerned, why it cannot be kept in practically continuous service. Ordinary inspection and maintenance require very little time, and if the equipment be well designed and constructed repairs of magnitude will be necessary only at intervals very infrequent as compared with steam practice.

The fact that the average daily run of the average locomotive is approximately 80 miles is due in large measure to causes which would still exist were electric locomotives substituted. The time spent by freight locomotives in yards and terminals making up trains or awaiting opportunity to take their place in the procession of trains which in these days are demonstrating the insufficiency of track equipment for the business of the country, is a large factor. Perhaps this would not be greatly modified were electric locomotives employed. But other considerations which operate to reduce average mileage are the facts that the steam locomotive spends a large part of its life in the repair shop, and a still larger part in firing up and preparing for its work in withdrawing fires, having boiler tubes cleaned, etc., after its daily run. Nothing short of years of actual experience can establish definitely the ratio of electric to steam locomotives required in average service, but it seems reasonable to assume that this ratio will not exceed 2 to 3 and will probably approximate 1 to 2. It will be noted that the foregoing estimate of cost of repairs and renewals is independent af any assumption as to the relative number of locomotives required, since it is reckoned on locomotive mileage.

. Item 13. In cases where electric locomotives are substituted for steam locomotives, there should be some reduction in this item. Painting should be considerably reduced by reason of the elimination of smoke. The life of the upholstery and interior decoration of the car will be increased.

Item. 14. This item will be favorably and very materially affected if it should ever prove practicable to operate heavy freight trains by locomotives located at intervals throughout the trains and controlled by the multiple-unit system. The bare possibility of this at present may seem fanciful, but those who realize the extent to which the wear and tear of freight cars results from the terrific strains to which the draft-gear is subjected under present operating conditions, especially on mountain grades, and who understand also the increase in track capacity and decrease in cost of train crews which would result in the adoption of a system which makes it possible, if necessary, to double the length and weight of the longest and heaviest freight trains now in use, will be ready to give this possibility serious consideration. Altering the present make-up of trains, so far as location of the locomotive is concerned, makes it possible to operate two or more locomotive units at the head of the train, and to utilize their power to the utmost by multiple-unit control.

Assuming that the methods of train operation remain the same, the adoption of electricity will still effect a reduction in the cost of Item 14, and for two reasons, viz:

1. The practical elimination of damage by fire which now frequently is superimposed upon damage caused by collision or derailment.

2. Reducing the wear and tear of wheels and brake equipment in descending long grades, by reason of the opportunity afforded to brake the trains by causing the motors to operate as generators. No statistical data are available upon which to base an estimate of the probable reduction in this item to be expected from this cause. On comparatively level lines it will not be important, but on mountain-grade divisions it should operate to prevent a very large proportion not only of wear and tear directly due to grade but also of the destructive freight wrecks which are now so frequent. In the way of an estimate, nothing more definite than a guess based upon consideration of probabilities can be advanced; but in the opinion of the writers the general substitution of electricity for steam operation in freight service should reduce this item from 7.657 per cent to something like 6 per cent of operating expenses.

Item 15 will not be changed materially.

Item 16 obviously will not be changed.

Item 17 will be reduced under electric operation since the repairs to locomotives will be radically decreased, as shown, and since the tool equipment required for the electrical machinery is materially less expensive and varied. It would seem reasonable to expect that this item would be reduced from 0.662 per cent to about 0.5 per cent of total operating expenses. Of course a large proportion of the shop machinery and tools are for car repairs.

Item 18 will not be changed.

Item 19. "Other expenses." The classification of operating expenses includes under this item "all expenditures for account of electric light, torches and lamps used in machinery department, shops, roundhouses and offices and the oil and material for the same; the proportion of labor and material for the proper operation and repair of electric lights used in connection with other departments; wages of engineers and firemen and the cost of fuel and water in operation of stationary engines or boilers for supplying power and heat to shops, buildings and roundhouses." We estimate that this item will be reduced to about 0.4 cent.

CONDUCTING TRANSPORTATION

Item 20 will not be changed.

Item 21. "Engine and roundhouse men" includes, in addition to the engine crew, round-house men whose work, of course, is chiefly in connection with the cleaning and maintenance of the engines. This item of averages for the railroads of the United States 9.451 per cent of the operating expenses, of which 91 per cent, or 8.6 of the operating exepnses, are for engine men and for firemen. Of this 8.6 per cent approximately 5.5 per cent is for engine men and 3.1 per cent for firemen.

In considering the substitution of the electric locomotive for the steam locomotive it is obvious that the change eliminates the work which the fireman is employed to perform. The point is frequently made, however, that to reduce the engine crew to one man means an increase in the risk incurred in train operation, and this point obviously is of such importance as to require careful consideration.

If we compare conditions which now exist upon such systems as the Manhattan Elevated with the conditions which existed before electricity was adopted, it seems reasonably clear that with a competent motorman operating the controller which instantly cuts off power and applies the brakes in case the hand of the motorman is removed from the handle of the controller, the safety of trains and passengers is assured in higher degree than it was under the old conditions. The usual argument against the elimination of the fireman is, of course, found in the allegation that in case of the sudden death or serious illness of the engineman the fireman can take his place and bring the train to a stop or operate it to the next station. The controller which automatically cuts off power and applies the brakes cannot operate the train to the next station, but it can stop it much more promptly than the fireman possibly can, even when he is so located upon the engine as to be in sight of the engineman.

But a very large proportion of our steam locomotives are now designed in such a way that the engineman is not in sight of the fireman, and the mechanism of the steam locomotive which he controls has no automatic device for shutting off power and applying the brakes in case he suddenly dies at his post. In such an emergency on trunk-line railways there would be some advantage in the presence of the fireman, owing to the fact that if competent he could operate the train to the next station. This point might be met by having the train conductor or brakeman or flagman qualified to operate the electric train to its destination in case of accident to the motorman. The degree of skill required, so far as actual manipulation of the mechanism is concerned, would be far less than in the case of the fireman who might in emergency be entrusted with the responsibility of operating the steam train.

As regards the wages of the engineman, the Manhattan Railway decided to pay its motormen the same wages which it had paid its enginemen. This decision was based largely upon consideration of the fact that familiarity with the road and experience in operating trains under the extremely close headway prevailing upon this system were of such importance that any risk which might be incurred by substituting new men must be avoided. The great majority of electrically-equipped railways operating under conditions similar to the Manhattan, however, pay their motormen wages comparable to the wages of the men who operate

street cars rather than to the wages of locomotive enginemen. It seems reasonable to assume that under average conditions the services of thoroughly competent motormen can be obtained at a figure which will represent a reduction of 1 per cent in operating expenses, making this item 4.5 per cent instead of 5.5 per cent.

The expense for round-housemen, which under steam operation is about 8.5 per cent, will be greatly reduced both by reason of the reduction in the number of locomotives required for a given service and also for the reason of the demonstrated less cost of maintenance per locomotive unit. It is entirely liberal to allow for this item one-fourth of its cost in steam operation, the saving here effected being equal to 0.64 per cent of the average operating expenses of steam railroads in the United States. The estimated cost of the item under consideration, therefore, is 4.71 per cent of total operating expenses.

Item 22. "Fuel for locomotives." One of the marked economies resulting from the substitution of the electric motor for the steam locomotive in railway operation is in the reduction of the fuel account. The cost of fuel upon the average steam railway in the United States for the five years 1901 to 1905, inclusive, constituted 11.292 per cent of total operating expenses. The aggregate cost in 1905 was $156,429,245.

The following figures show comparative fuel consumption upon the Manhattan Railway during the year ending June 30, 1901, when steam locomotives were employed and during the year ending June 30, 1904, when electricity was used. During the period first mentioned one pound of coal produced 2.23 ton-miles, if the weight of the locomotive be included, and 1.5 ton-miles, if the weight of the cars only be considered. During the latter period (electric traction) one pound of coal burned at the power house produced 3.85 ton-miles, excluding weight of locomotives; therefore, the ratio of ton-mileage per pound of coal in favor of electric operation was 2.57 to 1. Including weight of locomotive it was 1.72 to 1. The average speed under electric operation was approximately 2 miles an hour greater than that attained by steam, and if correction be made for this difference the ratio of ton-mileage per pound of coal, excluding weight of locomotives, is approximately 3 to 1, and including locomotives 2 to 1 in favor of electric traction. It should be noted also that in this case the coal burned at the power house was of lower grade, and therefore less expensive than that used by the locomotives, and it is reasonable to expect that in general electric traction will mean utilization of cheaper fuel.

We would point out that the argument from Manhattan experience cannot be met by the statement that the Manhattan is not an average railroad. Were the steam and electric apparatus now operating the Manhattan lines applied to the operation of a division of a trunk-line railway, the one part of the system which would be affected in respect to efficiency is the high-potential transmission lines, and the effect of their greater length in general would be to increase the relative fuel consumption of the electric system by not more than 5 per cent. For trains drawn by locomotives the fuel account (coal only) under electric operation would still be approximately one-half of the cost of the fuel for steam operation, and for passenger service using multiple-unit equipment it would be less than 40 per cent of the fuel used in equivalent steam service, even if we assume that the system of alternating transmission and conversion to direct current by synchronous converters be employed.

The advantage in favor of electric operation is of course more marked if we assume that alternating-current equipment is to be used, as in general would be the case in the electrification of trunk lines or long divisions. In a particular case which we have worked out with great care, the trolley and track rail losses average 3.9 per cent, the load factor being 0.33. This is the result obtained in using the single-phase system for the equipment of a division approximately 40 miles in length, the potential being 11,000 volts. The grand average of traffic in the United States does not exceed seven trains per day passing a given point in each direction, and the trolley and track rail energy losses for this traffic would be less than 2 per cent.

Assuming that such a trolley voltage is used in connection with a feeder potential of say 40,000 to 60,000 volts, the allowable loss in these feeders at maximum load certainly will not exceed 10 per cent and the energy efficiency of step-up transformers, transmission feeders, and step-down transformers will be 92 per cent. Combining this figure with the energy efficiency of trolley and track, as above stated, the resultant efficiency from bus-bars of power house to the train will be 90 per cent.

The works-cost of a kilowatt-hour at the bus-bars of the Manhattan plant is less than 0.6 cent when coal costs $3 per ton, this coal having a calorific value of 14,000 B. T. U. per pound. This cost includes fuel, water, labor, maintenance, miscellaneous supplies, and in short everything except capital charges. It is not abnormally low, the cost of both coal and labor being relatively high as compared with the grand average cost of equivalent coal and labor throughout the United States. Where fuel is less expensive, as in the Middle West, large modern plants, using steam turbines, are producing the average kilowatt-hour at a price not exceeding 0.5 cent exclusive of capital charges, and in at least one case at a works-cost approximating 0.4 cent.

As will be shown hereinafter, were all the railroads of the United States to be operated by electricity, the average plant required, assuming power to be transmitted 150 miles, would approximate 4,000 kw, if the plants supplied but a single line 300 miles in length. The great bulk of the total power supplied, however, would be derived from large plants in which the cost of producing the unit of energy, considering average costs of fuel and labor, should be less than 0.6 cent. While the small plants would exceed this figure we believe that as a grand average 0.6 cent is ample to cover the case. In this connection it may be remarked that water powers and other sources of cheap power supply would tend to keep down the average cost of power under the assumed condition of electrification of the entire railroad system of the country.

In the case of the single-phase, 25-cycle motor, assuming the average length of run for freight trains to be 15 miles and for passenger trains 20 miles, we have calculated that of the energy delivered to the locomotive approximately 86 per cent will be effective for traction in the case of the passenger locomotive, which is gearless, and about 84 per cent in the case of freight locomotive, which uses single-reduction gear. Combining the two, it is safe to say that of the energy supplied at the bus-bars in the power house not less than 75 per cent will be effective for traction in the average locomotive equipment with this apparatus.*

The cost of a kilowatt-hour effective for traction therefore is 0.8 cent and the cost of a horse-power hour effective for traction about 0.6 cent of which 0.35 cent is for fuel when coal is 14,000 B. T. U. per pound, costs $3 per ton of

*For the motor curves upon which these figures are based, we are indebted to the courtesy of the Westinghouse Electric & Mfg. Co.

2240 lbs., and 0.25 cent is for other power-house supplies, power-house labor, and maintenance of power-house equipment.

As we have stated, the railroads of the United States in 1905 used coal costing $156,429,245. For the purpose of estimating the cost of equivalent electric power the following data are necessary, of which those marked by an * are furnished by the report of the Interstate Commerce Commission while the others involve certain assumptions:

PASSENGER SERVICE

*Passenger train-miles.
Passenger car-miles.
*Passenger-miles.
Average weight of passenger trains.
- a. Weight of locomotives.
- b. Weight of cars.
- c. Weight per passenger.

Average speed of passenger trains.
Average length of run.
*Mail and express train-mileage.
Average weight of mail and express trains.
Non-revenue ton-mileage.

FREIGHT SERVICE

*Freight train-mileage.
*Freight car-mileage.
*Revenue freight-ton miles.
Average weight of freight trains:
- a. Weight of locomotive.
- b. Weight of cars.

Average speed of freight trains.
Average length of run.
Non-revenue ton-mileage, work-trains, switching, etc.

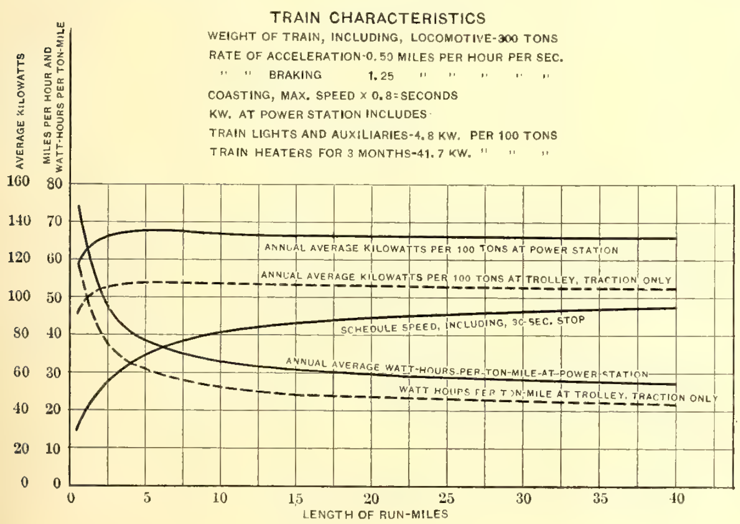


FIG. 1

Referring to the several items in the foregoing lists not directly derived from the report of the Interstate Commerce Commission the assumptions made are as follows:

PASSENGER SERVICE

Passenger Car-Miles: These we have calculated from the stated train mileage and the assumption that the average number of cars per train is 5.5.

Average Weight of Passenger Trains: We assume, a, weight of the average locomotive exclusive of tender equals 60 tons; this is the weight of the average passenger locomotive used by the Erie system; b, average weight of ordinary passenger coaches without live load equals 30 tons. This weight is somewhat in excess of the average weight of cars used by a number of railroads using rolling stock undoubtedly representative of the average in use throughout the country. To this we have added 10 per cent in estimating train weight to cover additional weight of Pullman cars

c. Average number of cars in trains. We assume five and a half cars per train, which is approximately correct for

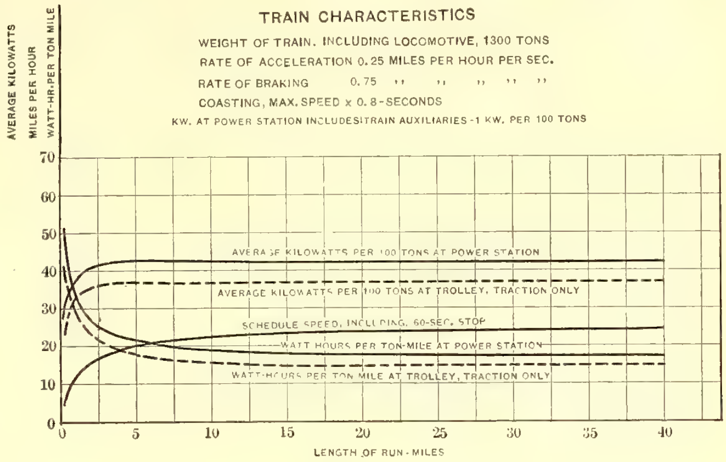


FIG. 2

a number of the more important railroads and is probably slightly above rather than below the grand average.

d. Weight per passenger. We have assumed an average weight of 140 lbs.

Average Speed of Passenger Trains: Referring to Fig. 1, the curve expressing the variation in the amount of energy required for traction as dependent upon average length of run between stations, shows that the increase resulting from a decrease in length of run from 20 miles to 10 miles is but 10 per cent. If the average length of run be further decreased to 5 miles, the increase in energy for traction as compared with that required for a 10-mile run is approximately 18 per cent. Including energy required for heating and lighting the cars, it is not far from accurate to assume 33 watt-hours output at power house per ton-mile in average passenger service.

Average Length of Run: We have assumed, as stated, 33 watt-hours at power house ton-mile including light and heat. This corresponds to an average run of 10 miles.

Average Weight of Mail and Express Trains: We have assumed average weight of mail and express trains to be the same as that of the average passenger train, viz: 180 tons without locomotive or live load.

Non-Revenue Ton-Mileage: This is assumed at 10 per cent to cover "double-headers" and switching. For the entire Erie system the actual figures approximate 7 per cent, and the assumption of 10 per cent is slightly less favorable to electric traction than the facts would probably warrant.

FREIGHT SERVICE

Average Weight of Freight Trains: As regards freight service, in estimating the average weight of trains we have assumed the following: a. Weight of locomotives equals 79 tons. This is the actual average of the freight locomotives of the Erie system exclusive of tender. b. Weight of cars equals 15 tons. This figure closely approximates the average weight of all freight cars of the Erie Railroad.

Average Speed of Freight Trains: The curves (Fig. 2) are based upon a gear ratio which produces on straight and level track a maximum speed of 25 miles an hour. Determination of the error involved by any mistake in our assumption of the average speed in

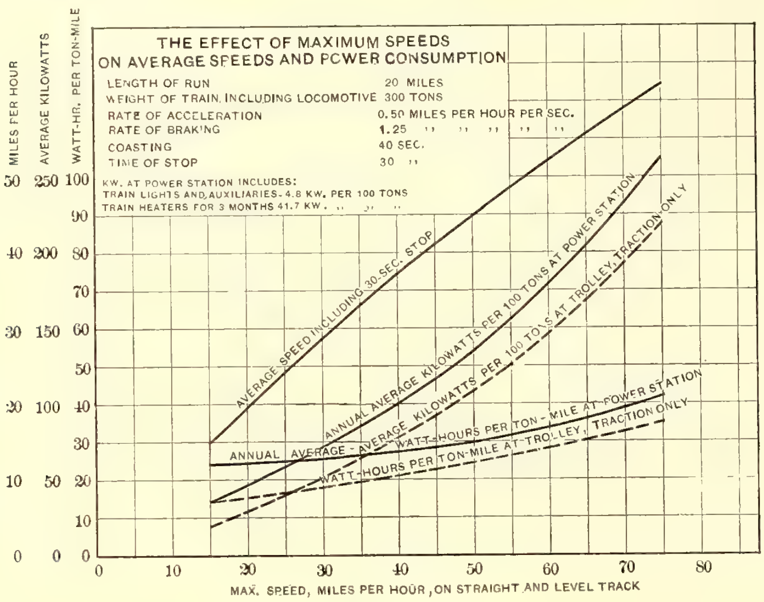


FIG. 3

freight service is facilitated, which shows, for example, the following relations:

Maximum Speed	Average Speed Including 60 Seconds Stop Miles per Hour	Average Watt-hours per Ton-mile at Power Station
20	19	17
25	23	18
30	27	19

Average Length of Run: We have assumed that for all freight service the average length of run is 15 miles. The actual average length of run may vary considerably from the distance assumed without causing material error in our calculation as shown in Fig. 2.

Non-Revenue Ton-Mileage: We have added 15 per cent of the total revenue earning ton-mileage.

Basing our calculations upon the foregoing statistical facts and the assumptions noted, we estimate that for the operation of the entire freight and passenger service of the United States as existing in 1905, the aggregate energy required at bus-bars of power houses would approximate 12,500,000,000 kilowatt-hours per annum. At 0.6 per cent per kilowatt-hour the total cost of energy for traction, for the operation of all auxiliaries, and for the supply of light, and heat to passenger trains would closely approximate $76,000,000 per annum. This figure represents a saving of about $80,000,000 as compared with the coal used by steam locomotives in the year 1905. Referring to the table, the average cost of this item for five years, viz: 11.292 per cent, would be reduced by electric traction to 5.533 per cent.

Item 23 is eliminated if electricity be substituted for steam.

Item 24 should be considerably reduced. We assume that it will be reduced to 0.25 per cent.

Item 25. We make no change in this item.

Item 26 is not changed.

Item 27, among many others, includes the following which will be changed by the substitution of electric power, viz: "Heating, lighting, cleaning and lubricating cars, including the cost of supplying and pumping gas into cars."

In discussing Item 22, we have included in the estimate of electric power required energy sufficient to light all cars three hours out of every twenty-four. We have also included energy sufficient to heat all passenger trains by electricity an average of three months per annum. Both of these are important items. The cost of clearing the cars should also be reduced by the elimination of smoke and cinders from the locomotives. All things considered we believe it is fair to assume that under electric operation this item will approximate 1 per cent of operating expenses.

Item 28 will not be changed.

Item 29. In general it is not to be expected that the large amounts of power required for train operation can be transmitted electrically under conditions which make it necessary to parallel telegraph lines by power circuits without more or less interference with the telegraph and telephone service. Certain technical questions in regard to methods of preventing interference remain to be worked out. The erection of overhead circuits carrying power supply will involve generally more or less shifting of the location of the telegraph lines. This item of expense is taken care of in our estimate by inclusion of the cost of overhead construction, and is treated as a capital account. Telegraph circuits being rearranged with reference to the power circuits, or equipped with one or another of the devices which have been suggested as preventives of difficulties resulting from inductive effects of the power circuits, it might be assumed, perhaps with safety, that Item 29 would not be changed, but we are

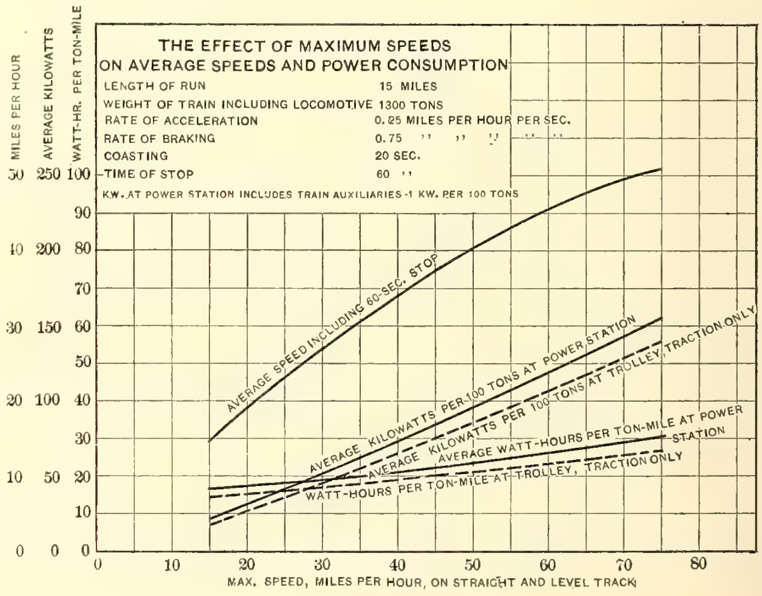


FIG. 4

inclined to the opinion that there will be a slight increase in the cost of this item even under the best plans heretofore proposed, and we therefore increase it in our estimate to 0.2 per cent.

Item 30. No material change.

Item 31. This item includes among many others the

following, viz: "All expenditures for account of heating and lighting depots, waiting rooms, freight and passenger offices and other station buildings; fuel and supplies for engines operating freight carriers on docks, wharves and piers to convey freight between boats and cars; supplies used for stations and yards, signal lights, street lights, switch lights, semaphore lamps, etc., also bills of municipalities for lighting highway crossings." For lighting and incidental power service the change to electricity would undoubtedly mean reduction in cost. We will let it stand as it is, however, and would point out the fact that without increasing the cost of this item, a great improvement in facilities for handling freight at docks and wharves and for lighting passenger stations and yards will result from the substitution of electric power.

Items 32, 33 and 34 will not be changed.

Item 35. Under this item the important factors which will be affected by the substitution of electricity for steam are the following, viz: "Charges for loss, damage, delays or destruction of freight, parcels, express matter, baggage and other property entrusted for transportation (including live stock received for shipment) and all expenses directly incident thereto. * * * Charges for damages to or destruction of crops, buildings, lands, fencing, vehicles, or any property other than that entrusted for transportation whether occasioned by fire, collision, overflow, or otherwise; also services and expenses of employees or others while engaged as witnesses in the case of suits." For reasons which have been referred to in our discussion of the subject "Safety," it is clear that there should be a material reduction in the charges for loss due to destruction of freight, etc. Another saving will result from the practical elimination by reason of damage of fire, which now not infrequently is caused by sparks from locomotives. These savings will be offset to some extent by damage due to telegraph, telephone, or other wires coming in contact with the power circuits of the railway, unless reasonable care be exercised in preventing such accidental contact by the adoption of proper precautions when the electric equipment is installed.

In our estimate we have reduced Item 35 to 0.75 per cent.

Item 36. "This account includes all charges on account of employees or other persons killed or injured except lawyers' fees and court expenses." While it is probable that a large part of the expenditures were on account of passengers killed and injured, and while any reduction in fatal and serious accidents to passengers therefore would materially affect this item, we have thought it best in the absence of satisfactory data to leave it practically as it stands, our estimate being 1 per cent.

Item 37. In our opinion this item will be reduced under electric operation for reasons which have been sufficiently indicated in what we have said in regard to item 35. It would seem that 0.2 per cent is a fair estimate of its probable amount.

The items Nos. 38 to 46 will not be changed, nor will there be any material change in "General Expenses."

GENERAL ESTIMATE

According to our estimate, if all the railways of the United States were to-day operated by electricity using the single-phase alternating-current system at the potential adopted for the equipment of the New Haven Railroad, the energy required for operation being developed by power plants such as are to-day in extensive use and transmitted at potentials well within limits established in practical service, and if the rolling stock equipment consisted of locomotives and multiple-unit trains fitted with motors and control apparatus no better than the best which now exist, the aggregate cost of operation which in 1905 amounted in round numbers to $1,400,000,000, would be reduced by about $250,000,000.

To accomplish this result, power plants delivering about 12,500,000,000 kw-h. per annum would be required. Assuming the radius of transmission from power houses to be 150 miles, the load-factor in railway service should be not less than 0.75, and taking this figure it appears that power plants capable of delivering a maximum output of about 2,800,000 kw will be sufficient to operate the entire railway service of the United States as existing in the year 1905. The average output required is about 10 kw per mile of line and 7 kw per mile of track.[6]

In 1905 the average gross earnings of our railroads per mile of line were $9,598, and the average operating expenses $6,409. The foregoing calculations lead to the conclusion that high-class electric equipment now available would reduce this average cost to $5,265. The difference is $1,144 per mile of line, against which apparent saving must be charged the annual interest and depreciation of the power plant, the addition to permanent way equipment, comprising overhead construction and track bonding, the transmission circuits, and the sub-station with their equipment. Assuming 5 per cent interest on cash cost of these items and allowing 5 per cent for a sinking fund to cover depreciation of power house with its equipment and 2½ per cent for a sinking fund to cover depreciation of the overhead construction and distributing system, the aggregate of fixed charges works out at $837 per mile of line. The saving in operating expenses, therefore, is more than sufficient to take care of the increase of fixed charges. In other words, it appears that the entire railroad system of the United States could be operated to-day at less cost by the electric motor than by the steam locomotive. That the railroads in general if so equipped would realize a large increase in earning power will be admitted by all who have given the subject intelligent attention.

In charging against electric operation 5 per cent upon cost of power plant and 2.5 per cent upon overhead construction, transmission circuits, sub-stations, and track bonding, we have departed from methods usually adopted in financing of American railway properties. If no depreciation be charged against the increased capital account represented by the items named, the apparent saving will be materially increased.

While our estimates have led us to the conclusion that under average existing conditions of railway operation in the United States, improved financial results would be attained by the substitution of the electric motor for the steam locomotive, the immediate and general adoption of the new motive power by our railroad companies is neither possible nor desirable. It requires no argument to demonstrate the wisdom of making haste with deliberation in a matter involving interests of such magnitude as those which are tied up with the transportation systems of the United States. Recognizing the magnitude of these interests and having in mind the fact that the art of electric traction as applied upon a large scale to heavy train units is yet young, the point which we desire here to emphasize is the necessity of conservative and carefully considered action upon the part of all members of this Institute who may be called upon to advise in respect to the electrification of railways now operated by steam.

Referring to the tabulated results (Table II.), in which we have applied the estimated reductions in operating expenses

under electric traction, amounting to 18 per cent of the present average operating expenses to the ten geographical groups into which the railroad systems of the United States are divided by the Interstate Commerce Commission, the relatively great advantages of applying electric traction to systems operating heavy traffic showing large gross earnings per mile of line are evident at a glance.

THE STANDARDIZATION OF ELECTRIC RAILWAY TRACTION EQUIPMENT

In the concluding part of their paper the authors made a plea for the standardization of 15 cycles for single-phase railway lines, on account of the better adaptability of the lower frequency to motor design, and then said:

For the equipment of the entire railway system of the United States as now existing an aggregate power-house output capable of supplying continuously 2,100,000 kw would be required. Of the electric apparatus installed in the power houses, a change in frequency affects the generators, transformers, and a large proportion of the measuring and indicating instruments. It also affects the cost of the engine or turbine employed to drive the generator. At 25 cycles, the apparatus affected by frequency should cost approximately $30 per kilowatt. At 15 cycles it would cost on the average perhaps $33 per kilowatt. Cost of sub-station transformers would be increased approximately one-third and, in round numbers, the total cost of turbines and electrical power house and sub-station apparatus would be increased from $70,000,000 to $80,000,000.

TABLE II.
COMPARISON PER MILE OF LINE—BY GROUPS STEAM AND ELECTRIC OPERATION.
(216,974 Miles Represented.) (Dollars per Mile of Line per Year.)

Group No.	GENERAL LOCATION.	Miles of Line Represented.	Gross Earnings.	(Steam) Operating Expenses.	(Electric) Operating Expenses.	Difference Steam and Electric Operation	5% Interest on Electrical Equipment Excluding Rolling Stock.
I	New England	8,094	$14,511	$10,493	$8,604	$1,889	$647
II	New York, Pennsylvania et al.	23,281	20,752	13,671	11,210	2,461	790
III	Ohio, Indiana, Michigan	25,208	12,483	9,198	7,542	1,656	640
IV	Virginias, North and South Carolina	12,542	7,359	4,590	3,764	826	484
V	Kentucky, Florida, Louisiana et al.	24,563	6,867	4,899	4,017	882	475
VI	Illinois, Wis., Dakotas, Iowa et al.	48,672	8,021	5,169	4,239	930	525
VII	Montana, Nebraska and Wyoming	11,546	7,737	4,092	3,355	737	461
VIII	Colorado, Arkansas, Missouri et al.	30,456	6,362	4,308	3,533	775	461
IX	Texas and New Mexico	14,875	5,588	4,108	3,369	739	445
X	Pacific States	17,737	8,439	4,880	4,002	878	464
	United States, total	216,974	$9,598	$6,409	$5,255	$1,154	$516

If it be assumed that one electric locomotive will do the work of two steam locomotives, about 24,000 electric locomotives would be required to take care of the present railway business of the country. Assuming the cost of the average electric locomotive to be $25,000, the aggregate cost of locomotives required would be $600,000,000. Allowing for the increased cost of the 15-cycle transformers, it would seem that the difference in cost of the average locomotive should be not less than $1,000 in favor of the lower frequency, or for 24,000 locomotives $24,000,000. This is more than twice the estimated difference in cost of power-house and sub-station equipment.

It seems entirely safe to say, therefore, that the aggregate first cost of electric equipment and of steam turbine will be decreased by a change from 25 cycles to 15 cycles. The operating cost will obviously be decreased very materially. At least three-fourths of the above estimated cost of electric locomotives, say $450,000,000, represents cost of electric equipment. It will be seen, therefore, that of the apparatus which our electrical manufacturing companies may be called upon to furnish, more than 85 per cent is rolling stock. Obviously, any argument in favor of 25-cycle equipment which may rest upon existence of drawings and patterns and convenience in manufacturing should have comparatively little weight.

The use of 15 cycles instead of 25 cycles also secures considerable advantage in respect to the overhead trolley conductor and track return. With a given limit of voltage-drop, this advantage may be utilized by reducing size and, consequently, the cost of the overhead copper and the copper used to reinforce the track return.

Under the plans which we have assumed as a basis of our calculations, the amount of copper required for feeder circuits, trolleys, and reinforced track-return, estimated at 20 cents per pound, would cost approximately $750,000,000 were the entire railway system of the country as existing in 1905 to be equipped with electric operation.*

DISCUSSION OF THE PAPER

Frank J. Sprague referred to the fact that the statistics quoted by the authors were based almost entirely on d. c. operation, but that the recommendations in their paper were for 11,000-volt a. c. trolley operation at 15 cycles. The speaker plead guilty to fads and fancies in the past, but said that these fads and fancies had been translated into facts. He also believed that ten years from now the railroads of the country would be using 600-volt, 1200-volt or 1500-volt direct current He doubted the advisability of generalizing on all of the railroads in the United States. Many of them are in the hands of receivers and could not raise the money to be electrified if they wanted to. He preferred to deal with the living, immediate question. Three great trunk-line railroads which have terminals in New York City are at present being electrified. He was connected with the development of one and is not ashamed of it. He has criticised some of the development on another. As regards the Pennsylvania Railroad between New York and Philadelphia, he believed that if that line were to be electrified to-day it would be by direct current. He also believed that on a large number of lines which can be properly considered as subject to electrification the higher voltage direct-current system, according to any present development, will give better results in every way than the alternating-current overhead system. He hoped in the early future to present a paper to the Institute on the subject of d. c. and a. c. operation.

Mr. Lamme, chief engineer of the Westinghouse Electric & Manufacturing Company, referred to the pioneer work accomplished by Mr. Stillwell in reducing the frequency used in a. c. power stations, which in the earliest times was usually 133 cycles per second. Three years ago the speaker read a paper at the Institute recommending a frequency of 16⅔ cycles. There were certain reasons for adopting that

* In all our estimates we have included 0000 copper conductor in the return circuit, this being bonded to the rails at intervals for the purpose of preventing dangerous potential on track in case of a broken bond.

frequency, although 10 per cent higher or lower would not have been of very great importance so far as the operation of the apparatus was concerned. Because of commercial conditions in connection with existing power plants his company has practically been driven to 25 cycles, but the speaker still advocated the lower frequency. From 25 to 40 per cent greater output can be secured from a motor on 15 cycles than on 25. The motor is equally efficient, and the power factor and commutation are equally good. In regard to a lower frequency than 15 cycles, with the latter it is possible practically to saturate the machine so that no great advantage is gained by any reduction below 15 cycles. Mr. Lamme pointed out that a 25-cycle motor will operate perfectly well at 15 cycles and at the same speed, and a 15-cycle motor if well designed will operate on 25 cycles at its nominal capacity fairly well, but at slightly reduced capacity will operate very well. Some tests at East Pittsburg indicate very little difference in the ratio of tractive effort to the weight on the drivers between 15 cycles and 25 cycles. Referring to European practice the speaker mentioned the Valtellina Railway as using 15 cycles. The Oerlikon Company has adopted 15 cycles as standard and the same is true of the Siemens-Shuckert Company. The Allgemeine Company is the principal company which is adhering to 25 cycles. This is largely due to its type of motor, as this company uses the so-called series-repulsion motor, which operates to better advantage if the frequency is not too low.

B. J. Arnold said that so far as he was concerned it made no very great difference which system were used so long as it was a system with which the steam railroads could be equipped and operated for less money than at present. He was one of the first to use the rotary converter system, but never looked upon it as a complete solution of the electric railway problem. He did not entirely agree with Mr. Stillwell that it was advisable to standardize at once, as this would shut out the prospect of developing something which may prove better than anything which now exists. If alternating current is to be used, however, he leaned toward the 15-cycle frequency on account of the increased capacity of motor available between the wheels. He believed in the third rail where it is applicable, but did not believe there were many places where is was applicable. In the Grand Trunk Tunnel he recommended the a. c. overhead system on account of the large yards at each end of the tunnel where a great deal of switching was done and where it was essential that the conductor should be kept from under the feet of the men. The decision to use single phase on this road was made five months before the decision of the New Haven road to adopt a. c. was announced.

W. B. Potter, chief engineer of the railway department of the General Electric Railway Company, thought that standardization was advisable where it did not cost too much, but one could hardly expect any road electrifying to-day to spend a great deal of money simply for the sake of standardization and in anticipation of perhaps some time effecting a junction with some other road. Fifteen cycles has many advantages, and the speaker did not look for the ultimate development of the 25-cycle single-phase motor. That motor weighs about 25 per cent more than the d. c. motor of corresponding capacity. The 15-cycle motor with the same degree of commutation would probably weigh from 10 to 15 per cent more, and its efficiency and the power factor would probably be very largely the same. As regards the tractive effort, tests which he had made indicated that, assuming the tractive effort of the d. c. motor is 100 per cent, that of the 25-cycle motor would be from 80 to 90 per cent, and that of a 15-cycle motor 70 to 80 per cent. When the d. c. motor slips, however, the wheel rotates rapidly and the torque falls off to something like 20 to 30 per cent of the maximum. With the a. c. motor, whether on 25 or 15 cycles, although the wheel slips at a lower point the torque falls off only 10 to 15 per cent, due to the fact that the slip is a series of progressive jerks which allows the wheel to grip the rail so that after the wheel has once slipped it may take hold of the rail and have a higher maximum pull than before it slipped by reason of having cleaned the rail off, which is a condition not secured with d. c. The average draw-bar pull after slipping with a. c. is perhaps 70 per cent greater than it is with d. c. He did not believe that any of the present systems could be considered as suitable to every case. He looked upon the addition of commutating poles to the ordinary d. c motor as comparable in importance with the substitution of the carbon brush for the copper brush. He finally referred to the much maligned third rail and said that up to the present time there had not been much chance to malign some overhead construction.

W. S. Murray, electrical engineer of the New York, New Haven & Hartford Railroad, said that he had recently been compiling some data on repairs of steam locomotives extending over a year and covering the practice with twenty passenger engines. This includes cost of oil waste, flues cleaned, ash pans and grates cleaned, engines wiped, engines turned, engines fired, boilers washed and cost of sand.

The passenger locomotives averaged 5.6 cents per locomotive mile, as compared with 8 cents or 10 cents for freight. This figure can be divided into shop repairs, 3.88 cents, and maintenance, 1.72 cents. He questioned the advisability of using the Interstate Commerce figures as the basis of an estimate to determine the standard frequency. The principal work to be accomplished in the early future is in the Eastern section of the country, where there are a great many 25-cycle plants.

O. S. Lyford, of Westinghouse, Church, Kerr & Company, referred to the opening on Jan. 22 of the Rochester Division of the Erie Railroad by 11,000-volt trolley with 25 cycles. The trucks, which are of unusual size, are entirely filled with 100-hp motors which, had 15 cycles been used, could have been of 150 hp. He pointed out that the cost of items 12, 21 and 22 in Mr. Stillwell's paper could be doubled and still electric operation would not cost more than steam. Another important point was that of getting more service out of the existing tracks, a matter recently emphasized by John J. Hill.

C. L. Muralt, of New York, presented some curves of d. c. single-phase, three-phase and steam locomotives to illustrate their running characteristics. His argument was a plea for the three-phase locomotive, not only because it will carry great overloads without trouble, but also because it can do so without drop in speed.

A. H. Armstrong, of the General Electric Company, pointed out that the New York Central locomotive No 6000 at the end of its trial run of 50,000 miles has a maintenance charge of less than 1½ cents per locomotive-mile for repairs and maintenance, as against 8 or 10 cents with the steam locomotive. He thought that ten years from now engineers would still be disputing over the question of frequency and a. c. and d. c. operation. The steam locomotive has not yet been standardized and master mechanics and engineers have different views of valve gear and other details.

N. W. Storer, chief engineer of the railway department of the Westinghouse Electric & Manufacturing Company, thought that neither the d. c. locomotive nor the three-phase locomotive will meet the requirements of the railways of the country. The single-phase locomotive seems to offer the greatest possibilities. He thought that by using 15 cycles a saving of at least $5,000 could be made in the cost of locomotive over one for 25 cycles, rather than the $1,000 mentioned by Mr. Stillwell. He also thought that very satisfactory lighting could be secured with 15 cycles by using a low-voltage lamp with a heavy filament.

Wm. McClellan, of Westinghouse, Church, Kerr & Company, endorsed the overhead trolley and favored 15 cycles. He did not think it necessary to carry standardization too far. The present steam railroads do very little in the way of exchanging locomotives, but the companies ought to standardize enough to exchange cars. For instance, it is very desirable to standardize the train line so that cars equipped with the same system of multiple-unit control could be operated together. He said that his company had found it very difficult to get entirely satisfactory figures of steam operation. The figure of 1½ cents on the New York Central electric locomotive, it should be remembered, was secured under the surveillance of expert engineers and might not perhaps be a fair comparison.

W. I. Schlichter, of the General Electric Company, favored 15 cycles, but thought that one must consider the question of ultimate cost as some items would be larger. The generator may increase in cost from 15 to 50 per cent, as the speed with 15 cycles will be somewhat of a problem in connection with turbine work. He also pointed out that although the output of the motor is increased 35 per cent this is during acceleration, and that the continuous output of the motor is not correspondingly increased. For long runs, therefore, not so much will be obtained by the lower frequency.

A STANDARD ROADBED FOR COLUMBUS

After testing many roadbed formations, a number of which are still under portions of the system, the Columbus Railway & Light Company, of Columbus, Ohio, has adopted a standard method of construction. Whenever any portion of the system is renewed hereafter, the standard foundation will be put in, until the entire system is laid on this foundation. E. O. Ackerman, engineer of maintenance of way of the company, says the company's present method of construction gives a permanent foundation and has been approved by the city engineer's department.

This foundation is of solid concrete formation, with concrete girders 18 ins. deep under each of the rails. The rails are anchored to steel ties, which are bedded in about 6 ins. of the concrete. Mr. Ackerman admits that this gives a rather rigid track, but this is the feature that is approved by the city engineer, who objects to too much elasticity on account of its destructive effect on street paving. Mr. Ackerman says there is no renewal or extension work on hand at present, but it is expected that when the Central Market system is taken over by the Columbus Railway & Light Company, there will be considerable work done on its lines to bring them up to the standard of the Columbus Railway system. It is also expected that a third rail will be laid on a considerable portion of the Central Market system, so that the Columbus Railway cars, which are broad gage, can be operated over its lines. The Central Market will not be made broad gage, because of existing contracts by which standard gage interurban roads enter the city over its lines. The Central Market also has a contract with interurban roads that have their own lines into the city by which it furnishes the city service required of the interurbans by their franchises.

ELECTRIC TRACTION IN VENEZUELA

A short interurban line between Caracas, the capital, and the neighboring town of El Valle has been changed from steam to electric traction by the Caracas Electric Tramways Company.

The line was originally a narrow-gage road, 68 cm (2 ft. 3 ins.) wide, and as 3 ft. 6 ins. had been decided on as the gage for the city lines, it was necessary to widen the old track to enable the El Valle cars to run into the city. To avoid shutting down the traffic, a third rail was laid to the new gage, and new ties were also placed throughout.

Electric power is purchased from a local transmission company and is received at the railway station at 5000 volts. Here the voltage is reduced by three oil-cooled transformers connected in delta to 460 volts for running a 150-hp, three-phase motor which is belted to a direct-current generator. The overhead line consists of 00 grooved wire with bracket construction on iron poles. The line has a great many curves.

The cars are of the eight-bench open type, with G. E.-58 motors and K-10 controllers. The bodies and trucks were supplied by the J. G. Brill Company. The whole of the electrical material was supplied by the General Electric Company. The entire construction was carried out with native labor under the supervision of E. H. Ludford, the Caracas Tramway Company's manager.

The conversion of the existing horse lines of the city of Caracas to electric traction is at present being actively pushed forward by the London branch of J. G. White & Company, and the Central Railway has also electrified the first section of its steam road with material supplied by the Allgemeine Elektricitäts Gesellschaft, of Berlin.

TRANSFERS IN ST. LOUIS

The new transfer system which went into effect in St. Louis, Jan. 1, as the result of the consolidation of the United Railways and the St. Louis & Suburban systems, necessitated thirty different transfers and introduced radical changes in the general transfer scheme. Transfers are now punched according to directions, and round trips for one fare are made impossible. According to records at the offices of the United Railways Company, more passengers transfer to and from the Olive Street line than any other. On a normal week day about 23,000 transfers will be taken in by conductors on that line. The Jefferson Avenue line is next with 19,000 transfers. Grand Avenue conductors receive about 18,000 transfers, and Broadway line conductors about 15,000. Easton Avenue comes fifth with 13,000. Other lines range from 2000 to 10,000.

The Compania Electrica de Alumbrado y Traccion de Santiago, of Santiago de Cuba, which plans to build about 16 miles of standard-gage electric railway in Santiago and vicinity, has begun the construction of the system and expects to have the lines in operation in October, 1907. Practically all the material was purchased in the United States. The officers of the company are Eudaldo Romagosa, of Havana, president; Jose Marimon, Santiago de Cuba, vice-president; Dionisio Peon, Havana, secretary and treasurer; E. J. Chibas, Santiago de Cuba, general manager; A. W. K. Billings, Havana, consulting engineer in charge of construction.

PROCEEDINGS AND PAPERS OF THE CENTRAL ELECTRIC RAILWAY ASSOCIATION AT THE INDIANAPOLIS CONVENTION

ANNUAL CONVENTION AND BANQUET OF THE CENTRAL ELECTRIC RAILWAY ASSOCIATION

The annual meeting and banquet of the Central Electric Railway Association was held on Thursday, Jan. 24, at the Claypool Hotel, Indianapolis, Ind. Interesting papers were presented on the cost of power, interurban cai design, the handling of accidents and claims and on car lighting. Officers for the ensuing year were elected and in the evening the annual banquet was held. About 175 operating men and trade representatives were in attendance.

MORNING SESSION

The morning session was opened at 11 o'clock by President E. C. Spring, who announced that a stenographic report of the papers and the discussion upon them and the speeches at the banquet in the evening would be made and that these would be incorporated in a souvenir pamphlet with which all members would be supplied. Secretary W. F. Millholland read a list of applicants for membership which included several supply representatives, all of whom were elected. Before the reading of the first paper on the program, President Spring said it was very gratifying to leave the office of the president of the association knowing that every bill contracted for had been paid and that there was a balance in the treasury. This balance, he said, would be depleted somewhat in helping defray the expenses of the evening's banquet, but he considered that the effects of the banquet in stimulating interest in the association justified the expenditure. He also expressed regret at the absence of H. A. Nicholl, general manager of the Indiana Union Traction Company, who was detained by sickness.

G. H. Kelsey, superintendent of power of the Indiana Union Traction Company, then read his paper on "The Cost and Sale of Power by Railways" printed on page 207 of this issue. He emphasized in a very effective manner the fact that maintenance and interest charges on power house, sub-station and line equipment should be included in getting at the cost of power. As noted in his paper, Mr. Kelsey showed a chart, one curve of which showed the cost of fuel, labor and miscellaneous expenses as varying from 0.45 cent on a 5000-kw plant operated by his company to 1.5 cents on a 500-kw plant. This curve was presented to show particularly that with plants larger than 1000-kw capacity the fuel and labor portions of the cost of power decreased very slowly with the increase in size ot the station. The second set of curves on the sheet showed the total cost of producing power in the stations, this cost including interest and depreciation charges. The three curves presented were for the cost with plants run at 40, 50 and 70 per cent capacity. A comparison of the second set of curves with the first curve showed the cost to be very much higher when all charges were taken into account and that the cost with interest and depreciation charges considered was influenced very much by the power factor. During the discussion of Mr. Kelsey's paper John F. Ohmer wanted to know whether or not in arriving at his cost figures Mr. Kelsey had counted in office fixed charges. In manufacturing business he said such charges were considerable, and he thought they ought to be included in power costs.

Mr. Kelsey replied that such items would not be large as compared with the maintenance and depreciation charges, but nevertheless they should be included and he had tried to do so.

T. C. McReynolds, manager of the Kokomo, Marion & Western Traction Company, on being called upon stated that his company had had some experience in renting power. At one town a transformer on a pole was connected to a 10,000-volt line feeding a sub-station and transformed the current to 200 volts for commercial lighting. At another place streets were lighted by arc lights on a 208-volt circuit, and some current was furnished to private consumers. In selling power he thought that item of expense in addition to those dealt with in Mr. Kelsey's paper was that of the care for the lines beyond the transformers. Selling power, however, had not been very profitable with him, largely, he believed, because it had not been pushed.

AFTERNOON SESSION

The first paper read at the afternoon session was that of E. C. Carpenter, claim agent of the Indiana Union Traction Company. His paper, "Handling Accidents and Claims," emphasized the importance of getting accurate reports of accidents from trainmen and of getting into communication with all injured as soon as possible. This paper is printed in full on page 209 of this issue.

In the paper by W. H. Evans, master mechanic of the Indianapolis Traction & Terminal Company, on "The Model Car for Long Travel," the author directed attention to some of the things that have prevented the designing and equipping of such a car as might be called a model car. This paper will be found on page 213.

In the discussion on Mr. Evans' paper, to the question of C. L. Henry as to what he considered a desirable length for an interurban car, Mr. Evans said he thought a 60-ft. car would take care of people on a one-hour schedule. He believed the 67-ft. car an extreme. He was also asked if he did not see a disadvantage in having entrances on one side of the car, since such an arrangement would require platforms on both sides of the track. In this respect he admitted it was a disadvantage, and the operating department of his system had caused him to put a second baggage door on a car that originally had but one.

C. D. Emmons, general manager of the Fort Wayne & Wabash Valley system, wanted to know about the weights of the cars which Mr. Evans had described. Mr. Evans said that the Indianapolis & Northwestern cars weighed about 75,000 lbs. and he presumed that the 67-ft. cars were much heavier. Mr. Evans stated that he preferred the ejector type of ventilator for use in cars. In discussing the ventilation of cars, reference was made to the new Chicago City Railway cars which have a ventilator in the ends of the upper deck. These showed on a recent test an air passage averaging 370 cu. ft. per minute.

R. C. Taylor, superintendent of motive power, thought that with longer cars the proportion of weight of the car to the passenger load was increased. He said the ratio of dead weight to the passenger load varied quite a great deal in different cars, but the dead weight was usually two or three times that of the passenger load, and he suggested

that a committee be appointed to bring out plans for the lightening of interurban cars. A motion made to the effect that a committee of four be appointed was passed.

The next paper on the program was that by R. C. Taylor on "Car Lighting," which is published on page 215 of this issue.

After the reading of Mr. Taylor's paper, the committee on nominations was called upon. It reported for president, H. A. Nicholl, general manager, Indiana Union Traction Company; vice-president, F. D. Carpenter, general manager, Western Ohio Railway; second vice-president, R. I. Todd, vice-president and general manager, Indianapolis Traction & Terminal Company; treasurer, W. F. Millholland, secretary and treasurer, Indianapolis Traction & Terminal Company; for the executive board of Ohio, H. P. Clegg, president, Dayton & Troy Electric Railway Company; F. J. J. Sloat, general manager, Cincinnati Northern Traction Company; L. C. Bradley, superintendent, Scioto Valley Traction Company; C. N. Wilcoxon, general manager, Cleveland & Southwestern Traction Company; E. C. Spring, general manager, Dayton, Covington & Piqua Traction Company; executive board of Indiana, Chas. Murdock, vice-president, Fort Wayne & Wabash Valley Traction Company; A. A. Anderson, general manager, Indianapolis, Columbus & Southern Traction Company; F. D. Norveil, general passenger agent of the syndicate lines of Indiana; C. D. Emmons, general manager, Fort Wayne & Wabash Valley Traction Company; C. C. Reynolds, general manager, Indianapolis & Eastern, Indianapolis & Northwestern, Richmond Street & Interurban, Indianapolis & Martinsville, Indianapolis & Western and Indianapolis Coal Traction Companies. The report of the committee was adopted and the secretary was instructed to cast a unanimous ballot for the officers named in it.

Before the meeting adjourned, a rather animated discussion took place as to whether or not interurban lines should make contracts with the old line express companies, and whether or not it would be advisable to organize an express company especially to do business with interurban lines. Mr. Henry said the most important question was whether it was wise and best at this time to make contracts with the express companies that were approaching different interurban companies or to organize a company especially interested in the interurban lines. He said the old line express companies frequently approached interurban companies, and ten years ago they had come to him when he was operating the Union Traction Company of Indiana, but he thought that, especially as the interurban companies had made a big mistake in making contracts to carry mails, they ought to be very careful about making contracts with express companies. Mr. Carpenter said that the old line companies were carrying on business all over the country, while the territory of any company organized by the interurban people would be limited to interurban lines. He said he understood that the Union Pacific had at one time tried to run an independent express company but had made a failure of the venture. He thought that if the interurban lines could get the same contract with the express companies that the steam roads have, such contracts would be to their advantage at the present time. Later on the interurban lines might go in business for themselves. Mr. Wilcoxon thought Legislatures might soon compel old line express companies to interchange with the traction companies. He said his company, the Cleveland & Southwestern Railway, once had a contract with the American Express Company which did not result in much profit to him. He said that there was now an interurban express company operating on all interurban lines out of Cleveland, and the company was making a splendid showing and a good profit. He thought the vital point in the question of entering into contracts at the present time was whether or not the interurban companies would be glad to get rid of them in the future. Mr. Henry explained that his idea was not to organize a company that would be limited in business to the interurban companies, but that they should unite in the support of a company that would have right to transfer its express to other express companies. He did not advocate an express company that would be limited to interurban lines. Mr. Bradley asked what was the duration of the contracts proposed by the express companies, and was told that usually they were to run five years. He added that he agreed with Mr. Henry in that the interurban companies should act with much deliberation and be very careful to make no mistake. The discussion regarding express companies terminated in the passage of a motion, presented by Mr. Anderson, to the effect that a committee of three be appointed to look into the matter of interurban railways handling express by old line companies or by a company to be operated by themselves. The meeting then adjourned.

THE BANQUET

About 175 members and guests were in attendance at the banquet, held in the Claypool Hotel at 6:30 o'clock. President Spring introduced Mayor Bookwalter, of Indianapolis, who, in a speech of welcome, said that when the question of interurban lines entering the city came up a few years ago he had secured a settlement by which all such companies were permitted to enter. He said interurban lines had increased the trading population of Indianapolis 300 per cent. They had also decreased the cost of the accounting rooms of many firms 50 per cent, through the fact that traveling men who formerly made six towns in a week could now make twenty towns in the same time. He referred to a bill that had been introduced in the State Legislature providing for a 1-cent rate on interurban lines, and said that the man who based such a fare on the earning sheets as shown by the company forgot that the time for replacement of apparatus and equipment would come.

President Spring made a few remarks concerning the work of the association for the year, saying he reviewed the work of the past year with a feeling of pleasure and satisfaction. With regard to the permanent secretary's office, he said it had been a complete bureau of information. During the year about 6500 letters had been sent out. He spoke of the resignation of Mr. John Merrill, former secretary, and thanked and complimented Mr. Merrill for the work he had done in instituting the office. He also thanked the Indianapolis Traction & Terminal Company for its co-operation and help. He regretted President-elect Nicholl's enforced absence because of sickness. Upon a motion made by Mr. Norveil, the convention sent a message of sympathy and hopes of an early recovery to Mr. Nicholl.

Mr. Henry, who was referred to by President Spring as the dean of the electric railway fraternity in Indiana, acted as toastmaster, and introduced the speakers of the evening. These were: Jos. A. McGowan, Indianapolis Traction & Terminal Company; John F. Ohmer, Dayton, Ohio; Charles W. Miller, ex-Attorney-General of Indiana; Matthew Slush, of Detroit; Mr. Van Camp, of Indianapolis; D. J. Evans, of The Rail Joint Company; Arthur W. Brady, president, Indiana Union Traction Company; Col. W. T. Durbin, ex-Governor of Indiana; C. W. Wilcoxon, Admiral

George Brown, of Indianapolis; E. W. Olds, superintendent of rolling stock of the Milwaukee Electric Railway & Light Company, and D. M. Parry, of Indianapolis.

INSPECTION TRIP TO RUSHVILLE

Several of the members of the association took advantage of the courtesy of President Henry, of the Indianapolis & Cincinnati Traction Company, and made a trip to Rushville over the lines of this company and inspected the new construction work in connection with the power station at this point.

CAR EXHIBIT

About 600 ft. of double track on Kentucky Avenue was used for the exhibition of cars. The exhibition included private cars, new types of interurban passenger and freight cars, and new type of city passenger and work cars of the Indianapolis Traction & Terminal Company. Among the private cars shown were the "Martha," of the Indiana Union Traction Company; the "Josephine," of the Cleveland & Southwestern, and the "Stillwater," of the Dayton, Covington & Piqua. New interurban cars of the Fort Wayne & Wabash Valley, Indianapolis & Cincinnati and of the Indianapolis, Columbus & Southern traction companies were also exhibited.

The exhibit of freight cars consisted of a large freight motor of the Indiana Union Traction Company, built with an oval roof and of about the same dimensions as furniture cars on steam roads. A trail freight car, built in the shops of this company, was also shown.

Among the cars exhibited by the Indianapolis Traction & Terminal Company was a newly built freight locomotive, for switching purposes about the power house and shops, and a crane or derrick car. The boom of this car is built of I-beams and is rigidly secured to the framework of the house over the machinery. This house is pivoted on a flat car and is mounted on rollers in such a manner that it may be turned through quite an arc on the flat-car body. The crane is operated by a GE-800 motor by means of a K type of controller. Another interesting car exhibited by the company was one containing a motor-driven rotary pump, which is used during floods at points along the line where the drainage facilities are not adequate.

THE COST AND SALE OF POWER BY RAILWAYS

BY G. H. KELSAY

As to what factors should be involved when estimating the cost of power for purpose of sale, there exists a difference of opinion: (1) Cost covering only fuel, labor, repairs, lubricants, wastes and miscellaneous material; (2) cost covering, in addition to the foregoing, interest, taxes, depreciation on equipment, and, we might justly include, legal expenses in connection with damages arising from the generation, transformation and transmission of such power. These costs truly and logically belong to each and every kw-hour of power sold, and each unit of power so disposed of without due regard to such items will surely make it that much harder for a company to make a good plant showing.

INTEREST AND DEPRECIATION

Then the question arises what per cent interest and depreciation shall we add to the fixed charges, such as labor and material, insurance, taxes and all other expenses logically arising from the operation of a power station and transmission line?

The rate of interest is quite easily determined, and on which there is not much room for discussion, whereas, the rate of depreciation will depend on the class of equipment and the portion of the power or transmission system which is being considered in the particular problem involved. Such rate is necessarily a variable quantity, ranging from practically zero to as high as 15 or 20 per cent, in certain parts of electrical railway apparatus, but on this subject railway men will express different opinions.

Some will say that what we take as a depreciation charge should truly be a daily maintenance or repair charge, or that we should keep our equipment up to a standard at all times. Others will say that such depreciation may finally be taken care of by increased earning capacity and increased value of franchise of a property. However, a certain per cent should be allowed when selling power to cover what may be termed depreciation, for there will surely be a day of reckoning when we will require new and better equipment or must replace miles of transmission pole line.

To illustrate by an example where, on account of the depreciation on a transmission line the arms and insulators were obliged to be replaced where such arms had been up only six years, 16 per cent should have been allowed each year to take care of the renewals of the arms and insulators so that it would not be such a heavy burden on the road for one season. The same principle will certainly apply to almost all details of the power equipment of the road, but what this rate of depreciation should be is a very much debated question and on which there has not been enough consideration.

Not all managers would care to operate their road, buying their power and renting transmission lines and distribution circuits from another company—paying for such power a reasonable rate for interest on investment and a fair rate to cover depreciation on the plant and lines, taxes, insurance and all other expenses chargeable, in addition to labor and material charge for such power. This is due to the fact that a fixed rate to cover depreciation has not been regarded as one of the charges in the operation of a power equipment, and to add a conservative rate to the cost of power would very materially increase the per cent operating expenses of a road as against the showing that is now made.

Oftentimes statements are made as to what power is really costing, mentioning such figures as 4½ mills, 5, 6, 7, or 8 mills per kw-hour, as the case may be, which covers only labor and material charges. I quote from one of our recognized authorities on electrical railway engineering, who writes as follows:

"There is a great difference between the cost of power computed from fuel and labor alone, as is often done by those who like to deceive themselves, and the cost with all the items of interest, repairs and depreciation relentlessly footed up. It is not unusual to find the item of depreciation deliberately neglected in computing the cost of power and in other estimates. Street railways have been particularly prone to this sort of financial juggling—it is so convenient to increase the capital account for 'improvements' instead of withholding dividends really unearned or shouldering a genuine deficit."

You will note it is not extremely hard to interpret this gentleman's view as to the propriety of a depreciation charge. We are not justified, therefore, in making a price for the sale of power without giving due regard to a certain per cent to take care of certain expenses, calling them depreciation charges or call them what we may.

SIZE OF PLANT AND POWER COST

In small plants the labor charge is proportionately large and fuel is also large on account of the inefficiency of small units. While in larger plants of 1000-kw output, equipped with approved machinery, the labor and fuel charge decreases very slowly by an increase of the size of the plant, which, however, depends to a large per cent on the character or demand factor of the load which it must handle.

(The author here presented a curve to show the effect of the increased size of plant on the cost of power per kw-hour at the bus-bar, this including only fuel, labor, repairs, lubricants, wastes and miscellaneous material; and another figure showing three curves covering the cost of power in plants ranging in capacity to as high as 2500 kw. These curves were given showing cost per kw-hour for an average output with 40, 50 and 70 per cent of the normal working capacity. They were plotted assuming coal worth $3 per ton delivered at coal bins and interest and depreciation grouped together at 10 per cent per annum. This was somewhat higher than the price ordinarily paid for coal in his locality, but the curves as plotted showed some very important facts, namely, that the cost for power per kw-hour at the switchboard is very much higher when including interest and depreciation and is very materially affected by the load-factor.)

COST OF POWER AT DISTRIBUTING POINTS

An estimate of the cost of power at some particular point on a railway system involves some very nice calculation and deals with somewhat uncertain factors, unless proper recording and indicating instruments are at hand for making some determination. The true labor and material cost of electric power at power plant bus-bars is very easily estimated, but a great amount of actual data from existing stations is often valueless on account of not being carefully and completely worked out, and it can readily be shown that there is a great difference between the cost of power, computing only fuel and labor and material items, as against the cost of power with all the items of interest, taxes, and depreciation carefully footed up.

Possibly the most practical way to determine the cost of power at any point on a railway circuit is to take the cost at the bus-bars of the plant as a basis for calculation. This can readily be determined as a definite sum covering all costs chargeable to the production of each kw-hour of power, by dividing by the efficiency of transmission and transformation to the point of delivery and adding to this all the costs chargeable to the transmission and transformation of such power. The latter would include the labor and material on lines and sub-station equipment, taxes, interest and depreciation on all apparatus from power station bus-bar to point of delivery.

The material and labor cost of direct-current power at any sub-station on a railway system is fairly well determined by dividing the total labor and material charge for generation, transformation and transmission by the total output of all sub-stations for a given time, if the power station and sub-station are equipped with wattmeters for carefully measuring all power. This cost will be different at different sub-stations on account of length and size of high-tension line and character of load on high-tension line and sub-station. If power is sold at a point midway between sub-stations, losses in direct-current feeders will be of some magnitude, depending on the railway load and the size of the feed copper and the distance between the sub-stations.

In figuring the cost of direct current as delivered to a consumer when located at a point on the railway line some distance from the sub-station, there should enter into the calculation on such estimated cost quite a number of elements, as follows:

1. Loss in d. c. feeder and track to sub-station.
2. Rotary and static transformer losses and battery losses where same are installed.
3. High-tension transmission losses.
4. Power house transformer losses.
5. Labor and material costs in maintenance of line.
6. Operation and maintenance of sub-station.
7. Operation and maintenance of power house.
8. Fuel charge for power house.
9. Interests, taxes, insurance, depreciation and any miscellaneous expenses on all power station and sub-station apparatus and transmission line.

The efficiency of a railway system from the power station bus-bar to the car or to a power consumer located at a point some distance from the sub-station is an element which enters into the cost of power to a degree often greater than at first thought, ranging from possibly as high as 85 per cent on a direct-current system with ample feeder capacity and medium loads, to as low as 50 per cent on an alternating-current system with heavily loaded high-tension line, lightly loaded sub-station and heavily loaded direct-current lines.

The following figures, which are of considerable value, were calculated by A. S. Richey and given in a very comprehensive paper on cost of electric railway power production and transmission in the State of Indiana, before the meeting of the Indiana Electric Railway Association in January, 1905. These values are estimated from a total of all railways generating and transmitting at alternating current at that time operating in the State. The figures as made up show per cent of efficiency of the various portions of apparatus from power station bus-bar to the car consuming the power:

	Per Cent
Efficiency of step-up transformers	94
Efficiency of transmission lines	97
Efficiency of step-down transformers	93
Efficiency of rotary converters	80
Efficiency of direct-current distribution	80
Combined efficiency	54

These efficiencies appear at first sight very low, but a little consideration will show them to be very logical, and represent very close actual conditions, when considering an average of all roads operating in the State two years ago.

(The author here exhibited a curve showing the general method and results obtained in determining the cost of power at the bus-bar of a certain sub-station "B," power station equipped with two 500-kw units, with an average load of 63 per cent of one-half of the maximum capacity. In the calculation, depreciation which was taken at 7½ per cent, was figured on 63 per cent of the total cost of the plant, and interest was estimated at 5 per cent on the total cost of the plant. Depreciation was figured on a transmission pole line and sub-station at the rate of 7½ per cent, exclusive of copper, on which there was no depreciation charged. Interest was charged on the transmission line and the sub-station at the rate of 5 per cent.)

In estimating the cost of transmission of power to a sub-station, only that portion of the expenditures on the pole line should be considered as was made necessary on account of such transmission line; that is, that portion necessary to carry the transmission circuit that is not required to sup-

port trolley wire, feeder and telephone line. The results as obtained in the calculation show that $.0257 should be realized per kw-hour on direct-current power sold at the d. c. bus-bar at sub-station "B."

Another calculation of the cost of power at the d. c. bus-bars at a certain sub-station located 10 miles from power station showed such costs, including all labor and material charge, 5 per cent interest and 6 per cent depreciation to be very close to $.027 per kw-hour. A similar calculation to determine the cost of power delivered at 15,000 volts 10 miles from a power station, realizing all labor and material charges and a conservative rate for interest and depreciation, figures such costs to be $.016 per kw-hour.

At times a power load may be added to a plant when the prices realized for such power are but little above the net labor and material cost, not even paying a good rate of interest on the investment, on the theory that such amount that is realized over and above the labor and material cost reduces to just that amount the cost of power for the railway load. This results in a better showing for the power plant, and greater earnings of the railway company.

This certainly is not a logical way to make a price for power, and will finally result in a poor investment.

DEVELOPING A DEMAND FOR RENTED POWER. DOES IT PAY

The development of demand for the rental of railway power necessarily depends on the service that the railway company can give and the adaptability of such power for the consumer. The hours of service obtainable from a railway circuit includes on most all railways all hours except from two to four hours in the early morning. These are the ones during which the consumer will prefer to do without service if he has a motor load, but result to a disadvantage if he is a light consumer. However, with a properly developed power and lighting load, the railway companies could very profitably furnish all-night service over their entire line, except at such intervals of time as are required for linemen to make repairs on the high-tension line, or other interruptions in the service beyond the control of the railway.

The kind of power that a railway can make a successful proposal to furnish covers practically every demand for power that can be asked for where such demand will warrant the installation of necessary apparatus. A 500-volt motor service can be handled at all points along the lines of a railway company where voltage on the feeder is sufficiently free from fluctuations to permit such a motor to operate.

A very successful a. c. motor service can be furnished at any point along a railway line where there is a transmission circuit and where the load will warrant the investment of necessary step-down transformer apparatus.

Lighting from railway circuits may be successfully accomplished in the small towns through the medium of step-down transformers and local distribution at any common operating voltage with either the two or three-wire system, furnishing 25-cycle current for such lighting, or by means of motor-generator set in addition to the step-down transformers, approximately 60-cycle current can be furnished and all the advantages obtained as are furnished by our local lighting companies. There may arise a question as to the service obtained by incandescent lighting from 25-cycle current, but such lighting is being done at a great many places without any complaint from customers on account of the low frequency.

Incandescent lighting service can be accomplished through step-down transformers and low tension a. c. distributing circuits, the railway company experiencing but a small per cent of loss from high-tension line to consumer and proportionately small first cost on equipment. Such an installation would not require constant attendance.

Arc lights can be furnished from d. c. feed wires direct, operating five or six lamps in series, thus giving excellent service where the voltage regulation on such circuits will permit such lamps to operate. If the d. c. lamps cannot be used, 60-cycle arc lamps can be furnished and operated through the medium of a motor-generator set at all towns through which high-tension power line pass.

Nernst lamps operating on 25-cycle current will give very satisfactory results, as is reported by the manufacturers and proved by a number of installations using them at various places in the East. Successful operation of Nernst lamps requires good voltage regulation, but the efficiency of a Nernst lamp is very high and deserves consideration when contemplating a lighting plant from a railway circuit.

Railway companies should, when going into the business of supplying power for lighting, provide their power stations with regulators to obtain more even voltage conditions on their transmission lines. However, a careful study of the voltage conditions on a great many power lines now will show better regulation than is furnished by a great many lighting companies.

Smaller towns, where they are not acquainted with the advantages of electric lights, will necessarily be a little slow in taking hold of a proposition that might be offered them, but if railway companies will establish a few such lighting plants, giving the consumer the advantage of a very good rate, which the company can certainly afford, a demand for such service will certainly grow with little effort on the part of the railway company.

The fundamental question is, does it pay to take up power and lighting business along a railway line?

When the railway companies can deliver power to the d. c. bus-bars of any sub-station at a net cost ranging from 2 to 3 cents, paying all costs for the generation and transmission of such power and a fair rate of depreciation and interest, or deliver a. c. power from the high-tension lines directly to the small towns along their lines for a price ranging from 1½ cents to 2 cents or 2½ cents per kw-hour, paying all the costs chargeable to the furnishing of such power, then they should, by adding a reasonable per cent to such cost, handle all the lighting business along their lines at a profit to themselves and at the same time give the consumer the advantages of electric light and power.

THE HANDLING OF ACCIDENTS AND CLAIMS

BY E. C. CARPENTER

There are about as many ways of handling accidents and claims as there are claim adjusters and general managers; very few operating along the same lines; each working along whatever line he has found practical for his company and the conditions under which it is operating. The best way to handle accidents is to prevent them, and it is wise—and dollars are saved—to employ the best and most intelligent men to be had in the various departments of the service thus securing the best results from every standpoint, but, as accidents will happen in the best of families, we will treat

the subject somewhat as the auctioneer who still has "one more left."

In a general way, accidents should be handled according to the policy of the company. Should there be no policy in these matters, then the adjuster should work along fairly liberal lines and determine what is best for his company, and gradually establish his reputation in the communities with which he comes in contact.

In the handling of accidents, every claim department should have a system of blank reports concerning the various classes and kinds of accidents, and that will be suited to the peculiar conditions of the individual company. For instance, where a company is operating interurban as well as city lines, the general forms of report should be prepared to cover all such conditions as nearly as possible. Then there is the trouble report blank for trouble occurring on cars, such as ejectments, controversy over fares, or assaults by either passengers or train men; blanks for securing names and addresses of witnesses; an employee's blank for accidents to employees in shops, sub-stations, machine shops track construction, etc.; stock reports for stock killed or injured; telephone report for use of dispatcher in case of serious or fatal accident, in securing short and concise information when accident is first reported; delayed baggage report blanks for agents' use in securing immediate report where baggage is delayed in transit; the usual release blanks covering the various kinds of claims on part of employees, passengers, other persons, or property, that may be made under the laws of the State in which you are operating; indexes for keeping accurate record of accidents, both daily and alphabetically, etc., etc. Thus equipped, the claim department is ready for active work.

The prompt reporting of all accidents, bad, slight, trivial and those of seemingly no importance, and the securing of accurate information regarding same, is of the utmost importance in the proper handling of those matters; and right here is where the transportation department, as well as the others, should exercise the utmost care and adopt vigorous measures to see that employees shall make immediate report of all accidents; that such reports are promptly forwarded to the claim department, and proper discipline should be administered for failure to obey; and further, that information concerning accidents must not be given to any one except the proper officials of the company.

The growing tendency upon the part of injured parties to rush off to attorneys and sue the company for real or imaginary injury, makes it of great importance to have all accidents reported in detail most promptly. This will give the claim department the opportunity for prompt action in such cases, as may be necessary. Usually it is the blind or unreported cases, or the cases which, in the opinion of the conductor, do not amount to anything and are too trivial to report or go to the trouble of taking witnesses, that give the most trouble. Fakirs are usually smooth enough to mislead the conductor and have this kind of a story, then afterward appear with more witnesses than the company, with the result that the case is either compromised or, if tried, a liberal verdict found for the plaintiff, where, had the matter been treated as serious and promptly reported, Mr. Fakir would go a-begging.

Another class of claims which deserves attention, and which seems to be growing and may be a source of considerable loss, is that of claims for delayed or lost baggage. There will be more or less of this class of claims so long as the present imperfect system of checking is in use. There should be a better system adopted to enable each company over whose lines baggage is routed to trace accurately each piece delivered to it. The only thing that can be done under existing conditions by the claim department is to keep the amounts paid on these matters as low as possible, and this can best be done by using a delayed baggage report (form 418), a copy of which is hereto attached. This form is placed with the agents, and as soon as a person presents a baggage check, and it is ascertained that the baggage is lost or delayed, the blank is filled out, giving the name and address of person holding the check, the firm and address represented, check number, where checked, destination, via what route, and value, including contents; this constituting the first part of the report. Suppose the baggage is delayed for two or three days—finally reaches destination—party holding check calls for baggage, the agent, who still

..................Station

Name .... Address ....
(No. Street and City.)

Representing .... Address ....

Kind of baggage .... How many pieces ....

Shipped from .... to .... via ....

On ....190 Check No. ....

Value, including contents $ .... Date 190

Received of INDIANA UNION TRACTION COMPANY all of the above described baggage and contents in same condition as when delivered to said Company, except as hereinafter stated: ....

Dated ....190 .... A. M / P. M.

Signed ....

AGENT'S REPORT.

Cause of delay ....

If damaged, describe condition ....

Forwarded to Claim Department ....190 .... A. M. / P. M.

.... Agent

Received by Claim Department ....190 .... A. M. / P. M.

By ....

INDIANA UNION TRACTION COMPANY'S DELAYED-BAGGAGE REPORT

has the report, fills out a receipt, which is the second part of the report, showing condition in which baggage is delivered, date and hour of delivery, and secures the signature of owner. This determines the condition and time of delay accurately, and reduces the opportunity for making a claim to the shortest possible length of time, as well as showing, under the signature of owner, the exact condition of the baggage. After this is done, the agent fills out the third part of the report which gives his report as to the cause of the delay, and any remarks he may make upon condition of baggage, marks the time of forwarding to claim department and signs and sends it in. In this way, all information needed is secured from interested parties under the most favorable circumstances.

Reports of accidents sent to the claim department usually do not give all the information needed, but are merely the starting point or foundation for the investigation which must follow, and this should be done as quickly as circumstances will permit.

We have found, in the investigation of accidents (except in cases of clear liability, such as collision cases where passengers are injured), that a splendid rule to follow is first to secure as full information as possible from the train crew or employees in charge, taking signed statement, and then, if possible, procure the signed statement of injured party, showing his version of the matter; thus getting at both sides of the question, and noting what will be necessary to be covered by disinterested evidence when the signed statements of the disinterested witnesses are procured. In this way you can gather the facts in a tangible manner, so the merits of a claim can be determined with reasonable certainty. A shrewd investigator can inquire regarding the vital matters of an accident and quickly develop all the witness knows, and in reducing the subject-matter to writing, if he will carefully follow the line of the conversation and use the peculiar expressions and language of the witness as far as possible, omitting immaterial matters, it is seldom indeed that a witness will refuse to sign a statement. Afterward, should the witness testify in court to a state of facts materially different from the statement, he can be confronted with the signed statement and his testimony discredited.

In the investigation of accidents it is absolutely essential for the investigator to have a sufficient knowledge of the law to know what constitutes negligence, not only of an injured person, but the company as well. He should also have a general knowledge of every department of the service for the reason that the rules of negligence differ in cases of employees, passengers, or a person who is neither an employee nor passenger. He should be sufficiently competent so to frame his sentences as to state facts clearly and concisely, and avoid the use of statements that are not clear or are misleading. When you have a witness who knows the facts about an accident, put them in such a way that there can be no misunderstanding. Such a statement will be doubly strong in refreshing the recollection of a favorable witness or of contradicting an unfavorable one in court. These points, we believe, demonstrate the advisability of employing men of sufficient capacity to grasp the situation under investigation.

We have thus indicated a general plan pertaining to the investigation of accidents, but there is one class of accidents—those resulting in death—where a different line of investigation should be followed. In this class of cases the company's employees should be required to report at the office of the claim department immediately after such accidents, and before information of any kind is given to any person, where full details should be secured by the claim department, after which short affidavits covering the main facts of the accident—free from objection—should be prepared, so that the employees can be taken by the claim adjuster before the coroner and affidavit sworn to by the employees. As a rule, coroners are satisfied with a general statement of fact, and they should not be misled, but coroners are usually doctors, and they are very likely, if left to their own resources, to ask about minor matters and secure statements from employees that would be embarrassing in court and hard to explain away, as such statements are reduced to writing and sworn to by employees. It is far easier to prevent employees from making embarrassing statements in this way than to have to explain them away after they are made. The claim adjuster can signify to the coroner his willingness to assist in the investigation, thus placing himself upon friendly relations. Investigation should, of course, be conducted independent of the coroner so as to develop the facts rapidly, and, where desirable, the names of reputable witnesses can be placed before the coroner (whose signed statements have already been procured by the claim department) who will corroborate the employees and relieve the company from criticism. While ostensibly, as well as in fact, aiding the coroner, the investigation can be retarded sufficiently to enable the claim department to interview first all witnesses, thus developing the names of the proper persons to place in the coroner's hands. This gives some idea as to the manner accidents should be handled with reference to the investigation.

The question might aptly be asked: Can the claim department be of any service to the company in the investigation of accidents, aside from the mere development of facts upon which to enable the adjuster to make a settlement or reject a claim? We believe it can.

The claim department is, or should be, the one disinterested department in the investigation of accidents, and every facility should be given to enable it to have the fullest information regarding matters about which it is necessary to inquire. An accident occurs—perhaps a derailment. The transportation department, anxious to be relieved from responsibility, claims a faulty track; the track and roadway department says: Bad judgment of train crew in rounding a curve; or, perhaps, trolley came off and pulled down wires,—transportation department claims overhead work in bad condition, not lined up properly, or headlight or trolley base out of order, etc. The electrical and motive power departments say: No, the trouble was due to fast or reckless running or some other cause. The claim department should pursue the matter as carefully as possible. When the real facts are known, make a report of the same to the general manager for his information.

Then, again, in investigating accidents in the various departments of the service, weak places will develop to which attention can be called and considered by the proper officers. For instance, some dangerous machine in the shops is not properly guarded as the law requires; there may be an exit needed from a dangerous place where men are required to work about the boiler room or elsewhere; foremen or heads of departments may not understand fully the necessity of properly instructing employees regarding the hazards of the work for which they are employed, or of giving additional instruction to employees where they are assigned to work more hazardous than that for which they were employed; the incompetency of conductors or motormen, or others, for one reason or another, may come to the attention of the claim department, and in all such matters valuable service can be rendered by promptly reporting them to the proper officials. It will be necessary, however, for the claim department to show by its work its disinterestedness and its willingness to place above every department, its own included, the good of the company whom it serves.

THE HANDLING OF CLAIMS

This part of the subject assumes that there has been some one chosen to handle them, and we will assume it to be the claim adjuster. I have heard of instances (I am pleased to say it has not been my personal experience) where the hands of the adjuster were so tied by foolish requirements that he is not able to get good results. Some managers

have so little confidence in the ability of their adjuster that they compel him to first ascertain what a claim could probably be settled for, then report back to the general manager or general attorney, then go back to the claimant and see if he cannot do a little better, then report back to the real adjuster—the general manager or general attorney—and getting instructions to settle at one-half to two-thirds of the amount the adjuster has reported, again make trips to see the claimant, etc., until all parties become so disgusted that the claimant goes to his attorney and brings suit. The result is that in cases of liability or close question the company pays double what the adjuster could have settled the case for in the first instance. If the officials of any road do not have confidence in the ability and judgment of their adjuster, they had better kick him out and get some one in whom they have confidence, and it will prove a benefit to both. By all means, if you expect good results, do not hamper him in his work by any such foolishness. No one but the adjuster can appreciate the delicacy of a situation when it reaches the critical stage, and he knows, or should know, better than any one, when he has gone the limit in the settlement of a claim, or when the claimant has reached the lowest sum at which a settlement can be made. Then is the time to settle, instead of going back for instructions, giving the claimant the opportunity to change his mind.

An adjuster is not necessarily a peculiar individual, but he should possess some qualifications to fit him for his work. At the recent convention at Columbus, Ohio, this question was asked: "What qualifications should a claim agent possess to be successful?" One of the answers given was the following: "Prepossessing appearance; a personality that attracts; level-headed, with a sufficient fund of common sense readily to adjust himself to surroundings; good judgment (especially of human nature), and with morals and character above reproach." While I am sure many of us do not fill all the requirements suggested, the more nearly we approach the ideal the more successful we shall be.

The settlement or adjustment of claims must, necessarily, be governed by the policy of the particular company represented. To my mind, there is but one right policy, and that is, every case should stand upon its merits; if the company is liable for an injury done, pay what is reasonable; if not liable, or unjust demands are made, stand upon the rights afforded by the law.

There are cases, of course, which should be treated somewhat more liberally: For instance, in case of death from an accident where no liability exists, many times a settlement can be made for reasonable funeral expenses. This should be done. A serious accident resulting in permanent injury, possibly the loss or partial loss of an arm or leg, can at times be settled for actual hospital and surgeon's bills; it is wise to do this, especially in cases of minors. It is also good policy to be somewhat more liberal in settlement with employees than with persons having no connection with the company. If employees understand that they will be treated with a reasonable degree of liberality in these matters, law suits from this class of cases will be very few.

In cases where there is a question as to whether or not the company is liable for an injury done, you have about even chances with the claimants before the matter reaches the court, although in court you must expect that the sympathy of the court and jury is likely to be with the plaintiff, for many times the courts treat cases much as the justice of the peace in Kentucky, who said: "Of course the plaintiff had a good case, or he would not have brought it." It is necessary, in view of the prevailing conditions, to make a very clear defense before a corporation can escape a judgment for the plaintiff. In this class of cases, before a suit is instituted, the adjuster can discuss the merits of a claim with the claimant, or his attorney, with a far greater degree of confidence than in liability cases, and usually secure a reasonable settlement.

In cases where the company is clearly liable, about the only ground the adjuster has upon which he can stand is to know his man; touch him in his vulnerable spot; ascertain what the real injuries are; appeal to the claimant's sense of fairness in the most effective way, and make the best settlement he can that is satisfactory to both parties.

In cases of non-liability, where the facts are clear, as a rule, there should be nothing paid. It is this class of cases it pays to contest in court and win. This will give the company a reputation for fair dealing and only contesting cases where unjust demands are made; and with this sentiment prevailing, a corporation will have more nearly even chances in the class of cases where large amounts are demanded for trivial injuries where it becomes necessary to take chances in court. The effect is that other claimants, who hear of these results, will come direct to the company for the adjustment of their claims.

Just here I would offer the suggestion that there is too little attention paid to giving publicity through the medium of the daily press to cases tried in court with favorable results for the company. It should be a part of the work of the legal department, through local counsel, to see that the local papers publish these matters with other news items.

In cases of injury to stock, or property damage, it pays to be reasonably liberal in the adjustment as the amount involved is usually small; and should suit be brought, it would likely be before a justice of the peace, which means a judgment against the company every time, necessitating an appeal to the circuit court, and taking chances on defeating the case there. The expense necessary for defending the matter is often as much, or more, than would have been paid in settlement in the first instance.

There is one class of accidents in which the adjuster should be "Johnny on the spot"; in collision cases where passengers are injured. There are but few matters that will so thoroughly shake a company, from the president down to the train crews doing the damage, as a serious collision between trains where many passengers are injured. Thousands of dollars are involved. It may be a critical time in financial matters with the company, and might mean a receiver. It is in cases of this kind where the attorneys for the company get "cold feet" and say "Settle; settle at any price," and they are usually seconded by the management. Here is where the adjuster must show his nerve. If he is big enough to handle the situation, and the officials have confidence in him, well and good; on the other hand, if the adjuster cannot master the situation, and is forced to call for assistance upon all the officials, many of whom may be unfitted and inexperienced in such work, then the situation is deplorable. A green hand at adjusting can make some mighty dangerous mistakes, and do it unintentionally. There are few of the officials outside of the legal department (and this is not casting any reflection upon their ability in their own department) who understand how fully a claimant's rights extend under the law, and how to prepare a release covering all matters growing out of an injury. Take the case of a minor, even though the person injured be past twenty years, but not twenty-one, the per-

sonal signature would not bind the claimant, and he would still have the right to sue the company within two years after he reaches the age of twenty-one. The same rule applies to all minors. Cases of this kind can only be settled in Indiana by a next friend by proper proceedings. Then the parents have a claim for loss of service, expenses, care, nursing, etc., which must be considered. In the case of a married woman, not only the claim of the injured party is to be considered and settled, but the claim of the husband for loss of his wife's services, expenses incident to the injury, etc.

In talking about an injury, the conversation is largely confined to the extent of the injuries, and when the amount is agreed upon it is easy to make a general statement that this is to cover all matters growing out of the injury, and prepare the release accordingly, securing the signature of husband or parents, as well as the claimant. Should the release cover only a part of the claims growing out of an injury, the settling of one part amounts to an admission of liability as to the others, and suit can be instituted for whatever is unsettled. Should this matter be taken up again, looking to the adjustment of some portion of a claim left unsettled, it is always more difficult to secure a reasonable settlement than had it been done in the first instance.

Quick action in the cases of clear liberality is most desirable, and in most cases settlement should be agreed upon at first meeting. In cases of very serious injury, this is not possible, as it is not expected that seriously or permanently injured persons will settle for a trivial sum; and, even if they did, the settlement could be set aside.

The larger companies have a decided advantage over the smaller ones in this class of cases. They usually have more men in the claim department upon whom they can call in cases of emergency, using their investigators in the adjustment of the minor claims. In collision cases, where possibly one hundred or more persons receive more or less injury, it is best to put just as many competent persons as are available at work securing settlement before ambulance-chasing lawyers have time to get at work, thus covering the ground quickly; and where settlements cannot be made, to establish friendly relations with the injured persons.

The manner in which the last serious collision on the lines of our company was handled will illustrate this in a practical way, if you will pardon the personal part of the illustration:

On the 3d of last September two sections of a train collided in a curve near Peru. Three cars, well filled with passengers (over two hundred in all) were in the wreck. A large number were more or less injured; many received serious injury; a few escaped without injury; no deaths have resulted. The names of 166 of the passengers were secured by train crews. Most of the doctors in Peru were called, and some from Kokomo were pressed into service. The writer was in Detroit, Mich., when he first learned of the accident. On reaching home as quickly as possible an alphabetical list of passengers, with a memorandum of injury, was prepared, and a letter of inquiry at once mailed to each, inquiring as to injuries and requesting prompt reply. This developed quickly those who had sustained injury, either serious, slight or trivial, as the next day replies began coming in, and the department was in touch with the individuals who needed attention, and, judging from the wording of the replies, the cases needing most prompt attention were quickly looked after. Lists were prepared, and a force of three men (a dozen would have been better) were put to work, each taking his own list so as not to conflict in the work, with the result that in ten days 67 releases had been secured; by the close of September 119 had been settled with (this number exclusive of 39 other releases in other matters taken during the month), and by Nov. 1, 141 settlements had been made. A tabulated statement at that time was prepared, in which was shown the party injured, nature of injury, amount paid in settlement and the probable amount of verdict had matter been contested in court. At that date we had made a net saving from the one accident of over $15,000, not including any attorneys' fees or costs incident to the matters. Since that time, several of the more serious cases have been settled. Only five suits have been filed on matters growing out of this accident, one of which has since been settled, and, so far as we know up to the present time, settlement has been made with all but six persons, including the four in suit.

We can demonstrate with reasonable certainty that we have saved the company on this one accident alone over $20,000.

What should the attitude of the claim department be toward the lawyers? Our experience has been that lawyers, as a rule, should be treated fairly, and they should be protected in settlements made, except in cases where lawyers are known ambulance-chasers and in bad odor. These deserve no consideration, for their only motive is to secure blood money, and they will resort to almost any means to get it. Most lawyers are inclined to be fair in their dealings, though high in price. They usually have the ability to make injuries appear fully as bad as they really are, and allowance must be made accordingly. In matters of clear liability, it is better to beat them to the case and get it settled before the lawyer is consulted.

What about the doctor? He is "the power behind the thrown." Doctors usually have more influence with their patients and can do more with them than any one else. Fortunately, reputable doctors often look upon the legal profession with an eye of suspicion, and will, if protected in their bills, assist in legitimate ways in securing settlements. Make friends with the doctors.

The claim department has been dubbed "the rat hole of the treasury." In one respect, all money paid out is a clear loss. In what department, however, is there a greater opportunity to save money? Take the cases of serious trouble; if properly handled there can be a larger per cent of saving than in many of the other departments. The competent adjuster will guard the dollars in the treasury as carefully as though they were his own. He should have every encouragement to keep the "rat hole" as small as possible, and, in order that this may be done, no bill chargeable to the claim department, large or small, in court or out, should be paid without the approval of the claim adjuster.

Where a claim department is conducted along the lines indicated, the result should be a small per cent of the gross receipts paid out, and a large saving for the company.

A MODEL CAR FOR LONG TRAVEL

BY W. H. EVANS

In discussing this topic, it might be well to say that I am not prepared to present what is or could be expected as a model car for long travel but rather to present a few points upon this subject, in the hope that the discussion which may be brought out will serve to advise us just the particular points that would be most desirable in a car of

this character, and if this paper will result in creating a live discussion of this topic, the object will be largely accomplished. I am decidedly of the opinion that the most benefits to be derived from meetings of this kind are from the live discussions that usually take place, presenting the advantages and disadvantages to be derived from any proposed new apparatus or equipment. It is not my purpose to occupy your time with any lengthy discussion, but rather to present to you a few points which occur to me as being novel and possibly in the way of an improvement to meet the requirements of a constantly increasing demand for a better and longer service on our interurban lines. This topic is, no doubt, an interesting one to all connected with the traction interests, but presumably appeals more to those directly connected with the handling of passenger traffic, and it is largely from this point the subject is to be considered.

It may be well at first to direct attention to a few of the things which have largely prevented the designing and equipping of such as might be called a model car. This applies particularly to the width of cars for interurban service, which has so far been limited to 8 ft. 6 ins. over all. This necessarily compels the use of narrower seats and narrower aisles than are used on the steam road car in similar service where the cars are built from 9 ft. 6 ins. to 10 ft. 6 ins. in width. It usually occurs that at some point over the line, where it is desired to run interurban cars, the distance between track centers is too narrow, and in some instances this is located in cities where the streets have been improved and paved, making it a very expensive operation to have the so-called "devil strip" widened. But it would appear that this is something that should be corrected in the near future and at least should be very carefully guarded against in locating new tracks or in rebuilding old lines.

This same thing applies to curves at right-angle turns and other congested points which interfere with the operation of cars of sufficient length to accommodate the business, and while there would appear to be some logical excuse for this in cities of the larger class, this trouble is frequently found in small towns and villages, where with a comparatively small additional expenditure for right of way the curves could be made of sufficient radius to permit of the easy operating of any class of equipment which it is reasonable to expect the traffic will require.

In this connection, I would also desire to call your attention to the limited overhead clearance under the bridges and viaducts, particularly where the steam roads cross above the interurban lines, and as this is a time when the subject of track elevation is being actively taken up in a large number of cities, it appears extremely important that traction companies should use every effort to get as high an overhead clearance as possible. We should also remember that the conditions are rapidly changing, and that it may be necessary to have more overhead clearance, and it is impossible at this time to tell what the development of a few years will require in the way of overhead trolley arrangement to properly take care of the heavier cars and higher voltage. What formerly served for the ordinary city street car to pass under with safety is insufficient to take care of even the larger and later improved type of city service cars, to say nothing of the interurban type.

It is well to bear in mind the type and section of rail which is placed in the improved streets in cities, and above all to insist that the tracks are laid standard 4-ft. 8½-in gage.

The question of suitable cars for long-distance travel is one which is rapidly requiring our best attention, and it will be but a short time until through lines will be inaugurated where cars will run from five to ten hours, and possibly more, in one direction. At the present time in the vicinity of Indianapolis this service is inaugurated to Ft. Wayne, Dayton, Lafayette, Indiana and Connersville, with the expectation that this line will be extended to Cincinnati and through service inaugurated. Also that the other lines will be considerably extended, with the prospect of through service from Indianapolis to Louisville, Terre Haute, Toledo and Columbus, and at each of these points connected with the traction systems radiating from those centers.

The type and style of cars which appear to have become the most popular with traction companies is similar to the cars at present in service on the Indianapolis & Northwestern Traction Company's line, where they have been running for some time. Those who have been connected with their operation, are enthusiastic over this style of car for both local and limited service.* Throughout the Middle States this style of car is being used, I think, by the majority of the lines. It is usually arranged to run in one direction, but with a control arrangement on the rear platform to facilitate switching and backing up, should occasion require. These cars are seldom shorter than 50 ft. nor longer than 67 ft. Twenty of these have been in service on the road started, and a number of additional cars have been ordered for service on other lines. These cars are 61 ft. 6 ins. over buffers and 8 ft. 6½ ins. over side sheathing. They are composed of three compartments; the forward compartment serving for the motorman's vestibule and to accommodate the baggage and express as well as the location of the hot-water heater, and is 11 ft. 3½ ins. long. Directly in the rear of this is the smoking compartment, 13 ft. 4 ins. long, with seats for sixteen passengers, the passenger or coach department, being at the rear, is 27 ft. 4½ ins. long with seating capacity for thirty-eight passengers with a roomy platform at the rear which can be entirely enclosed, the step and door openings being on either side. These cars are liberally supplied with glass in the partitions and there is little to obstruct the view looking forward, depending largely, however, on the amount of baggage which is being carried.

It is a question in my mind whether, with the increase of traffic and the carrying of baggage and express on our longer runs and the fact that a larger number of commercial men are making use of the interurbans and require that their baggage and sample cases arrive with them at their destination, it may possibly be (in order to accommodate this business) necessary to have two cars—one to provide liberally for baggage and express and a smoking compartment, and the other to be a strictly coach department. So far, however, the car mentioned has taken care of this question as well as anything that has yet been devised in a single car.

A car very much on the same plan as this is being operated on one of the Ohio systems, I understand, quite successfully, but it is designed to run with the coach department ahead, the baggage compartment being on the rear of the car, as run in ordinary service. This car in question is 67 ft. long over buffers, 8 ft. 5½ ins. over sheathing and 8 ft. 8 ins. over all. This particular car is seated with parlor chairs and accommodates twenty-nine people in the coach department and ten in the smoker, and has two toilets. That for the men is located in the rear

*The floor plan of these cars was published in the STREET RAILWAY JOURNAL of Oct. 13, 1906, on page 633.

vestibule at the rear of the baggage room, thus locating the hopper at the extreme rear end of the car and clearing the trucks, the entrance being through the baggage room. The motorman's cab is at the front end and is so constructed as to obstruct the view of the passengers as little as possible, giving practically all of those seated in the coach department a clear view ahead, the entrance and the exit of the car being at the front end for both motorman and passengers. There is also an entrance at the rear of the car. The doors and steps of this car are placed all on one side, the left-hand or pole side of the car being entirely free from any door openings whatever, thus forming a very substantial and solid construction. Particular care has been taken in this car with the bottom frame, consisting of six steel I-beams running full length of the car, and the floor is triple, the bottom being steel plates fastened to the sill, covered with yellow pine flooring and that covered with a floor of hard maple, the passenger compartment in this particular car being covered with carpet.

I am aware that this is to a certain extent quite a radical departure from the usual operation of cars of this character, and while from an operating standpoint there may be some things which would condemn this practice, there are features which would appear as commendable. Principally among these is the fact that the passengers boarding the car and leaving it are under the direct supervision of the motorman. An arrangement could be devised whereby the motorman opened and closed the door, thus preventing passengers from alighting from the car except at the proper designated stations, and also avoid numerous accidents from people alighting from the car while in motion. This applies particularly to cases where the conductor is required to go forward and flag a railroad crossing, which frequently results in accidents to passengers at that time. The smoking room in the rear is also an advantage, as this is entirely separated from the coach department, and the fumes of smoke are never carried into it. This arrangement, however, makes it necessary for the conductor to look after the baggage, which I presume would be by some considered a disadvantage, but it would appear to me that this would be offset by the safety secured by passengers boarding and alighting from the car, under the eye of the motorman.

There is no question but that being able to view the country from the forward end is a decided attraction for most passengers on interurban lines, and would appear to have considerable advantage over the practice of having the observation on the rear of the train, so long in vogue on the steam road lines. Particularly in the summer time and in pleasant weather this arrangement should appeal to travelers. Being able to look ahead is also quite a relief to passengers who become sick on the cars, which sickness can be largely attributed to looking out at passing objects through the side windows. The motorman is located in a small vestibule enclosed with glass windows, thus saving him entirely from interference by the passengers, and at the same time offering very little obstruction to the forward view.

It is important, however, that the forward or pilot end of this car be made as substantially as possible and thoroughly braced and strengthened to withstand any impact from collisions which might occur. In fact, this is a matter which requires very serious attention from all those who are connected with the designing of traction equipment, particularly so on cars which are to be used on high-speed lines. A considerable improvement has been made in this direction within the last few years with the introduction of steel into the bottom framing, and while this leads to a somewhat heavier car, the tendency is in the right direction, in the way of securing substantial cars, which should be aimed at rather more than cars of elaborate finish or expensive interior arrangement. In fact, it will not be surprising in the next few years to see all-steel cars in common use on interurban roads, judging from the rapid advancement made in this line with subway and elevated railway cars.

It is possible that the car for longer travel will require considerably more conveniences than has been the practice, particularly in the way of toilet and lavatory facilities, and it is pleasing to note that recently considerably more attention has been given to this. Toilet rooms of more liberal dimensions are being designed, and in some cases water flushing hoppers have been installed as well as lavatories. These latter, while they considerably increase the cost and trouble of maintaining the equipment, afford a convenience on the longer travel cars, which we will probably be required to furnish, notwithstanding the fact that on electric lines very little of the dust and dirt and other inconveniences are experienced incidental to a trip on steam lines, with the locomotive burning soft coal.

I would recommend as far as possible the sliding doors be substituted by swing doors, to permit of a considerably more substantial framing and bracing at the partition of our longer cars, as the sliding door takes up a space which would otherwise be used to considerable advantage in securing a stronger car.

In connection with this paper, we have prepared for your entertainment an exhibition of the principal types of interurban cars, which are actually in service on lines centering in Indianapolis. These, I trust, will serve not only as an exhibition, but will aid you in further investigating the subject of "A Model Car for Long Travel."

CAR LIGHTING

BY R. C. TAYLOR

Few subjects in electric railway equipment have received less attention and deserve more than the question of the proper illumination of electric railway coaches. The modern interurban car carrying passengers over long distances should have its lighting arrangements so designed as to provide sufficient light at all times to give the passengers an opportunity of being able to read with comfort.

HEADLIGHT REQUIREMENTS

The car should also be provided with a headlight burning with sufficient brilliancy to enable the motorman to have a clear view of the roadway far enough ahead to be able to run his car at high speed in the darkness without danger or discomfort to the passengers on his train.

The car should also be provided with sufficient light for danger signals on the rear end sufficiently bright to enable the motorman on a car approaching on the same track to stop in time to prevent a rear-end collision.

The headlight should be an arc headlight with large reflector so designed, arranged and constructed as to be a permanent part of the car's equipment, and if set above the line of vision of the motorman will give a clearer view of the

track and more satisfactory light both near the car and at the limit of its range.

The mechanism of the headlight should be strong, simple and reliable with carbons arranged to burn at least six days without renewal. In cities where the ordinances require the screening of the light while passing through streets, a screen of the ordinary type should be arranged as a permanent part of the lamps and facilities provided in the motorman's cab for shifting it to either one or the other of its positions at will.

The headlight should be designed to give a clear view of 3000 ft. along the track on a clear night. During fog or rain or driving snow this range of vision is liable to be cut down to 500 ft., which will be just about as short a distance as a high-speed car can be stopped. This range of headlight view will probably call for an expenditure of energy at the lamp terminals of 5 amps. at 80 volts. This design will provide sufficient light for the "unfavorable" conditions of atmosphere and weather, as it is usually during such unfavorable conditions that an accident or collision is most liable to occur. The headlight of a high-speed car is considered one of the most important features of its equipments, and hence the reason for advocating as strongly as possible and with earnest emphasis the arrangement of keeping one headlight for each operating end of a car.

TAIL AND CLASSIFICATION LAMPS

Most interurban cars are being fitted up for single-end operation, and when so arranged should be supplied with electric tail lights. These should also be arranged as a permanent part of the car's equipment. Two 8-cp lamps behind ruby lenses give a very satisfactory set of tail lights. These should be wired up in connection with a clear light when the trolley is removed or the line current interrupted for any reason. Classification lights equipped with colored lenses may also be fitted up on the front end of the car in the same manner as the two tail lights in the rear and be ready for use at any time it may be necessary to run the car as a classified portion of a train.

LIGHTING THE INTERIOR

The arrangement of lights in the interior compartments of the car should be of such a character as to produce a pleasing effect on the minds of the passengers. Most of our high-speed cars have been designed to attract passenger traffic formerly handled by steam railroads. Our managers have made commendable efforts in designing and furnishing their best cars so as to equal or excel the best rolling stock of other railways, and there is perhaps nothing that will enhance the appearance of the car and conduce more to the comfort of the passenger than comes from riding in a well-lighted coach. There are a great many reasons too self-evident for discussion why a car should have plenty of light at every part of the trip.

The fact that out of nine interurban lines running into Indianapolis, the interior lighting arrangements varies from twenty lights to sixty-five lights per car seems to indicate that there is still room for discussion on the best method of electric car lighting. The performance of these lights on the road and the quantity of light given out seem to indicate there may be room to advocate some improvement in their arrangements.

ARRANGEMENT OF CIRCUITS

The usual method of car lighting is to connect five incandescent lights in series and put as many circuits in the car as its architecture will permit, or the fancy of its designer may suggest. The arc headlight is then connected across the line in series, with enough iron-wire resistance to cut down the line voltage to 70 volts across the arc.

POWER REQUIRED

With this arrangement, assuming a car with seven circuits or 35 lamps, we then have the following energy consumption per car:

Arc headlight and resistance	2,700 watts
Thirty-five 16-cp incandescent lamps	1,965 watts
Total energy consumption for lighting	4,665 watts
Energy consumed in light by the arc	315 watts
Energy wasted in heat in the arc	2,385 watts

In other words, there is energy enough wasted through the resistance of the arc to furnish more than sufficient light for the interior of the car.

RESISTANCE AND REGULATION

Since the arc lamp as at present arranged seems to be the pivot point around which any suggested improvement might be made, let us assume that enough incandescent lamps are inserted in the circuit to take the place of the resistance and furnish the interior lights. We have a net saving of 1965 watts per car while the lights are in service. So long as the line voltage remains constant and the resistance of the lamp filaments remains constant, with this arrangement the interior lighting effect in the car will be quite satisfactory; but unfortunately it is very difficult with the very best possible design of feeder arrangement, without involving enormous expense, to maintain anything like a constant voltage over the entire system or even a fair average, and especially is this true on long interurban lines, and the results are in a great many cases that the interior lighting of the car becomes very unsatisfactory indeed. The obvious remedy for this fluctuating line voltage would be to insert in the light circuit some form of regulator or other apparatus to maintain a constant potential on the light circuit irrespective of the fluctuations on the line. Several suggestions for the accomplishment of this desirable condition have been advocated, but so far as known none of them has met with a very conspicuous success. A design for this purpose has recently been brought to my attention in which a portion of the current from the headlight resistance is used in regulating the lighting circuits and the balance of the resistance current is used for lighting a number of specially designed arc lamps for lighting the interior of the car. This system seems to merit full consideration, and I believe is on exhibition at this convention.

Another regulator for railway lighting circuits has been designed, which short-circuits a number of the lights in the car, maintaining a constant voltage on those left burning. This regulating system was applied to a car several years ago with quite satisfactory results. There is certainly a demand for such a device for interurban service, and it seems quite reasonable to expect that it will soon be on the market.

USE OF THE COMPRESSOR MOTOR

In the event of no satisfactory regulator being produced to meet this service, this matter of constant potential on the lighting circuit is sufficiently important to warrant the adoption of an independent motor-generator set for car lighting. It is a well-known fact that either the life or efficiency of an incandescent lamp will be very greatly affected if run at a very small percentage either above or below normal voltage. In the design of a new car this detail could be very nicely cared for in connection with the compressor motor.

This motor could be designed to maintain a constant speed at a variable voltage and of such capacity as to run the air compressor and lighting circuit. The lighting generator could be mounted on the motor shaft and no additional bearings or frame would be required. On the compressor gear would be mounted an automatic air-operated clutch. The operation of this machine would then be this: When the lights were burning the motor and generator would run continuously, and the automatic air-operated clutch would throw the compressor part of the device out and in to meet the demands for compressed air. When the lights were not required the operation of the compressor would be the same as at present, starting and stopping the motor. This device is so extremely simple, efficient and of such low cost and its results so prolific of beneficial results in giving satisfactory illumination and long life to the lamps, that it should speedily be adopted.

NEW LAMPS

From the earliest days of electric railroading the time-honored incandescent carbon-filament railway lamp has been the medium of interior car lighting, but it seems quite reasonable to expect that further economy and better light for the same or less energy may very soon be looked for by the selection of some form of more efficient lamp. Experiments have been conducted and incandescent lamps have been manufactured and tested during the past year, having their filaments made of the metals osmium, tantalum or tungsten, with the result that the tungsten lamp has raised the standard of efficiency of incandescent lighting three times as high as the present standard and exceeding in efficiency every form of incandescent or arc lamp except the vacuum tube and flaming arc. Combined with its virtue of high efficiency the tungsten lamp possesses the merit of the simplicity of the present railway lamp and it is hoped may even exceed it in durability. Given, therefore, a high-efficiency lamp that may be made in small units, offering unlimited opportunities of correct distribution, and a constant potential on the lighting circuit, the proper illumination of a luxurious interurban car becomes a very easy problem for the engineer. Whether the high-efficiency incandescent lamp or a specially designed arc be employed in the illumination of the modern interurban car, they should be surrounded with a frosted or opalescent globe backed up with reflectors against a white background giving a soft, pleasant diffusion of the light in all parts of the car interior.

With the car lighting arrangement as outlined the potential of the lighting circuit may be made that which is most suitable for the headlight and the interior lights may be designed for that voltage. This will effect the saving of the energy dissipated through the headlight resistance. The interior lamps may be designed for high efficiency and the total aggregate saving of energy will be the difference between the present practice, 4665 watts, and the suggested arrangement, 1850 watts, or a total net saving of 2815 watts per car. The suggested arrangement, therefore, presents the pleasing prospect of affording an abundant supply of constant light for the headlights, tail lights and interior, and at the same time effects a very handsome financial saving per car per year over the accepted practice of the present system of car lighting.

Fire destroyed the car house of the Camden Interstate Traction Company at Huntington, Va., a few days ago, and seventeen out of twenty of the cars were burned. The loss is $120,000, with full insurance.

THE "GET-TOGETHER" MEETING OF THE ELECTRIC RAILWAY SHOP FOREMEN'S ASSOCIATION

As noted in the Street Railway Journal of Jan. 19, a movement recently was started among the electric railway shop foremen in New York and vicinity to organize an association devoted to the study of car depot and shop problems. The first regular meeting was held on the evening of Jan. 29 in the Wood Building, 122 Market Street, Newark, and was attended by some forty or fifty men connected with the shop departments of electric railways in the metropolitan district.

The proceedings were opened by an introductory speech by Alfred Green, whose personal acquaintance with the individual shop foremen has been very valuable in bringing them together. Mr. Green outlined the purposes of the organization and then announced the committees appointed to select officers for the ensuing year and to adopt the constitution and by-laws. The following officers were elected: President, Clark Prather, of the Public Service Corporation; first vice-president, Milton Hutt, of the Brooklyn Rapid Transit Company; second vice-president, A. Gotshall, of the Interborough Rapid Transit Company; third vice-president, R. Morse, of the Public Service Corporation; secretary and treasurer, John R. Case, of the Public Service Corporation.

After a brief discussion it was decided to adopt the title, "Electric Railway Shop Foremen's Association," as the permanent name of the organization The term "electric rail way" was chosen purposely to enable the inclusion of shop foremen of any type of electric road, whether street, interurban or former steam lines. Upon motion, the original constitution and by-laws committee of four was increased to seven with instructions to meet on Feb. 14 to decide upon the regulations to be adopted. The association is taking as its model the constitution and by-laws of the American Street and Interurban Railway Association. The place and time of the next meeting were left to the discretion of the third vice-president. The general sentiment, however, appeared to be that the best place for holding the meetings would be somewhere on Manhattan Island.

After this business had been settled there was an impromptu discussion on the care of armatures. As this was simply intended for a "get-together" meeting, the members were unprepared to present shop data. Nevertheless the talk developed some interesting points, one of the speakers asserting that, judging from his experience, 80 per cent of armature troubles were due to neglect of the bearings. The same speaker suggested that the cost of repairs would be greatly decreased if cars were overhauled every thirty days instead of every sixty days. Another point considered was the number of controllers which one man could thoroughly inspect in a day.

I. R. Nelson, of the Public Service Corporation, congratulated those present on having formed such a valuable organization. He said that this movement for the co-operation of the shop foremen was highly appreciated by the management of his company, and he felt that it would not only be willing to assist with advice, but also with money. He was sure that the managements of other street railway companies would exhibit a like spirit in dealing with this subject.

Alfred Green then addressed the meeting on the value of the work that the association could do. Another speaker was E. C. Parham, who promised to give a talk on brushholders at an early meeting.

MEETING OF EXECUTIVE COMMITTEE, AMERICAN STREET & INTERURBAN RAILWAY ASSOCIATION

A meeting of the Executive Committee of the American Street & Interurban Railway Association was held at the office of the secretary of the association, 60 Wall Street, New York City, on Jan. 28. There were present: President Beggs, Vice-Presidents Shaw and Brady, and the presidents of the three affiliated organizations, Messrs. Tingley, Adams and Rhoades. By invitation H. H. Vreeland, president of the New York City Railway Company; James H. McGraw, president of the American Street & Interurban Railway Manufacturers' Association, and Messrs. Evans, Martin, Wilson and Williams, members of the executive committee of the Manufacturers' Association, were in attendance.

The secretary presented a report of the progress of the association since the Columbus convention. He stated that the company membership had increased from 200 to 237 and the associate membership from 113 to 156. The proposal that the association change its headquarters from 60 Wall Street to the seventh floor of the new United Engineering Building on Thirty-Ninth Street was approved by the executive committee. The secretary announced that the change would certainly be made within sixty days and that possibly the offices could be moved during February. Announcements of the change in address will be sent to the member companies when made.

The secretary gave an estimate showing that the whole revenue of the association this year would probably amount to about $26,000. This will enable the organization to enlarge its facilities for carrying on work. On account of the extent of the discussions at the Columbus convention and the time necessary to revise the report, the annual printed proceedings of the four associations are not yet ready for distribution, but it is expected that they will be sent to the member companies some time during February. The reports of the four associations will occupy approximately 1400 pages octavo this year. It is planned to bind these reports in two cloth-bound volumes, one containing the proceedings of the American and Engineering Associations and the other those of the Accountants' and Claim Agents' Associations. Member companies will receive a number of sets of these reports, depending upon the amount of annual dues paid to the association. Associate members will each receive one copy of the volume containing the American and Engineering Association reports.

The next subject discussed was the place of meeting for the 1907 convention. The management of the Jamestown Exposition sent an urgent invitation to the association to meet upon the Exposition Grounds or in the city of Norfolk this year, and a representative of the exposition was present to urge the claims of this place of meeting. Invitations were also received from the Board of Trade of Norfolk, the Norfolk Business League, and the management of the local railway system in Norfolk, and these interests were also represented to second the claims of the Jamestown Exposition Company. In behalf of this plan it was claimed that the hotel, convention and exhibit facilities in Norfolk and vicinity would be ample. The secretary also read a letter from the Atlantic City Business Men's League urging the selection of that city as the meeting place, and suggested the location of the exhibits on the pier. This league was also represented at the meeting, and the suggestion was made that the exhibits on the pier could be housed by temporary coverings which would protect them from rain and salt water. The secretary also read invitations which the association had received from the boards of trade in Boston and Chicago to hold its 1907 convention in those cities.

The result of an extended discussion on this subject was that it was the general consensus of opinion that the convention should be held preferably in the East and at some place on the Atlantic seaboard. A committee was appointed consisting of Vice-President Shaw, chairman; Mr. Tingley, president of the Accountants' Association; B. V. Swenson, secretary, and President Beggs, ex-officio, with instructions to investigate the facilities at Boston, Atlantic City, Norfolk and other places in the vicinity of the latter city, and to confer for this purpose with a similar committee to be appointed by the Manufacturing Association. The committee was also given power to select the place of meeting and to make all necessary arrangements for holding the convention there.

The best method of increasing the membership was discussed at some length, and in view of the services which the association is now rendering its members it was considered a very opportune time for securing applications for new members. Mr. Vreeland, chairman of the membership committee, stated that he was planning to conduct a vigorous campaign in this direction. While the membership has increased very materially since the reorganization, and while most of the important street and interurban railway companies are now members of the association, there is still a considerable number of companies not at the present affiliated with the organization.

President Beggs announced that he had made appointments on various standing and special committees and that at the present time he was able to announce that the committees on membership, compensation for carrying the mails, and heavy electric traction were complete. They are as follows:

MEMBERSHIP

H. H. Vreeland, chairman, president, New York City Railway Company, New York City.

C. S. Sergeant, vice-president, Boston Elevated Railway Company, Boston, Mass.

E. C. Foster, president, New Orleans Railway & Light Company, New Orleans, La.

H. J. McGowan, president, Indianapolis Traction & Terminal Company, Indianapolis, Ind.

W. Caryl Ely, president, Ohio Valley Finance Company, Buffalo, N. Y.

James H. McGraw, president, STREET RAILWAY JOURNAL, New York City.

Hugh M. Wilson, president, "Electric Railway Review," Chicago, Ill.

W. G. Ross, managing director, Montreal Street Railway Company, Montreal, Ont., Can.

W. A. House, vice-president, United Railways & Electric Company, Baltimore, Md.

T. K. Glenn, vice-president, Georgia Railway & Electric Company, Atlanta, Ga.

COMPENSATION FOR CARRYING U. S. MAIL

G. T. Rogers, chairman, president, Binghamton Railway Company, Binghamton, N. Y.

Capt. Robert McCulloch, vice-president, United Railways Company of St. Louis, St. Louis, Mo.

Gen. G. H. Harries, vice-president, Washington Railway & Electric Company, Washington, D. C.

P. F. Sullivan, president, Boston & Northern Street Railway Company, Boston, Mass.

A. H. Stanley, general manager, railway department, Public Service Corporation of New Jersey, Newark, N. J.

HEAVY ELECTRIC TRACTION

Calvert Townley, chairman, vice-president, Consolidated Railway Company, New Haven, Conn.

E. B. Katte, chief engineer of electric traction, New York Central & Hudson River Railroad, New York City.
L. B. Stillwell, consulting engineer, New York City.

The membership of the other committees will be announced in the technical press as soon as acceptances have been received from all those appointed to serve on them.

Mr. Tingley, president of the Accountants' Association, reported that at its executive committee meeting held in Philadelphia on Jan. 21 the committee considered at length the disposition of the discussion on depreciation which occupied the entire day at the 1907 convention. This discussion has been thoroughly revised and the committee recommended that it be printed in the annual proceedings of the Accountants' Association, subject to the approval of the executive committee of the American Association. On motion, this approval was granted and Secretary Swenson was instructed to incorporate the report of the discussion in the printed annual proceedings of the Accountants' Association. The reports of the committees on public relations and on municipal ownership, presented at the Columbus convention of the American Association, were also ordered printed in the proceedings of that body.

The committee then adjourned.

CORRESPONDENCE

SUBSTITUTION OF THE ELECTRIC MOTOR FOR THE STEAM LOCOMOTIVE

New York, Jan. 29, 1907.

Editors STREET RAILWAY JOURNAL:

The writer attended the meeting of the American Institute of Electrical Engineers on Jan. 25, with the hope of hearing the views of certain steam engineers on the paper presented by Mr. Stillwell. But although an invitation had been extended among others to the members of the American Society of Civil Engineers, the American Society of Mechanical Engineers, the New York Railroad Club and the New York Transportation Club, and a number of steam railroad engineers were present, none had an opportunity of offering any remarks, as all of the speakers were called from the floor by the presiding officer. The paper stirred up an extended discussion on the relative merits of alternating and direct current, the proper frequency and other fine electrical distinctions, but the view point of the average railway man received little or no consideration. It also seemed as if both authors and speakers unconsciously forced a balance to make a showing for the electrical side, and were by no means just or fair to the steam locomotive.

It is frequently claimed that one electric locomotive owing to inherent advantages, can displace two or more steam locomotives. This is undoubtedly based on the very low mileage, e. g., 3000 miles per month, made by the average freight locomotive. As this low mileage is not caused by mechanical or physical limitations, but is entirely due to track and traffic conditions, there is no reason for believing the electric locomotive can make any better mileage than the present steam locomotive. Assuming 10 miles per hour for the steam locomotive, there is a potential possibility of 6000 miles per month, as the portion of time that the locomotive is not available for service is only about 18 per cent of the total time.

The general statements in the paper have little or no bearing on the conditions involved in trunk line service, consequently the portion of it that will most interest the steam railroad man is the reference to cost of operation and especially the summary on page 53. The first point to be noted is that no allowance is made for depreciation. Reconstructing the table to provide for depreciation reduces the saving to a point when the average amounts to only 3 per cent above interest (5 per cent) and depreciation (3 per cent). Group II., New York, Pennsylvania et al., the largest saving, amounts to only 7.6 per cent. Group VI., Illinois, Wisconsin, Iowa et al., nine-tenths of 1 per cent; Pacific States, three-tenths of 1 per cent, etc. This has been done below. Columns 1, 8, 9 and 10 have been added by the writer. The percentage of saving would be even less if the cost of rolling stock were included.

It is quite obvious that such small gains, based on preliminary engineering figures, could not receive consideration for a moment, and leads to the conclusion that the problem is infinitely greater than the mere substitution of one kind of power for another. The statement made at the last International Railway Congress by Mr. Aspinall, of England, that the reason his road adopted electricity was "not to save money but to make money" covers the case.

The cost per mile to run the Albany night boats a few years ago was not much higher than the company now pays for electric lighting on the new modern Adirondack and Morse. Yet what justifies the newer and much more expensive boats? Surely not the cost per mile. The only answer, then, is: "Not to save, but to make money."

STEAM ENGINEER.

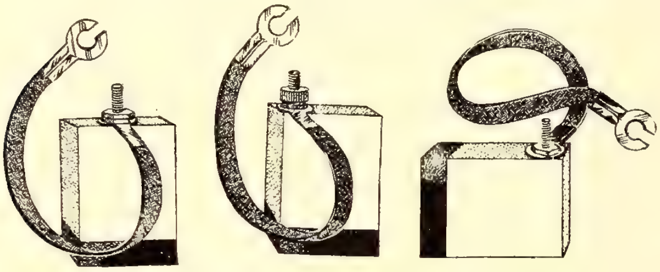
Group No.	GENERAL LOCATION.	1. *Electric Cost per Mile.	2. Miles of Line Represented.	3. Gross Earnings.	4. (Steam) Operating Expenses.	5. (Electric) Operating Expenses.	6. Difference Steam and Electric Operation.	7. 5% Interest on Electrical Equipment Excluding RollingStock*	8. 8% Interest.*	9. NET SAVING. Amount.	10. NET SAVING. Per Cent
I	New England	$12,940	8,094	$14,511	$10,493	$8,604	$1,889	$647	1,035	854	6.6
II	New York, Pennsylvania, et al.	15,800	23,281	20,752	13,671	11,210	2,461	790	1,267	1,194	7.6
III	Ohio, Indiana, Michigan	12,800	25,208	12,483	9,198	7,542	1,656	640	1,020	636	5.
IV	Virginias, North and South Carolina	9,680	12,542	7,359	4,590	3,764	826	484	775	51	.5
V	Kentucky, Fla., Louisiana, et al.	9,500	24,563	6,867	4,899	4,017	882	475	760	122	1.2
VI	Illinois, Wis., Dakotas, Iowa, et al.	10,500	48,672	8,021	5,169	4,239	930	525	840	90	.9
VII	Montana, Nebraska and Wyoming	9,200	11,546	7,737	4,092	3,355	737	461	738	0	....
VIII	Colorado, Arkansas, Missouri, et al.	9,200	30,456	6,362	4,308	3,533	775	461	738	0	....
IX	Texas and New Mexico	8,900	14,875	5,588	4,108	3,369	739	445	710	29	.33
X	Pacific States	9,280	17,737	8,439	4,880	4,002	878	464	742	36	.35
	United States, total	$10,300	216,974	$9,598	$6,409	$5,255	$1,154	$516	$822	$332	3.

*Exclusive of rolling stock.

$$\text{Col. } 1 = \frac{\text{Col. } 7 \times 100}{5\%}$$

A CARBON BRUSH DESIGNED ESPECIALLY FOR ELECTRIC RAILWAY SERVICE

A carbon brush designed especially to meet the requirements of street railway service is the American Special Brush, made by the American Carbon & Battery Company, of East St. Louis, Ill. It is dense, highly tempered and of low resistance, besides being self-lubricating. In addition to street railway service it is adopted for crane service and all machines subject to severe usage. A feature of

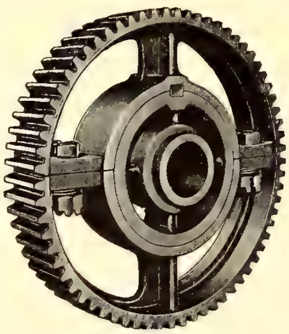


DIFFERENT TYPES OF PIG-TAIL CONNECTORS

great value in connection with the brush is a pig-tail connector for small machines. This connector is especially advantageous, as the connection can be detached and saved when the original brush is worn out. Besides the American Special Brush, the American Carbon & Battery Company makes the American Graphite Brush and the American Diamond A Brush, the former designed to meet conditions where a soft, dense brush is required and the latter for use on stationary motors and generators.

GEAR WHEEL WITH RENEWABLE RIM TO FIT ANY TYPE OF MOTOR

A novel type of gear wheel has recently been put on the British market by the Electric Tramway Equipment Company, of Birmingham, Eng., and presents so many striking features as to be worthy of description and illustration. As will be seen from the illustration, it is composed of three parts, not counting the keys and bolts used to connect these parts together. They consist of a solid hub, which is a heavy steel casting and is forced on the axle in the usual way by hydraulic or other means. This part is independent of the rim, and the advantage claimed for its use is that as it is subject to no wear it can be left on the axle until the latter is worn out. In this way there is no pressing on of new gears when the teeth are worn. After the axle has to be scrapped the gear hub can be placed on another axle. The rim of the gear wheel is in halves which are bolted together and keyed to the center piece.

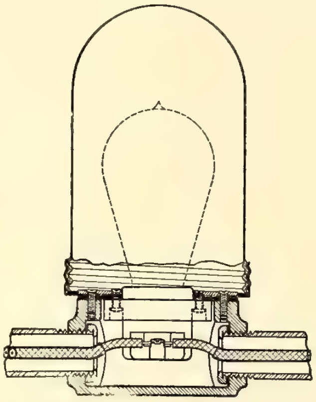


GEAR WHEEL WITH RENEWABLE RIM

The saving in the cost of renewals, owing to the fact that no part of the wheel has to be scrapped, is said to more than repay the slightly increased first cost. The rims of different sizes of gears are interchangeable, so that the gear ratio can be altered at any time if desired, without removing the hub. The wheel is claimed to combine the advantages of both the solid and split gear, and is recommended by the manufacturers in all cases where trouble has been experienced from broken axles.

OUTLET BOX RECEPTACLE

The Benjamin Electric Manufacturing Company, of Chicago, is placing upon the market a new No. 6-B receptacle especially designed for use with outlet boxes, which embodies a number of attractive features. Its contacts do not project beyond the walls of the receptable, and therefore do not readily come in contact with the metal parts of the box or projecting parts of the conduit; wires are easily spread around the base, thus making slack wire unnecessary; binding screws are accessible from the front, obviating the necessity of reversing the receptacle or of tapping wires to make connections; it may be connected while in position in the box, the cover being attached after connections have been made. A steel plate cover is furnished through which the porcelain receptacle slightly projects. Over this a polished brass cover may be used with or without shade holder. Where a shade holder is desired, it is spun upon the brass plate, forming a neat and substantial device.



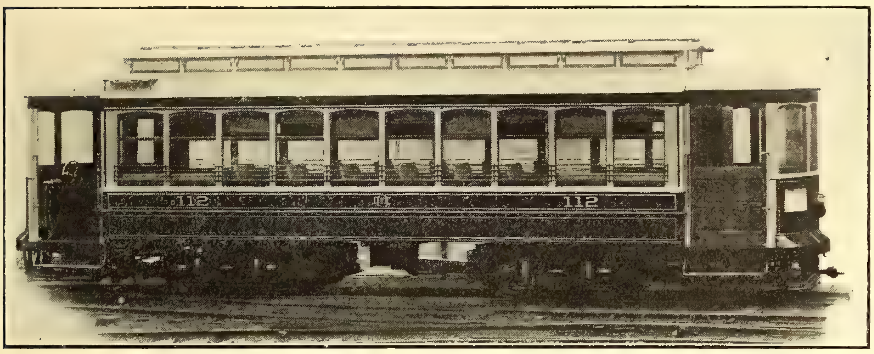
OUTLET BOX RECEPTACLE

Special interest attaches to these receptacles in connection with their contemplated use in the Port Huron tunnel of the Grand Trunk Railroad. The accompanying cut shows a vertical cross-section of the box to be used. It is of cast iron with threaded outlets to receive the conduit, thus securing a water-tight joint. A rubber gasket extending from the outer edge to the center opening through which the socket projects is placed under the steel-plate cover. Both the outer edge and the socket are thus protected against moisture. If found necessary, a vapor-tight globe will be screwed against the rubber gasket. If no globe is used, as will probably be the case with so tight a box, a rubber lamp ring will be substituted. Globe holders of sheet aluminum will be supplied. Where it is deemed desirable to use a guard, provision is made for attaching it directly to the holder.

W. S. Barstow & Company, of New York and Portland, Ore., in order to meet the demands of their rapidly extending business, have recently enlarged their power-plant department. At the head of the department is Perry West, who formerly was general equipment engineer to Joseph Williams & Company, of Louisville, Ky. Subsequently Mr. West joined the forces of Pattison Brothers, New York, and was actively engaged in steam turbine work. Recently he has been with the New York Edison Company. Associated with him is Carl F. Schreiber, who is favorably known for his work in the testing department of the Brooklyn Rapid Transit Company, in the steam department of the New York Central & Hudson River Railroad, and as one of the engineers of the electric traction commission. Another notable addition to the staff is Rulof Klein. Graduating from the Delft Technical University, Holland, Mr. Klein entered on the field of gas engineering. Among other charges in this country, Mr. Klein acted as designing and constructing engineer in the gas-engine department of the Wellman, Seaver, Morgan Company, of Cleveland, Ohio. Mr. Klein has just returned from Europe, after making a tour of inspection of gas-engine power plants in Germany and Belgium.

NEW ROLLING STOCK FOR HAMBURG RAILWAY AND DUNKIRK & FREDONIA RAILWAY

The G. C. Kuhlman Car Company has delivered within a short time twelve double-truck cars of the Brill grooveless-post semi-convertible type to the Hamburg Railway Company, of Buffalo, N. Y., and six of the same type and dimensions to the Dunkirk & Fredonia Railway Company.



EXTERIOR OF CAR FOR HAMBURG RAILWAY

These cars are practically of the same dimensions as a standard 28-ft. car of this type with the exception that they are 3 ins. wider and the platforms are 10 ins. longer. The seats are 36 ins. long, leaving the aisle 25 ins. wide; the longitudinal corner seats accommodate four passengers each. The transverse seats are of the push-over back type with corner grab handles. The seating capacity of each car is 40 persons. A substantial bottom framing is composed of 4-in. x 7¼-in. yellow pine side sills plated on the inside with 13-in. x ⅜-in. plates. The interiors are finished in cherry, stained to a mahogany color, and the ceilings are of three-ply birch veneer; the lights are placed singly along the center of the dome and at each side under the lower ventilator rails. Four-bar bronze window guards extend from corner post to corner post and are an essential adjunct to this type of car in consequence of the unusually low window sills. The trucks are of the No. 27-GE1 type and the cars are equipped with one motor each on the inside end of the trucks of 45-hp capacity. The Chicago type of sliding fender is used and the bumpers are provided with inclined shields. The track scrapers, drawbars, sand boxes, platform steps, gongs and signal bells are of the Brill manufacture.

SOME OF APPLEYARD PROPERTIES OUT OF HANDS OF RECEIVERS

Four of the old Appleyard properties are now out of the hands of the United States Court, Judge Thompson having ordered a final distribution of a balance of $386,966 to claims amounting to $2,000,000. The Columbus, London & Springfield has a balance of $48,628.62 to be paid on claims of $694,709.81, which is 7 per cent to the bondholders. For the Columbus, Grove City & Southwestern the percentage is 10.78, the balance being $10,312.57 for claims of $95,648.21. Claimants of the Central Market Street Railway will receive $8,256 on an aggregate of $269,643, or 3 per cent, while there is a balance of $154,382 for bondholders of the Urbana & Northern, who have claims of $384,645.

SHEAR PLOWS FOR BALTIMORE

An interesting shipment of snow plows was received by the United Railways & Electric Company from the J. G. Brill Company last month. The plows are of the shear board type, as they are required for double-track service. Although not in a latitude in which much snow is encountered, the managers have found that at times the sweepers must be supplemented by a heavier type of snow-removing apparatus to prevent stalling of the cars at critical times, especially on the lines which extend far into the suburbs and over which the sweepers operate infrequently. The powerful construction includes 6-in. x 12-in. side sills with heavy truss rods anchored at the ends of the sills and brought up to the letter board of the cab, where they are supported by straps three-quarters of an inch thick, which are folded to the posts and reach down to the sill with a toe at the bottom inserted in the sill; iron bars 3 ins. x 3½ ins. extend between the plow posts at each side, forming a powerful brace for the back of the plows behind the lower edge where the greatest strength is needed. The lower edge of the shear boards is horizontal for the full width of the

INTERIOR OF PLOW FOR BALTIMORE

track and sheared on an incline at each end, giving an elevation of 2 ins. to avoid contact with paving stones. The plows are adjustable to a height of 9 ins. above the rails. Folding wings or levelers are provided at the sides, and ice diggers operated by pedals in the floor of the cab are a part of the equipment. The car measures 18 ft. 9 ins.

EXTERIOR OF PLOW FOR BALTIMORE

over the body and 34 ft. 5 ins. over all; width over side sills, 6 ft. 10½ ins.; length of shear plates, 12 ft. 4 ins. The trucks are of the Brill gear type and have a wheel base of 7 ft. The weight of an entire equipment, motors excepted, is 16,000 lbs.

LONDON LETTER

(*From Our Regular Correspondent.*)

With the exception of two routes, the Bristol Road route, which was electrified some years ago by the owning company, and the route between Colemore Row and Hockley, which is at present operated by cable system, all the tramways of the city of Birmingham, with the commencement of this year, passed into the hands of the Birmingham Corporation, and are now being operated by it under the able managership of Mr. Alfred Baker. During the past two years the work of converting the various systems of traction which have been used in this city, has been steadily proceeding, Mr. Baker having been appointed general manager of the Corporation Tramways some little time after the Corporation decided to take over the whole of the tramways and to electrify them. Birmingham is the last of the large cities of Great Britain to have its tramway system electrified, owing to various reasons. The tramways have been operated in this city by different companies, whose leases expired at various periods, and during the past five years it has been probably the worst served city in Great Britain, so far as tramways are concerned. I do not mean that the city actually has been badly served, but in these modern days when one expects to see the light, elegant and well-equipped electric car in all cities of importance, it was something of a shock, even so late as Dec. 31, 1906, to find old, antiquated steam tramways still in possession of many of Birmingham streets, and the cable system in possession of others. This is now entirely changed, and the citizens of Birmingham are now learning what it is to have a first-class electric system. As will be readily understood it was a work of no small magnitude to change over the whole of the system, and when the last steam car arrived at its destination on Monday night, Dec. 31, with crepe attachments amid the funeral groans of those assembled, large gangs of men were set to work all over the city making the necessary final arrangements for the running of the electric cars, which had to be started within the next 4 hours. Many final alterations had to be made in the tracks, and much of this work had to be done at junctions. The whole work was triumphantly accomplished, however. The first day's working of the electric tramway was eminently satisfactory and practicable, and everything worked to everyone's satisfaction. The progress of the 200 cars was necessarily slow, as the drivers were not accustomed to their duties, driving a steam tramcar being a very different operation from driving an electric tramcar. During the first week the average number of passengers carried was 200,000 per day, though when everything is working more smoothly, after a month or two's operation, that figure will undoubtedly be exceeded. There have been no very serious accidents, although there has been a number of trivial ones. Many of them, however, would doubtless have occurred under any other circumstances, and very few were attributable to the drivers of the cars. It is satisfactory that Mr. Baker himself has been entirely pleased, and is quoted as having said that though he had experience with the opening of many new systems he had never known one which had worked so well as the Birmingham system from the commencement and with such freedom from accidents. The Corporation has expended upon the work of the electrification something like a million pounds, but experience has already shown that this will be an excellent investment. The tramway committee will now become one of the best customers of the electrical department of the Corporation, whose new electrical power house was recently described in these columns. The Council has sanctioned the arrangement that for the first 4,000,000 units of energy taken per annum, the tramways are to pay 1½d. per unit, for the second 4,000,000 1¼d. per unit, and for the third 1d. per unit, and it is expected that the whole 12,000,000 units will be required when the full system is in operation. It is also interesting to state that the violent opposition to the extension of the tramways system to the aristocratic suburb of Edgbaston has availed nothing. The Lord Mayor has now announced that the opponents of the scheme have been defeated by the vote which was recently taken, and that the Corporation has been authorized to promote the necessary bill in Parliament for carrying out this extension.

After years of doubt the York City Council has finally decided to adopt the recommendation of the tramways committee to purchase the existing tramways of the City of York Tramways Company Ltd., for the sum of £11,000. As the Corporation has no authority to operate the tramways, it has also necessarily decided to promote a bill in Parliament for that purpose, and will make arrangements for the present system to be continued to be operated by the company until the necessary powers have been obtained. The hands of the Corporation have been somewhat forced by the fact that another bill, called the York and District Tramways Bill, has been duly deposited at Westminster. This is a comprehensive bill for the purpose of providing York and district with a complete system of tramways, including the purchase of the existing system. The Corporation will, therefore, have to be in opposition to this company bill, though doubtless now that the decision has been reached to operate the tramways municipally the company's bill will be thrown out.

The city of Edinburgh seems to be as yet a long way from the solution of its tramway question. It is well known that for years back the city has been well, though incompletely, served by an admirable system of cable tramways, but with the growth of the city, extensions of tramways have become more and more imperative. The limitations of a cable service have become more and more apparent, and for some time it has become quite evident that some modification of the existing system would have to be made. The question having become vitally important, and Edinburgh being opposed to an overhead electric system in the main streets of the city, from an æsthetic point of view, deputations have visited recently many of the English cities where underground conduit or surface contact systems are in use. For the past year or so the tramways committee has been made familiar in Edinburgh with various conduit and surface contact systems by the promoters of these various systems, but this deputation has now had an opportunity of seeing all of the systems at work with the exception of the Kingsland system, which has been strongly pushed in Edinburgh. On the return of the deputation, consultations were had with Sir A. B. W. Kennedy, to guide them in the production of a proper report, and this report has now been presented to the Town Council. The report deals at great length with the various systems seen by the deputation, but the main points are that they find that the electric conduit system is admirable, and having been tested on a large scale in London, has been found to work well in all kinds of weather; that the slot in the existing cable system in Edinburgh could be utilized for an electric conduit system, though the cost of installing a new conduit system, except in streets where the traffic is very heavy, is a serious consideration. They also find that of all the surface contact systems which they saw the "G. B." system, as observed in the city of Lincoln, is the most s[illegible] for the city of Edinburgh, as they claim that it is comparatively noiseless, that it runs smoothly and that the studs, which are small, are flush with the surface of the streets. They find also that the [illegible] the various contact systems does not materially differ, that the running cost per car mile on the various contact systems also are not greatly dissimilar, and they confirm the statement that with the present cable system of tramways it is impracticable to have any mutual interchange of traffic with outside systems. The report goes on to deal with the particular extensions which Edinburgh has at present in view, and goes more fully into the details of all the cost necessary. The report is an important document, though it contains no information which is not already well known to tramway engineers. It is to be hoped that it will have a convincing effect upon the tramways committee, and that something will be done before long in Edinburgh to relieve the existing condition, as extensions of tramways in all directions in Edinburgh are becoming absolutely necessary.

As we hinted last month in this column it has been found necessary for the London County Council to modify to a large extent the running of the electric cars on the Embankment. It has become a somewhat complicated problem, and undoubtedly many alterations will be made before a perfect system is devised; in fact, no perfect system will probably be devised until Blackfriars Bridge is opened for car traffic. At certain hours of the day there seems to be a great rush for cars from the Embankment terminus, but, naturally, at other hours of the day there is no traffic along the Embankment at all, so that cars become unnecessary at that time. On the other hand, the passengers who used to join the cars at the south end of Westminster Bridge, and who can now get them at the north end of the bridge, find that when the cars arrive there they are already full at the busy hours. As we stated last month, all of the cars which used to come to the old terminus at Westminster Bridge have been brought across Westminster Bridge to the

Embankment terminus, but arrangements have now been made so that some of them will stop at various points. Some, especially the cars from the eastern districts, will stop at the old terminus at the south end of Westminster Bridge, some will go as far as Charing Cross, and only a portion will traverse the whole distance to the terminus. The natural conformation of the district has evolved necessarily new problems, as though it is more convenient now for certain passengers to take tramcars on the Embankment, it is a much longer way round to certain points on the south side than by the old routes, but it avoids the walk across the bridges. On the other hand, extra fares have been charged for the journey along the Embankment, so that even now it is more expedient for some still to follow the old route. It will take a few months before everything is satisfactorily arranged.

It is interesting to note that a scheme has now been prepared for providing the tramway employees at the various depots with recreation rooms, and the first which is being got ready is the New Cross depot, which is the largest tramway depot on the system. The room which is being prepared for the purpose will be divided into a dining room and a recreation room, in which will be billiard tables, draughts, chess, a piano, etc. As many of the employees live at great distances and cannot reach home at meal times, or at other times when they are off duty, it has been considered expedient to provide quarters of this kind for them. Several new routes of tramways on the London County Council system have been inaugurated during the past month. The most important on the south side is the one from Tooting Broadway by way of Wandsworth, Battersea and Vauxhall to the Hop Exchange, a distance of between 8 and 9 miles. Another new route on the south side which has been opened is the one between Clapham Junction and Westminster, via Battersea Park Road, Nine Elms Lane and Vauxhall. On the north side of the river the new electric route from Aldgate to Bloomsbury has now been opened, this being part of the tramways system recently purchased from the North Metropolitan Tramways Company. At the Bloomsbury end this system is conected with the lines which go through the subway under Aldwych to the Embankment, and is the first of the new tramways on the north side of the river reaching away to the east to be electrically equipped. The London County Council has also intimated to the local authorities of East London that the work of electrification will shortly be commenced on the tramway lines in Bow Road, and at Bow Bridge connection will be made with the West Ham tramways. The management of the latter will probably arrange with the London County Council for the temporary working [illegible] the new line is connected with the remainder of the London County Council system.

The South Metropolitan Electricity Company, a subsidiary compa[illegible] the British Electric Traction Company, has now opened its system of electric tramways from Croydon to Sutton. The tramways are divided into two sections—the Mitcham and Tooting line and the Sutton line—both starting, however, from Croydon, and a contemplated extension will probably enable them eventually to make a circular route. These tramways run through interesting and beautiful country, one of the routes lying across the famous Mitcham Common and Green, and tapping a rapidly growing residential neighborhood. The other route passes through Waddon, a suburb of Croydon, and also the rapidly growing town of Wallington, skirts the ancient village of Carshalton and passes through the famous Carshalton Park, well known as frequently visited by Queen Elizabeth. About 16 miles of track have been laid at present, and current is provided from a large generating station at Sutton, owned by the South Metropolitan Company.

At the annual general meeting of the Underground Electric Railways Company, of London, the company which owns the three Verkes tubes, two of which are now opened and the other rapidly approaching completion, Mr. Edgar Speyer, chairman of the company, stated that within six months the company would be out of the construction period and would have completed the system of tube railways which it had undertaken to make. The cost of financing these railways has been greater than was anticipated, owing to the unfavorable condition of the money market, but there is ample capital to complete the work still in hand. It is also interesting to note that it is now proposed that the three London tube companies owned by this company be brought under one management. These three tubes are the Great Northern, Piccadilly & Brompton, the Baker Street & Waterloo, both of which are completed and in operation; and, thirdly, the Charing Cross, Euston & Hampstead, which will be ready for traffic early in July. The unification of the management of these tubes will probably take place about that time, when all of the tubes will be in operation. It is expected that considerable economy will be effected by consolidating the management, although the companies will continue to have a separate corporate existence, as amalgamation would mean the promotion of a bill in Parliament, which is considered unnecessary, and the present object can be attained without that. The three companies will possess 23 miles of tube, and have a combined capital of £12,000,000.

The Swansea Tramways Company has recently inaugurated, in conjunction with the Swansea Express Delivery Company, a service by which parcels, traveling bags, etc., may be delivered to any address in the city by means of their electric cars. These packages may be handed to the conductor of any car for delivery to any address in the locality, and if these packages are placed in the cars before 4 p. m. they will be delivered the same day.

The Plymouth Corporation, in electrifying the West Hoe section, determined some time ago that to run full-size cars with top seats in this section would be a mistake. Somewhat of an innovation has therefore been made by supplying some half dozen demi-cars, which will run to and from Pennycomequick and the Promenade Pier. These demi-cars are more economical both in first cost and in operation, as no conductors are used, the driver looking after the fares. As the cars are small, only about two-thirds of the power is required compared with that necessary for the ordinary cars. Passengers can board these cars only at the end where the driver is, and an iron bar arrangement prevents people either entering or leaving while the vehicle is in motion, each passenger being requested to pay on entering. The fare is handed to the driver, who places it in a patent collecting box, which registers the coin inside, though probably tickets will be issued later on, being more convenient for this purpose.

To meet the ever-increasing requirements of the traffic on the Glasgow Corporation tramway system, and to provide the necessary equipment for extended routes, the works sub-committee of the tramways committee has unanimously recommended the building of a hundred extra cars. A proportion of these will have covered tops. The work is to be carried out at Coplawhill, and it is expected that the cars will be turned out at the rate of about two a-week without interfering with the regular maintenance work which is carried on in the department.

The earnings of the Glasgow Corporation electric tramways from June 1 last to Dec. 31, are announced as amounting to £513,642 10s 6d, an increase of £44,674 1s 3d as compared with the corresponding period of the preceding financial year, while the number of passengers carried increased from 119,496,689 to 129,150,604. This is the first occasion upon which the receipts have reached half a million sterling in a half year, and there is now every prospect that when the financial year closes in May the unique record of a million sterling will have been reached. Further important suburban extensions of the lines are contemplated during the present year.

C. W. Mallins, the traffic manager of the Liverpool Corporation Tramways, has submitted a statement showing that during last year the undertaking established a record in receipts, mileage and passengers. The car mileage was 12,115,934, an increase of 48,901 miles, as compared with the previous year. The total number of passengers carried was 122,094,528, being very nearly 3,000,000 more than in 1905, and the receipts were £563,793, an increase of £13,672. The average earnings per car mile last year showed an increase, having been 11.17d, as against 10.94d in 1905.

The Haslingden Town Council has resolved to give notice to the Accrington Steam Tramways Company, Ltd., that at the end of six months from Jan. 4, 1907, it will exercise its powers to purchase the portion of the company's undertaking that is in the borough. It is proposed to electrify the system after the purchase.

Estimates of the cost of constructing the proposed electric railway from Euston to Watford by the London & North-Western Railway Company have been deposited for the information of Parliament. The total cost is put at £2,508,000, the principal items being tube station and loop line beneath Euston terminus, £202,090; passenger subway at Euston, £22,080; tube railway (two tunnels), about 2¼ miles long, £760,360; widenings, alterations, etc., on surface to Watford, £1,119,105; new works in Watford district, £90,200; widening Rickmansworth branch railway, £69,715; and new branch to Croxley Green, £72,855. The company in its bill seeks additional capital powers

to the extent of £2,700,000 and to borrow £900,000. The underground tubes, as far as Loudoun Road, will be nearly 4000 yds. in length, and will rise to the surface on a gradient of 1 in 63. There will be two intermediate stations underground—at Chalk Farm and Loudoun Road. The diameter of the tunnels between stations will not exceed 13 ft. 6 ins. (or 2 ft. 6 ins. less than that on the Great Northern & City Railway), and at the stations 30 ft. The deepest point of the line will be at Avenue Road, N. W., where the rail level will be 120 ft. below the surface of the ground. Where the new tube runs beneath the existing tunnels of the London & North-Western Railway at Chalk Farm the depth will be nearly 60 ft., while at Finchley Road the tube will be 100 ft. below the Metropolitan Railway. The new station beneath Euston will make the third there, as stations of the City & South London extension and the Charing Cross, Euston & Hampstead Railway are being built. Intercommunication will be provided between each. The directors propose to make an innovation, so far as tube railways are concerned, by accepting passengers' luggage for conveyance.

A. C. S.

CHICAGO TRACTION MATTERS

Since the Council committee on local transportation of the Chicago City Council recommended the adoption of the traction ordinances providing a referendum vote was not desired by 25 per cent of the voters, all interest in the traction situation has been centered in the collection of the proper number of names to petitions asking that a referendum vote be taken. Two forms of petition have been circulated, one drawn up by the City Council and another prepared and circulated by the Referendum League. In addition to the traction question this latter petition contains a clause with regard to the repeal of the Illinois Sunday blue laws of 1845. This last question was put on the petition in order to obtain signers who would not have signed a petition containing the traction clause alone.

Mayor Dunne has been most active in pushing the circulation of the City Council petition, and in order to cover the city most effectually has pressed the police department into service. This has been strongly criticised by many who consider that the police force should not be utilized for this purpose. The petition of the Referendum League has been circulated largely by men hired especially for this work. In many cases these men were paid according to the number of names secured, and as a result some names are said to have been obtained by fraud.

If the required 86,000 names are secured to the petitions the signatures will be investigated by the Election Board before a referendum is declared.

Mayor Dunne has secured opinions on the traction ordinances from Attorneys Clarence N. Goodwin and Benjamin D. Magruder, formerly judge of the Illinois Supreme Court. These gentlemen state that the united operation of the Chicago City Railway and the Union Traction Company would be subjected to the approval of Judge Grosscup, receiver for the Union Traction Company. Several other objections are stated in the written opinion furnished Mayor Dunne.

President Mitten, of the Chicago City Company, in a recent statement, said if the ordinances are passed and become a law early in February, 300 new cars could be secured during the summer months, and track and power improvements could be made in time to take care of the heavy travel during November and December. If settlement is delayed until after a referendum vote in April the actual work of reconstruction will be so delayed that present congested conditions will continue for another year.

CHICAGO & WESTERN INDIANA COMPANY'S PLANS

The Chicago & Western Indiana Traction Company, known as the "Educational Route," which was organized and incorporated by Edward H. Barrows, has been reorganized by the American Engineering Company, of Indianapolis, which will undertake to complete the road. At a meeting, a few days ago, the following officers were elected: Charles N. Wilson, president; Edward W. Barrows, secretary-treasurer. Mr. Barrows retains the office of general manager. The road is chartered to connect Chicago and Louisville through Valparaiso, Lafayette, Crawfordsville, Greencastle and Bloomington; but the first division, that between Lafayette and Greencastle, is all that will be built now. This division will be 57 miles long. This will be the link that will give a through traction express service from Evansville to Princeton, Sullivan, Terre Haute, Greencastle, Crawfordsville, Lafayette, Delphi, Logansport, Peru, Wabash, Huntington, Ft. Wayne, and, later, Toledo, Ohio. Indianapolis will be reached by a through fast express service over the "Educational" and "Ben-Hur" lines by the joint use of tracks, bringing the cars directly into the station in this city. This service will put Romney, Linden, Whitesville, Ladoga, Roachdale, Carpentersville and Bainbridge in close relation to this city, which does not at present exist by traction lines. The new company will get its power from the power plant of the Indianapolis, Crawfordsville & Western Traction Company—the "Ben-Hur" route—which is located at Crawfordsville.

CHICAGO & OAK PARK ELEVATED EARNINGS FOR YEAR ENDED DECEMBER 31, 1906

The report of the Chicago & Oak Park Elevated Railway Company, which holds the securities of the Chicago & Oak Park Railroad Company, for the year ended Dec. 31, 1906, as submitted to the stockholders at their annual meeting in Jersey City, Jan. 10, 1907, compares as follows:

SECURITY HOLDINGS

The amount of stock issued and now outstanding is:

	Dec. 31, 1906	Dec. 31, 1905
Preferred stock, shares	30,448	30,390
Common stock, shares	56,561	56,458
Total	87,009	86,848

The amount of capital stock scrip outstanding is:

	Dec. 31, 1906	Dec. 31, 1905
Preferred	$12,965.70	....
Common	4,257.00	....
Total	$17,222.70	....

The company now holds of the securities of the Chicago & Oak Park Elevated Railroad Company:

Income bonds, par value	$864,100	$858,900
Stock, shares	91,496	91,446

BALANCE SHEET

Assets		Dec. 31, 1905
Securities—		
Stock of Chicago & Oak Park Elevated Railroad Company and income bonds Chicago & Oak Park Elevated Railroad Company, carried at	$7,682,555	$7,670,948
Notes receivable	1,608,500	1,488,600
Cash on hand	1,239	814
Total	$9,292,294	$9,160,362
Liabilities		
Capital stock—		
Preferred	12,966	14,405
Common	5,656,100	5,645,800
Capital stock, scrip—		
Preferred	12,966	14,405
Common	4,257	12,557
Notes and accounts payable	574,171	448,600
Total	$9,292,294	$9,160,362

Following is the report issued by President Redmond D. Stephens:

The company now holds $1,608,500 of the notes (demand obligations) of the Chicago & Oak Park Elevated Railroad Company for moneys advanced and loaned to said company. The railway company has issued, and now has outstanding, $568,500 of its notes (demand obligations), in addition to which there is a debenture note of $350,000 issued by the Chicago & Oak Park Elevated Railroad Company, and by this company indorsed over and guaranteed to the Northwestern Elevated Railroad Company. The annual meeting of the stockholders of the Chicago & Oak Park Elevated Railroad Company will be held in the city of Chicago on Jan. 31, 1907.

THE CLEVELAND SITUATION

The conferences between President Horace E. Andrews, of the Cleveland Electric Railway Company, and President A. B. Dupont, of the Municipal Traction Company, of Cleveland, relative to the holding plan, have been conducted in private. It is understood that Mayor Johnson has objected to the plan of the two gentlemen in not giving out information as to all that takes place at the meeting, but both men think it better to keep their discussions private until the results are ready for announcement. Of course, some information is given out regarding the subjects that are being discussed, but nothing that would have any bearing in one way or the other on the matter.

Atorneys were called in at times during the past week to settle legal points that came up in the negotiations, and each side has had frequent conferences with attorneys representing the two interests. In this way they hope to get all legal obstacles out of the way before any final settlement is reached. Mr. Dupont has also asked for a mass of information from the city, and the various ordinances of the Cleveland Electric have been carefully gone over by attorneys for the Municipal Traction Company. It seems that they hold that the decision on the Central Avenue and Quincy Street expirations will hold good with all the others, and that they expire on the dates originally fixed, without reference to any other streets with which they may be connected by transfer or other arrangements. That point will have to be determined later on, as the various actions of the City Council may not be similar or of the same intent.

The physical value of the property was under discussion for a portion of the time, and it is said that the figures will be completed within a short time. This work is difficult, because of the increased value of all kinds of material that goes into the makeup of railroads. Copper, steel, electrical machinery and ties have all advanced materially since the greater part of the plant was built, as well as labor. The real estate owned by the company is also much more valuable than when it was first purchased. All these things must be taken into consideration in making up the estimates.

In order to get at a fair valuation of the properties of the company, a prominent real estate man and a contractor, just as able and reliable, have been calld into the case. They will go over all the properties owned and report to the two presidents their finding. Of course, no one is bound by this finding, but at the same time, it is believed that it will aid materially in settling the values.

A report was in circulation during the week that Mayor Johnson would be unwilling to accept a franchise for the Municipal Traction Company that would not allow it to increase the rate of fare above 3 cents in case experience proves that the system cannot be operated at that rate. This report has not been confirmed. It is thought that the Cleveland Electric would not lease its lines unless the rate be made ironclad at 3 cents, although certain conditions might be incorporated that would make it possible to accept such a contract. While the Mayor says that Mr. Dupont has a free hand in these negotiations, the finding will be approved by the Council and by himself if they are satisfactory or disapproved if not.

Nothing has been made public as to the arrangements for the maintenance of the properties or as to who will be the judge as to whether they are being kept up properly in case of a lease. It is believed that no railroad company would be willing to turn its property over to a holding company without reasonable security in this respect, and some provision for deciding without recourse to legal proceedings. A new road entails little cost for maintenance the first two years, but after that the charge becomes heavier all the time and provision must be made for it. Whether the proposed holding company has taken this matter up or not is not known.

Still another point must be settled, and that is as to the corps of department heads and engineers connected with the company. Few companies would be willing to throw out a competent force of men and turn their roads over to others of whom they know nothing. Considerable interest is felt on this point, not only among the men themselves but among outsiders who are following the course of the negotiations.

A prospectus has been issued by the Municipal Traction Company, which states that an issue of Forest City Railway stock will be sold in small lots, as low as $10, the purchasers being given certificates. The issue will be 1000 shares and will sell at par, or $100 a share. The idea is to secure the good will and sympathy of small investors, working men and others who have a little money. The proceeds will be used to purchase new cars and make other improvements. Fred C. Albers will act as trustee for the purchasers and will retain the proxies. No one can purchase more than $30 worth of the issue, according to the rule that has been fixed.

The City Council has extended the time of Secretary H. J. Davies, of the Cleveland Electric, and A. B. DuPont, of the Municipal Traction Company, one week to make their report on the amount the Cleveland Electric owes the city for the use of the streets. Both men have been busy with the holding company work, Mr. DuPont, in negotiating, and Mr. Davies, in furnishing data.

A report has been current the past week that if the holding company succeeds in leasing the Cleveland Electric properties, the 3-cent fares will be good only within the city limits, and the old rate will be charged the suburban towns. It is understood that the franchises of the Cleveland Electric in some of the villages, at least, provide that any rate that may be adopted in the city applies also to them. It would seem that this would make it imperative for any leasing company to charge a single fare between points.

PRIVATE CAR JOSEPHINE MAKES A FAST RUN BETWEEN CLEVELAND AND INDIANAPOLIS

The trip of the private car, Josephine, of the Lake Shore Electric, to Indianapolis and return last week, is probably the longest ever made by a trolley car. The distance is, approximately, 300 miles. The average speed for the entire route was about 30 miles per hour, but in places the car was speeded up to 60 miles an hour. The trip, however, was made on the regular limited schedules over the roads that were used. The route was by way of Lima, Fort Wayne and Wabash to Indianapolis, and the return was made over the Indiana Union and Schoepf lines to Dayton, thence to Toledo over the Western Ohio through-route, and to Cleveland over the Lake Shore. On the return trip the car left Indianapolis Friday morning, at 7 o'clock, and would have arrived at Toledo at midnight had it not been for the stops made at different points. The trip from Toledo to Cleveland was made in 4 hours, the regular running time that will be fixed for the limiteds a little later on. The car bore a party of trolley officials from Cleveland, from the various roads that center in that city.

B. R. T. EXTENDING ITS KENT AVENUE POWER PLANT

The Brooklyn Rapid Transit Company has just disclosed its plans for enlarging its Williamsburg power station structure to accommodate the turbo units recently contracted for. Several years ago the company arranged for land adjoining its Kent Avenue plant, and planned for the ground a structure to be built in sections as demands required. Shortly thereafter work was begun on the first section of this plant to cover half the property, and a few months ago the equipment was installed and the plant placed in operation. The new building now proposed and in which the new equipment previously referred to will be installed, will cover the remainder of the plot. The dimensions of the new half will be about 200 ft. by 130 ft., and like its forerunner, the structure will rise to the full height of a ten-story building. Together with the half already completed and now in partial use, the new addition will cover a tract 200 ft. x 260 ft. and cost $5,500,000. The new power house adjoins the south wall of the old Eastern station, built by the old Brooklyn City Railroad. The first half of the Williamsburg station was built on the Kent Avenue side of the property. The second half will be built to the west, and close up upon the company's dockage. The temporary west wall of the present structure will be torn out and the engine room will be doubled in size. Similarly the two boiler rooms, the one imposed above the other, will be increased in dimensions and thirty-six new boilers of the improved water-tube type will be added to the thirty-six similar boilers already in service. There will be four tiers of offices along the Kent Avenue frontage of the engine room. These will be reached by plunger electric elevator.

INAUGURAL BANQUET OF THE EXPOSITION OF SAFETY APPLIANCES

The first international exposition of safety appliances and industrial hygiene, which is being held at the American Museum of Natural History, in New York, was inaugurated by a dinner at the Waldorf-Astoria, Jan. 28. Hon. Chas. E. Hughes, Governor of New York, was the guest of honor, and thoroughly endorsed the plans of the American Institute of Social Service, under whose auspices the exposition is being conducted. Other speakers included the Italian Ambassador, Chas. Stewart Smith, Carroll D. Wright and W. H. Tolman. The latter gave some particulars of other museums of this character, which are conducted with governmental assistance abroad. A letter was also received from President Roosevelt, commending the American Institute of Social Service, under whose auspices the exposition is being conducted, for initiating the work in this country. The exhibition will remain open for two weeks, but it is hoped to form a nucleus for a permanent museum of this character.

THE FLOOD AT CINCINNATI—INGENIOUS SCHEME FOR OPERATING CARS

High water, which prevailed for the greater part of last week in Cincinnati, interfered with many of the traction lines entering the city as well as the street railway lines. In some sections of the city the tracks were abandoned for several days, while cars especially arranged for high water made their way over other streets as frequently as possible. The bodies of these cars were elevated by placing ties on the top of the trucks and bolting all together. They served their purposes well, although they were not able to accommodate the people desiring transportation. At Eighth Street and McLean Avenue a bridge was built across the back water. At Dodsworth Avenue the water was more than 6 ft. over the tracks, and passengers had to be ferried across. In many other places traffic was either suspended or badly crippled. Lines crossing the river to Newport, Covington and Dayton were also crippled badly, and for a portion of the time Dayton could not be reached. On all the local lines transfers on transfers were given during the flood, in order to aid people as much as possible, and then many were compelled to walk from one line to another or to connecting cars, often several squares distant. The Cincinnati, Lawrenceburg & Aurora suffered severely, and traffic was almost suspended over the entire line for a time. When it began operations it was in a section where the water was not over the road. Great care has had to be exercised in watching the tracks, bridges and trestles to see that they are not damaged sufficiently to be dangerous. Some of the trestles were weighted down to hold them in place.

McDONALD SUBWAY PLAN FOR NEW YORK APPROVED

The Board of Estimate, of New York, on Thursday, Jan. 24, approved the so-called McDonald plan for a subway loop between the Brooklyn and the Williamsburg bridges, deciding upon a four-track road instead of a two-track road and agreeing to leave the question of leasing until the construction work has been completed. It is estimated that the road will take two and a half years to build, and that it will cost approximately $5,250,000.

While no action was taken on the leasing, there is a distinct sentiment in favor of not giving exclusive operating privileges to any company, but holding the loop open to the cars or trains of all companies on payment of a certain rental and under specified conditions. If this plan is carried out the loop will remain practically under the control and supervision of the city authorities, and the trains of the Brooklyn Rapid Transit Company will run across the bridges and round the loop back to Brooklyn, while, should an agreement also be made with the Interborough, the trains of that company would also run round the loop, and thus carry passengers from the furthest parts of Manhattan to such sections of Brooklyn as the loop system will reach. It also would be possible for a third independent company to operate loop trains exclusively.

The action of the board was taken after Engineer Nelson P. Lewis had made his report favoring the plan generally, as outlined in a communication from the Rapid Transit Commission. As proposed, the line will run from the Manhattan end of the Williamsburg Bridge through Delancey Street and its contemplated extension to Centre Street, under Centre Street to the Brooklyn Bridge terminal at Park Row, with a spur running through Canal Street to the Manhattan Bridge. The whole plan includes also a spur running down Nassau Street to the financial district, but there is some doubt as to whether this will be built, as it would interfere with the proposed subway under Third Avenue. In Brooklyn the line will run through Broadway to Lafayette Avenue and thence under that street to the extension of the Manhattan Bridge approach.

REPORT BEING PREPARED ON PLAN FOR BETTERING TRAFFIC FACILITIES IN PHILADELPHIA

Following the request of the directors of the Philadelphia Rapid Transit Company that the Trades Leagle prepare suggestions as the basis of a plan for the solution of the passenger transportation question, the street-car service committee of that body has commenced work upon the proposition. The suggestions which they will prepare will include all feasible points of the plans already presented. The members of the committee hope to be ready to report at least by the time the directors of the Trades League meet on Feb. 14. If work of the committee is in shape before that, a special meeting of the directors will be called. With the approval of that body the suggestions will be submitted to the Transit Company.

CAPITAL TRACTION ANNUAL REPORT

The report of the Capital Traction Company, of Washington, D. C., for the year ended Dec. 31, 1906, shows as follows:

GROSS EARNINGS FROM OPERATION		
Receipts from passengers	$1,704,221.82	
Freight	1,338.00	
Mail	2,903.28	
		$1,708,463.10
Less operating expenses (including taxes; 47.019 per cent of passenger receipts)		801,314.09
Net earnings from operation		$907,149.01
INCOME FROM OTHER SOURCES		
Advertising	$9,000.00	
Rent from land and buildings	7,927.26	
Sale of tickets	1,659.18	
Miscellaneous income	4.29	
		18,590.73
Gross income less operating expenses		$925,739.74
DEDUCTIONS FROM INCOME		
Interest	$43,200.00	
Dividends	720,000.00	
		763,200.00
Net income from all sources		$162,539 74
Add:		
Income from securities owned by insurance reserve		4,280.00
Bills payable		405,000.00
Balance, Jan. 1, 1906		32,670.31
		$604,490.05
LESS EXPENDITURES FOR		
Construction and equipment	$66,234.20	
Extension account	497,618.79	
Insurance reserve	4,227.50	
		568,080.49
Balance, Dec. 31, 1906		$36,409.56

The Tecumseh-Norman Traction Company, of Tecumseh, Okla., will begin construction work as soon as the line has been finally laid out. The power station will be located midway between Norman and Tecumseh. The company will operate a park or parks, but has not determined its policy in this respect. The officers of the company are: W. E. Powell, president; E. J. Dickeson, vice-president; George Weed, secretary; M. H. Tennison, treasurer and financial agent; J. H. Surber, superintendent, all of Tecumseh.

LANCASTER PROPERTIES SOLD

What is regarded as the initiatory steps toward the acquirement of existing electric railway systems necessary to a complete line between this city and Philadelphia was the consummation on Jan. 25 at Lancaster of a deal transferring the electric railway and lighting properties of the Lancaster County Railway & Light Company to interests closely identified with the McCall's Ferry Power Company and the Pennsylvania Railroad Company. The name of the new company will be the Susquehanna Railway & Light Company. The firm that financed the deal are Bertron, Starrs & Griscom, bankers of New York, and financial agents for the McCall's Ferry Power Company. At a meeting, Jan. 25, of the stockholders of the Lancaster County Railway & Light Company, which operates practically all of the trolley lines in Lancaster County, lights Lancaster and Columbia, and furnishes all the electric heat and power used in that county, it was unanimously agreed to accept the New York firm's offer of $100 per share for the common stock, 20,000 shares of which are outstanding, the par value being $50, with the alternative offer of preferred stock in a new company that will be organized, with a bonus of common stock.

PERSONAL MENTION

MR. R. L. HARRISON has been appointed superintendent telegraph and chief dispatcher of the Toledo & Western Railroad.

MR. CHAS E. INGERSOLL has been elected a director of the Lehigh Valley Transit Company, to succeed Mr. Arthur E. Newbold, resigned.

MESSRS. G. S. ACKLEY, president, and E. B. Stone, vice-president of the National Brake Company, of Buffalo, N. Y., are making a trip in Mexico.

MR. E. B. KATTE, chief of electric traction of the New York Central & Hudson River Railroad Company, was married Jan. 26, at Irvington, N. Y., to Miss King.

MESSRS. LATEY & SLATER, the formation of whose firm was recently announced in these columns, have been appointed consulting electrical engineers to the Rapid Transit Commission of the city of New York.

MR. JOHN B. CRAWFORD has resigned as superintendent of the Groton & Stonington Street Railway Company, of Mystic, Conn., to become superintendent of transportation for all the lines of the Ft. Wayne & Wabash Valley Traction Company, with headquarters at Ft. Wayne, Ind., to succeed Mr. C. F. Shelton, resigned.

MR. FREDERICK J. WHITEHEAD has been elected secretary and assistant treasurer of the Washington Railway & Electric Company, of Washington, D. C., to succeed as secretary of the company Mr. James B. Lackey. Mr. Whitehead has been with the company ten years, and is conversant with its history and affairs. In addition to his other duties he will act as head of the claim department.

MR. W. R. DICKEY has been appointed auditor of the Toledo & Western Railroad, in charge of accounting department, vice Mr. C. E. French, resigned. Mr. A. L. Bennett has been appointed trainmaster of the company, in charge of operation of trains, train crews, station agents and the distribution of freight and passenger equipment. Mr. T. U. Franklin has been appointed purchasing and freight claim agent and chief clerk to the president and general manager of the company.

MR. R. W. BROWN has been appointed superintendent of the Adrian Street Railway Company and agent for Toledo & Western Railroad, at Adrian Terminal and Wabash Subway. Mr. Brown will have charge of Toledo & Western trains and crews while on the tracks of the Adrian company. The jurisdiction of Mr. Ira P. Schofield, superintendent motive power and equipment, and Mr. J. S. Deiter, roadmaster of the Toledo & Western, have been extended over the lines of Adrian company.

MR. WILLIAM H. FORSE, JR., assistant treasurer of the Indiana Union Traction Company, has been appointed by President Tingley, of the American Street and Interurban Railway Accountants' Association, chairman of the sub-committee on interurban accounts. Associated with Mr. Forse on this committee will be Mr. A. C. Henry, auditor of the Lake Shore Electric Railway Company, and Mr. A. B. Bierck, auditor of the Long Island Railroad Company. The committee will report at the next convention upon a standard classification for interurban railway accounts.

MR. F. R. NICHOLAS, of Reno, Nev., has been appointed by Gov. John Sparks as State engineer, to succeed Mr. Henry Thurtell, who is to resume his chair as professor of mathematics in the University of Nevada. Mr. Nicholas is at present superintendent of the Reno Traction Company and chief engineer for the Nevada Power, Light & Water Company in Reno. He is also president of the Riverside Park Railroad Company, which intends to build an electric line from Reno to Laughton's Springs.

MR. C. W. CHASE, secretary of the Mobile Light & Railway Company, Mobile, Ala., has resigned to accept a position in Leavenworth, Kan. The employees of the different departments on Jan. 16, presented Mr. Chase with a solid service, consisting of five pieces in a handsome case. Mr. Z. P. Watson has been elected to succeed Mr. Chase. Mr. C. T. N. White-Spunner, who has been with the Mobile Railway & Light Company in different capacities for several years, has been elected treasurer.

MR. THOMAS F. DELANEY has been appointed foreman of the East New York elevated shops of the Brooklyn Rapid Transit Company, succeeding Mr. Ferris A. Overfield, whose resignation is announced elsewhere in this column. Mr. Delaney has been with the Brooklyn Rapid Transit Company for some fourteen years. He has been a foreman of surface car house work for the past seven years, but his wide experience with the company's equipment in general should make him well fitted to take up the elevated railway work at East New York.

MR. H. A. NICHOLL, who was elected president of the Central Electric Railway Association at the meeting of the association last week, is general manager of the Indiana Union Traction Company, embracing more than 250 miles of line. Mr. Nicholl has been engaged in electric railway work for a number of years, but formerly was connected with the Chicago & Northwestern, Yazoo & Mississippi Valley, and Illinois Central Railroads. Previous to his connection with the Indiana Union Traction Company, Mr. Nicholl was general manager of the Cleveland & Southwestern Traction Company. His connection with electric railroading includes terms of service as superintendent with the Rochester Railway Company, and as assistant manager and treasurer with the Ithaca Street Railway, Brush-Swan Electric Light Company, and Cayuga Lake Railway, all of Ithaca and under the same control.

H. A. NICHOLL

MR. FERRIS A. OVERFIELD resigned as general foreman of the East New York elevated shops of the Brooklyn Rapid Transit Company on Feb. 1, to open a general machine business. Mr. Overfield has had a very comprehensive mechanical experience both in and out of the railway field. Previous to entering the employ of the Brooklyn Union Elevated Railroad Company in 1892, as a brakeman, Mr. Overfield was track foreman on the Long Island Railroad, leaving that work to become a stationary engineer, and later to carry on a general blacksmith shop. He remained with the Brooklyn Union only a few months to take up carriage building. In May, 1893, he became a carpenter for the old Brooklyn City Railway, and resigned two years later to do similar work for the New York and Brooklyn Bridge division, on which he later became a motorman and then carpenter foreman. In November, 1901, he was appointed foreman of the bridge shops and advanced to the position of general foreman of the East New York Elevated shops on Oct. 14, 1901, which position he held until the present time. During the period that Mr. Overfield spent at East New York the layout was entirely changed, and the new yards and shops constructed as described in the series of articles beginning in this issue. This reconstruction work gave Mr. Overfield many opportunities to exercise his mechanical ingenuity in working out some of the complicated problems that presented themselves during the transformation. Mr. Overfield leaves the company with the best wishes of his associates for success in his new field.

TABLE OF OPERATING STATISTICS

Notice.—These statistics will be carefully revised from month to month, upon information received from the companies direct, or from official sources. The table should be used in connection with our Financial Supplement "American Street Railway Investments," which contains the annual operating reports to the ends of the various financial years. Similar statistics in regard to roads not reporting are solicited by the editors. * Including taxes. † Deficit.

Company.	Period.	Total Gross Earnings.	Operating Expenses.	Net Earnings.	Deductions From Income.	Net Income, Amount Available for Dividends.
AKRON, O.	1 m., Nov., '06	153,388	99,341	54,047	41,014	13,033
Northern Ohio Tr. &	1 " " '05	118,620	74,340	44,280	39,297	4,983
Light Co.	11 " " '06	1,058,674	588,647	470,026	284,932	185,094
	11 " " '05	964,215	537,676	427,538	285,797	141,742
BINGHAMTON, N. Y.	1 m., Nov., '06	21,634	13,804	7,830	7,711	119
Binghamton Railway	1 " " '05	20,489	11,947	8,541	7,282	1,260
Co.	5 " " '06	138,478	71,388	67,090	38,556	28,534
	5 " " '05	131,072	63,926	67,146	36,128	31,018
CHAMPAIGN, ILL.	1 m., Dec., '06	302,165	*168,779	133,385	......	......
Illinois Traction Co.	1 " " '05	247,449	*126,483	120,965	......	......
	12 " " '06	3,013,108	*1,651,155	1,361,952	......	......
	12 " " '05	2,442,389	*1,294,651	1,147,737	......	......
CHARLESTON, S. C.	1 m., Dec., '06	57,644	37,913	19,731	13,349	6,382
Charleston Consolidated Ry., Gas & Elec.	1 " " '05	54,596	33,371	21,225	13,167	8,059
Co.	10 " " '06	546,579	341,638	204,941	130,349	74,592
	10 " " '05	510,657	304,890	205,767	131,217	74,550
CHICAGO, ILL.	1 m., Nov., '06	96,722	56,817	39,904	26,158	13,746
Aurora, Elgin & Chicago Ry. Co.	1 " " '05	89,415	51,579	37,836	24,450	13,386
	5 " " '06	599,542	306,888	292,654	126,967	165,687
	5 " " '05	540,885	273,666	267,220	122,193	145,027
Chicago & Milwaukee	1 m., Dec., '06	80,615	33,112	47,503	......	......
Elec. R.R. Co.	1 " " '05	66,584	24,199	42,384	......	......
	12 " " '06	884,207	366,397	517,810	......	......
	12 " " '05	594,875	244,552	350,323	......	......
CLEVELAND, O.	1 m., Nov., '06	18,057	11,931	6,127	6,658	†531
Cleveland, Painesville	1 " " '05	20,392	10,841	9,551	7,108	2,442
& Eastern R.R. Co.	11 " " '06	225,248	131,126	94,121	74,031	20,090
	11 " " '05	250,945	134,045	116,900	76,747	40,153
Cleveland & Southwestern Traction Co.	1 m., Dec., '06	52,431	28,895	23,536	16,917	6,619
	1 " " '05	47,540	26,548	20,992	13,955	7,038
	12 " " '06	645,850	363,856	281,994	179,252	102,742
	12 " " '05	543,227	314,254	228,973	152,693	76,280
Lake Shore Electric	1 m., Nov., '06	61,592	35,903	25,690	20,450	5,240
	1 " " '05	61,501	33,992	27,509	20,404	7,105
	11 " " '06	796,128	436,806	359,322	224,653	134,669
	11 " " '05	721,711	393,830	327,881	224,446	103,435
DALLAS, TEX.	1 m., Nov., '06	82,081	*66,150	15,931	15,883	48
Dallas Elec. Corp'n.	1 " " '05	104,111	*52,039	52,072	14,618	37,454
	12 " " '06	1,018,432	*676,495	341,937	184,671	157,266
	12 " " '05	920,051	*565,702	354,349	182,357	171,992
DULUTH, MINN.	1 m., Nov., '06	65,393	41,271	24,122	17,851	6,271
Duluth St. Ry. Co.	1 " " '05	55,154	30,597	24,557	18,171	6,385
	11 " " '06	702,285	377,200	325,085	194,345	130,740
	11 " " '05	602,333	311,906	290,427	188,349	102,078
EL PASO, TEX.	1 m., Nov., '06	35,672	*25,995	9,677	4,067	5,610
El Paso Electric Co.	1 " " '05	25,480	*17,510	7,970	3,823	4,147
	12 " " '06	378,185	*264,040	114,145	46,831	67,314
	12 " " '05	286,116	*188,015	98,101	42,874	55,226
FT. WAYNE, IND.	1 m., Nov., '06	93,143	54,156	38,987	......	......
Ft. Wayne & Wabash	1 " " '05	80,474	46,926	33,548	......	......
Valley Tr. Co.	11 " " '06	1,007,813	618,949	388,864	......	......
	11 " " '05	862,171	530,503	331,668	......	......
FT. WORTH, TEX.	1 m., Nov., '06	67,485	*43,763	23,722	9,942	13,780
Northern Texas Tr. Co	1 " " '05	66,271	*36,247	30,023	9,938	20,086
	12 " " '06	832,681	*535,707	296,975	119,296	177,679
	12 " " '05	658,906	*387,077	271,829	117,372	154,457
GALVESTON, TEX.	1 m., Nov., '06	25,801	*15,149	10,652	4,167	6,485
Galveston Elec. Co.	1 " " '05	22,523	*13,757	8,765	4,167	4,599
	12 " " '06	310,480	*187,969	122,510	50,000	72,510
	12 " " '05	265,940	*184,643	81,297	41,667	39,631
GLENS FALLS, N. Y.	3 m., Dec., '06	123,667	98,378	25,289	49,729	†24,440
Hudson Valley Ry. Co.	3 " " '05	114,045	71,368	42,677	64,218	†21,541
	12 " " '06	599,828	371,721	228,107	235,813	†6,706
	12 " " '05	538,997	320,282	218,715	259,483	†40,768
HANCOCK, MICH.	1 m., Nov., '06	18,545	*11,994	6,552	3,907	2,645
Houghton County St.	1 " " '05	15,215	*11,067	4,148	3,749	400
Ry Co.	12 " " '06	226,125	*146,069	80,056	46,807	33,249
	12 " " '05	167,294	*169,996	†2,703	43,205	†45,907
HOUSTON, TEX.	1 m., Nov., '06	57,105	*35,198	21,907	7,792	14,115
Houston Electric Co.	1 " " '05	52,236	*33,572	18,664	9,049	9,616
	12 " " '06	583,647	*376,667	206,980	94,276	112,704
	12 " " '05	509,008	*307,211	201,796	105,025	96,771
KANSAS CITY, MO.	1 m., Nov., '06	466,220	230,388	235,832	145,529	90,302
Kansas City Ry. & Lt.	1 " " '05	431,486	208,514	222,971	137,299	85,672
Co.	6 " " '06	2,872,989	1,414,620	1,458,369	869,724	588,646
	6 " " '05	2,596,240	1,263,397	1,332,843	820,459	512,383
LONG ISLAND C., N.Y.	3 m., Dec., '06	204,752	149,319	55,433	50,817	4,616
New York & Queens	3 " " '05	188,856	125,501	63,355	50,986	12,369
Co. Ry. Co.	12 " " '06	900,063	601,560	298,503	203,725	94,778
	12 " " '05	795,330	515,445	279,885	204,066	75,819
MANILA, P. I.						
Manila Elec. R.R. &	1 m., Dec., '06	46,500	23,250	23,250	......	......
Ltg. Corp., Ry. Dept.	12 " " '06	513,801	267,674	246,127	......	......
	1 " " '06	85,300	42,233	43,067	......	......
All Depts.	12 " " '06	909,080	464,623	444,457	......	......
MILWAUKEE, WIS.	1 m., Dec., '06	435,006	157,942	277,064	96,874	180,191
Milwaukee Elec. Ry.	1 " " '05	400,905	138,565	262,341	83,087	179,254
& Lt. Co.	12 " " '06	3,679,229	1,734,587	1,944,642	1,073,515	871,127
	12 " " '05	3,348,696	1,551,463	1,797,233	931,016	866,217
Milwaukee Lt., Ht. &	1 m., Dec., '06	86,447	25,035	61,412	28,417	32,995
Tr. Co.	1 " " '05	78,464	19,561	58,903	22,807	36,096
	12 " " '06	733,049	277,416	455,632	324,715	130,917
	12 " " '05	639,128	252,557	386,572	255,314	131,258
MINNEAPOLIS, MINN.	1 m., Nov., '06	458,637	224,969	233,668	117,258	116,410
Twin City R. T. Co.	1 " " '05	417,218	190,360	226,859	113,208	113,650
	11 " " '06	5,149,896	2,402,455	2,747,441	1,236,169	1511272
	11 " " '05	4,320,887	1,961,448	2,359,440	1,113,425	1246015
MONTREAL, CAN.	1 m., Nov., '06	263,260	174,933	88,327	39,276	49,051
Montreal St. Ry. Co.	1 " " '05	232,635	153,628	79,008	22,074	56,933
	2 " " '06	545,083	331,174	213,909	79,886	134,023
	2 " " '05	482,424	295,309	187,115	43,137	143,978
NORFOLK, VA.	1 m., Nov., '06	127,256	74,260	52,996	......	......
Norfolk & Portsmouth	1 " " '05	115,494	65,796	49,697	......	......
Tr. Co.	11 " " '06	1,356,348	837,571	518,777	......	......
	11 " " '05	1,236,644	744,063	492,581	......	......
PHILADELPHIA, PA.	1 m., Dec., '06	234,983	......	......	......	......
American Rys. Co.	1 " " '05	215,308	......	......	......	......
	6 " " '06	1,490,940	......	......	......	......
	6 " " '05	1,358,963	......	......	......	......
PLYMOUTH, MASS.	1 m., Nov., '06	7,215	*5,474	1,740	1,814	†74
Brockton & Plymouth	1 " " '05	6,595	*5,268	1,327	1,828	†501
St. Ry. Co.	12 " " '06	111,109	*70,450	40,660	21,844	18,816
	12 " " '05	101,422	*71,563	29,859	21,346	8,514
ROCHESTER, N. Y.	3 m., Dec., '06	589,695	410,032	179,663	101,770	77,893
Rochester Ry. Co.	3 " " '05	499,539	300,389	199,150	92,237	106,913
	12 " " '06	2,280,452	1,418,613	861,839	402,665	459,174
	12 " " '05	1,930,880	1,079,009	851,879	369,316	482,563
ST. LOUIS, MO.	1 m., Dec., '06	782,515	*463,591	318,924	198,026	120,898
United Railways Co.	1 " " '05	730,462	*428,522	301,940	198,609	103,331
of St. Louis	12 " " '06	9,146,348	*5,567,412	3,578,936	2,377,476	1201460
	12 " " '05	8,460,016	*5,318,369	3,141,647	2,387,915	753,732
SAVANNAH, GA.	1 m., Nov., '06	45,049	*32,594	12,455	11,300	1,155
Savannah Electric Co.	1 " " '05	50,420	*28,413	22,007	11,155	10,852
	12 " " '06	616,706	*383,736	232,970	134,065	98,905
	12 " " '05	580,544	*343,357	237,187	127,342	109,845
SYRACUSE, N. Y.	1 m., Dec., '06	104,816	63,807	41,009	24,358	16,651
Syracuse R. T. Co.	1 " " '05	90,953	50,982	39,971	20,723	19,248
	12 " " '06	1,099,762	853,016	246,746	279,915	187,372
	12 " " '05	964,233	736,704	227,529	245,358	170,157
TAMPA, FLA.	1 m., Nov., '06	48,791	*28,355	20,436	452	19,984
Tampa Elec. Co.	1 " " '05	45,108	*24,210	20,899	1,894	19,004
	12 " " '06	465,414	*271,821	193,593	1,695	191,898
	12 " " '05	408,063	*237,085	170,979	22,714	148,264
TERRE HAUTE, IND.	1 m., Nov., '06	75,437	*43,899	31,538	13,596	17,942
Terre Haute Tr. & Lt.	1 " " '05	55,459	*33,883	21,576	10,429	11,147
Co.	12 " " '06	800,954	*464,696	336,258	157,158	179,100
	12 " " '05	620,768	*407,350	213,418	120,652	92,766
TOLEDO, O.	1 m., Nov., '06	172,728	*94,521	78,207	42,845	35,362
Toledo Rys. & Lt. Co.	1 " " '05	164,418	*86,389	78,029	42,825	35,204
	11 " " '06	1,860,762	*977,209	883,553	466,807	416,746
	11 " " '05	1,737,711	*888,296	849,415	467,846	381,569
WASHINGTON, D. C.	1 m., Dec., '06	18,460	11,197	7,262	......	......
Wash. Alexandria &	1 " " '05	20,529	11,880	8,649	......	......
Mt. Vernon Ry. Co.	12 " " '06	273,267	147,849	125,418	......	......
	12 " " '05	251,643	135,022	116,623	......	......

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During 1906 *the Street Railway Journal printed and circulated* 426,950 *copies, an average of* 8210 *copies per week. Of this issue* 8000 *copies are printed.*

Investigation on Useless Weight of Cars

The action of the Central Electric Railway Association at the Indianapolis meeting providing for the appointment of a special committee to look into the matter of reducing the unnecessary weight of cars is certainly a timely one, and the results of the committee's investigation will be looked forward to with expectancy. The question of the weight of electric cars has received very little consideration, and it certainly has not been given the attention that it deserves. That it is important may be comprehended with very little calculation. Assume that a car weighing 50,000 lbs. is operated at a current cost of 2 cents per mile, and that this car is run 50,000 miles a year, or an average of about 140 miles per day. The total cost of power for the year will be $1,000, or it will be 2 cents per pound of weight of the car. Assuming a car to last ten years, every pound saved in the weight of a car without the sacrifice of carrying capacity, strength or any other benefit means 20 cents to the operating company in the cost of power alone.

But some may question whether or not much weight can be saved without sacrificing some valuable feature. In this connection it might be stated that one company operating in a large city has made a reduction of 500 lbs. in the weight of its car by the substitution of pressed steel seat pedestals instead of those of cast iron. According to the assumptions made above this company will save in power during the lifetime of a car about $100 per car. The company will probably order several hundred cars of the type upon which the improvements have been made, and no one will question whether or not this step, which may result in a saving of several thousand dollars, is worthy of attention.

No doubt if an average car were subjected to a close examination and estimates were made on the probable saving in weight of fittings and attachments alone it would be found that in the neighborhood of 2 per cent of the weight of the car could be gotten rid of. The results of the study of the Central Railway Committee on this point will be of value. There are, to be sure, other advantages to be gained by eliminating unnecessary weight in cars aside from the lessening of the power required to operate the cars. The consideration that should be most effective is that decrease in cost will in most instances go hand in hand with decrease in weight.

Inspection of Line Lightning Arresters

The master mechanic's duties as a general rule should be limited to the maintenance of the cars, so that the care of the line lightning arresters logically should be left to the line department. On the other hand, the condition of the lightning arresters usually has so much influence on the expense of maintenance of the cars that from this standpoint it is advisable to put the inspection of these arresters in the charge of the most interested party, the master mechanic. If this were done, the chances are very great that the arresters would be kept in better shape than when they are in charge of the line department. The line department is not inconvenienced in the least when arresters are neglected, but the fear of having a wholesale grounding of armatures as sometimes occurs during serious storms would keep the master mechanic on the alert with regard to the condition of every arrester on the line. If some one else has the care of the arresters the master mechanic can plead the negligence of others whenever cars are put out of service

during a storm. The line department may throw part of the blame back from whence it came and scatter the rest so that censure for the neglect loses much of its effect.

One thing is certain: time spent in keeping arresters in working condition is very seldom wasted, whether it be done by the shop or the line department. Some people are too prone to regard lightning as being too mysterious to be controlled and to consider as unavoidable those cases where armatures are lost through this cause. But we have a great deal of evidence that where lightning arresters are properly installed and then properly cared for the cars go through storms repeatedly without damage. An incident on one road shows what can be obtained in the way of effects when proper steps are taken. A small city system had been continually losing armatures through lightning. A few days after a new superintendent assumed charge about half the motors on the system were disabled during a storm. The new superintendent started to inspect the arresters next day, and discovered that practically all of the few he could find were not in working order. He immediately sent in an order for enough lightning arresters to equip the whole system at 500-ft. intervals, and heavy choke coils were gotten on the cars as soon as possible. Since the installation of these only one or two machines have been disabled during storms.

A few instances of this character show that faith must not be lost in the present form of arresters. It is possible that some people who are prone to depreciate them don't give them a chance. They expect them to give perfect protection when installed at possibly one-mile intervals, and to give this protection without any attention or inspection whatever. In the instance cited the arresters were placed ten to the mile. Usually they are spaced from two to five per mile, but it might be a good investment on any line where lightning is especially destructive to approximate more or to follow the practice on the small system.

Difficulties in Terminal Design

For a business which fundamentally consists of the apparently simple task of picking people up at one point and carrying them to another, always along a fixed path and for the exceedingly moderate sum of a nickel apiece, it is at times surprising even to the eye of experience that every act performed in electric railway work carries with it such far-reaching consequences. As the years of urban trolley operation lengthen into decades it becomes more and more apparent that every decision of an active street railway management with respect to design, construction or operation facilitates or impedes traffic, tends to reduce or increase the cost of maintenance, and either makes for better or poorer public service.

The relations between car design and traffic congestion illustrate these points fully, and that the importance of studying the best forms of cars for different conditions is fully appreciated by electric railway men can be doubted by no one who realizes the development which is at present taking place in the fitting of rolling stock to the public's needs. The difficulties of the problem, especially in rapid transit service, are very serious, and they are complicated to no small degree by the influence of station design upon the congestion of travel.

Experience with different types of stations, and particularly rapid transit terminals, has not been lacking in the past ten years, yet the unsettled questions are almost as stubborn as at first. The difficulties encountered in trying to satisfy the wishes of the public, meet the judicial criticisms of municipal and State authorities, and conserve the profitable and economical movement of traffic are most perplexing. One can sit in his office with a pad and pencil and figure by the hour all sorts of smooth running schedules over loops, assuming uniform station stops cut down to fifteen or twenty seconds each by an obliging public, moving the streams of entering and leaving passengers in polite curves past one another over wide platforms to their desired destination, and in general planning for a continuous flow of traffic through proper channels; but let these schemes be put in actual operation, and how quickly assumptions become invalidated! Irregularities develop in the flow of passengers past the ticket offices; people crowd into cars partly filled rather than entering cars practically empty; congestion occurs at doors, stub track berths and newspaper booths; station stops consume twice the estimated time, and finally, the intervals between cars run short and long because of external causes beyond the control of the company. The narrowing of a doorway by 3 ins., the closing of a ticket office at 6:30 p. m. instead of at 6:45, the increasing of the height of the risers in an approaching stairway by ½ in.—these minute architectural and operating features and others which might be named by the score by any one who has ever tried to design a terminal or to oversee the movement of traffic carry a weight in the resulting success of the transportation scheme. The difficulty of foreseeing future conditions makes it doubly hard to know what dimensions and arrangements are best for the long-run good of the service.

One of the most trying of these questions is whether passengers shall be transferred between cars and trains at the same level or whether surface cars shall keep to the surface and elevated or tunnel trains remain above or below ground. Off-hand it would seem to be a clear case that a direct transfer at one level is preferable on all counts, but when one considers the need of future expansion in rapid transit terminals, the question arises whether a double or triple-level arrangement may not finally prove best. The inevitable law of rapid transit facilities that new routes and opportunities to travel create new traffic and soon become inadequate applies as much to a terminal station as to the tracks and rolling stock. It is hard to foresee the conditions, and platform room which looks ample for years to come when a station is built may easily have to be increased 50 to 75 per cent within five years. Such extensions may be almost impossible if the transferring cars are brought to a common level. Again, the cost of operating cars up the 4 or 5 per cent grades common in inclined approaches to one-level terminals is another consideration, while the difficulty of running cars into a ground-level and second-story terminal without complicating the highways below too much for public satisfaction is a troublesome problem in itself, well-nigh impossible of solution.

Problems of this kind cannot all be perfectly solved in any single terminal scheme. Compromises must be inevitable results of attempts to attain an ideal design. Several

points are apparently pretty well established, however,—the superiority of loop over stub track layouts, the desirability where possible of avoiding stair climbing in making transfers, the very slight need of much waiting room area in urban terminals with frequent car service, the immense advantage of separating opposing traffic streams even if a double stop at loading and unloading platforms is entailed, the value of wide platforms with straight edges parallel to the tracks, the worth of a simple and effective scheme of visually announcing car and train destinations, and finally, in very congested stations, the need of platform attendance with special police powers to cope with disorder, confusion and bewilderment among passengers. The combination of these features in the most reasonable scheme must be the basis of solution in the modern terminal problem.

Substitutes for Copper

The present enormous price of copper is a rather serious matter for electric roads that are compelled to install it on their feeder systems. Copper has now reached a price so high as to make it necessary to look sharply into the question of substitutes. Whatever may be the cause of the present prices, and information differs with respect to this, they have persisted in a way that has been both disappointing and unexpected to those who are compelled to use the metal. Nothing like it has before been known, and if it be due to actual scarcity it is certainly high time to seek other material for conducting purposes. If, on the other hand, the price is in whole or in part due to artificial causes, then its persistence over a long period argues the probability of a continuance or of the repetition of the same conditions, and leads to the same conclusions.

The two substitutes for copper most available at the present time are aluminum and iron. The former has been within the past few years extensively used as a conductor. In the earlier stages of its employment people were rather afraid of it as of uncertain tensile strength and lack of capacity for making sound joints. Its high coefficient of expansion made it somewhat difficult to string, and many engineers were decidedly afraid of it. At the present time experience has removed most of these fears. Stranded aluminum cables as at present manufactured have proved reliable and they are now being successfully employed in a good many high-voltage systems. The tensile strength of such cables is about equivalent to that of soft-drawn copper, but their relatively small weight enables them to be used with a somewhat greater factor of safety. The question of joints, too, seems to have been satisfactorily settled by the use of aluminum sleeves put on under pressure, and while the joints are more troublesome to make than in copper, we have not heard of late of any material difficulty with them when once in place. In fact, there has been recently a considerable tendency to use aluminum for long spans on account of its relatively small weight. It is also claimed that aluminum conductors are less likely to hold sleet than copper ones, and hence are less exposed to destructive strains.

With respect to cost the current price of aluminum is largely regulated by that of copper, since owing to the patent situation aluminum manufacture is at present a monopoly. Those competent to judge of the cost of producing it practically agree in holding that it can profitably undersell copper at any price reached by the latter metal within recent years. As a matter of fact its market price can be counted upon to keep materially below that of copper, and the chief present difficulty is that of securing reasonably prompt deliveries. A few years hence, when the patent situation clears itself up and foreign producers of aluminum reach the American market, the effect upon the price of copper will be very considerable and a repetition of the present situation will be well nigh impossible.

For all overhead feeder construction aluminum is surely available if it can be secured at suitable price. For working conductors and for underground cables copper has the advantage, but these uses are on the whole of a subsidiary character. With respect to iron or steel the case is different. The conductivity of steel rails, for example, is an eighth or a tenth that of copper. At any high price of copper, however, steel for equal conductivity is and is likely to remain the cheaper, particularly if, as is possible in some instances, old rails can be used for conducting purposes. On elevated structures and in subways the location of such conductors is comparatively an easy matter and they have been used to a limited extent. Of course, old rails are available only in relatively short lengths, generally 30 ft., and the question of joints is a somewhat serious one. Rails can be electrically well united, however, by electric or some other form of welding and even by some forms of bonding, and since a 70-lb. rail has conductivity about equal to a million circular mils of copper, the fundamental economy of its use is evident even at a considerable expense for making suitable joints. It is even possible to use such a conductor underground in a plank conduit filled with an insulating compound at a price probably considerably below that of insulated copper cable installed in a conduit. Of course, the utility of steel as a conductor is greatly limited by the difficulty incurred in attempting to use it with alternating currents, but as a direct-current feeder under favorable circumstances, steel, with copper at anywhere near its present price, deserves to be seriously considered.

Beyond all this consideration of metals lies the possible chance of relief by the use of high-voltage distribution for electric railways, and the last two years have made a prodigious difference in the conditions of economy as between loss of energy and investment in copper. Kelvin's law applied to the present price of copper and the present cost of the electrical energy generated in large stations, leads to results very different from those obtainable a few years ago. The application of alternating current in railway practice may make also a great change in the existing situation. With small working conductors supplying energy over long stretches of track and fed from aluminum cables transmitting high-voltage current, an electric railway within the next few years may be far less at the mercy of the copper market than is now the case. Certainly a continuance of exorbitant price of copper demands earnest consideration of every possible means of relief. Of course, copper is likely to fall in price, but if it has once reached, naturally or artificially, the figures now current, the same causes may again maintain it for long periods at high prices, and one might as well begin at once the investigation of means for avoiding its use in its present large quantities.

THE ELEVATED SHOPS AND TERMINALS OF THE BROOKLYN RAPID TRANSIT COMPANY—THE INSPECTION AND TRUCK OVERHAULING SHOPS AT EAST NEW YORK

INSPECTION SHOP

The inspection shop is located just west of the main shop building and on a level with the second floor. The construction of a building for inspection pure and simple is another evidence of the care that the Brooklyn Rapid Transit Company is giving to the maintenance of its rolling stock. Where inspection is done in the open the inevitable consequence is that in cold or otherwise disagreeable weather the inspectors cannot perform their duties properly. Hence, slight defects are frequently overlooked and receive no attention until some serious breakdown occurs. Without question, an inspection shop that is comfortable in all kinds of weather more than pays its cost by the reduction it brings in the repair and accident accounts.

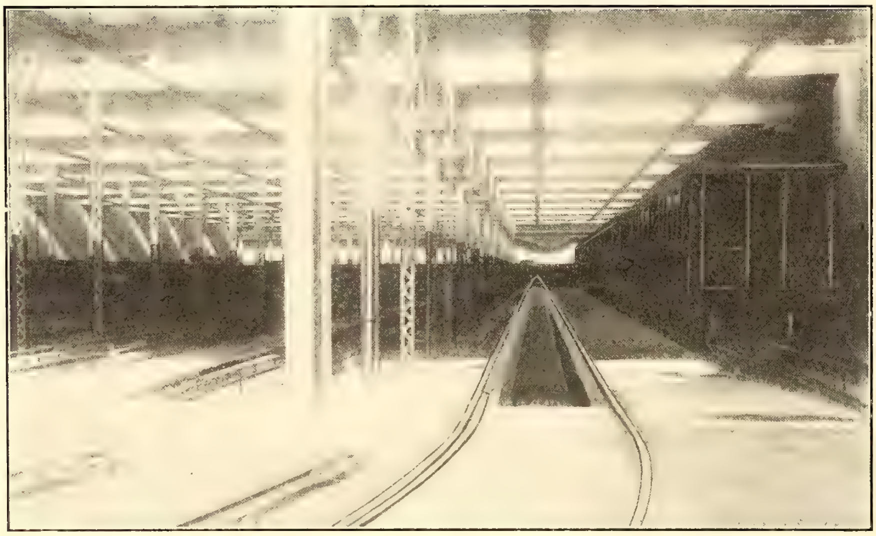


FIG. 14.—PART ENTRANCE VIEW OF THE INSPECTION BUILDING

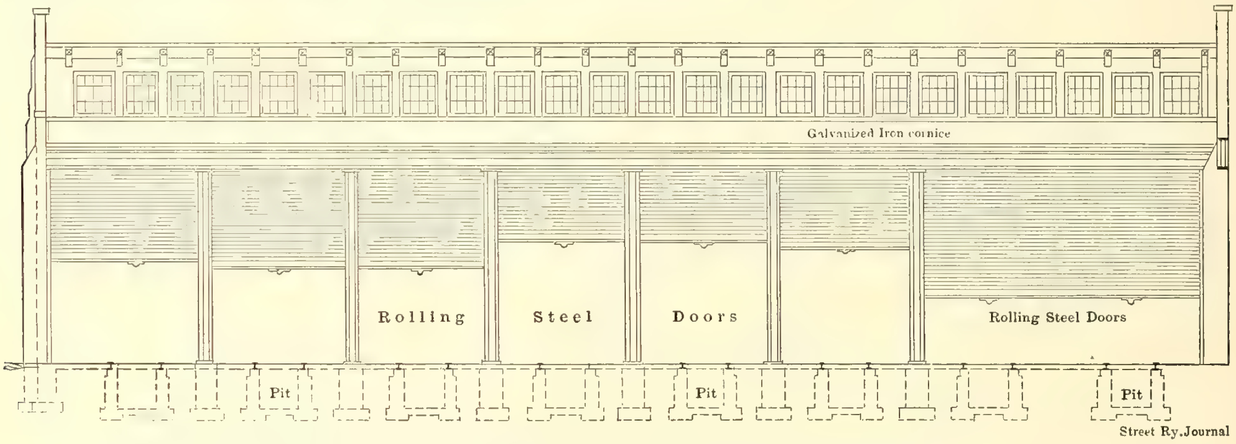


FIG. 15.—FRONT ELEVATION OF THE INSPECTION BUILDING AT THE OPEN END

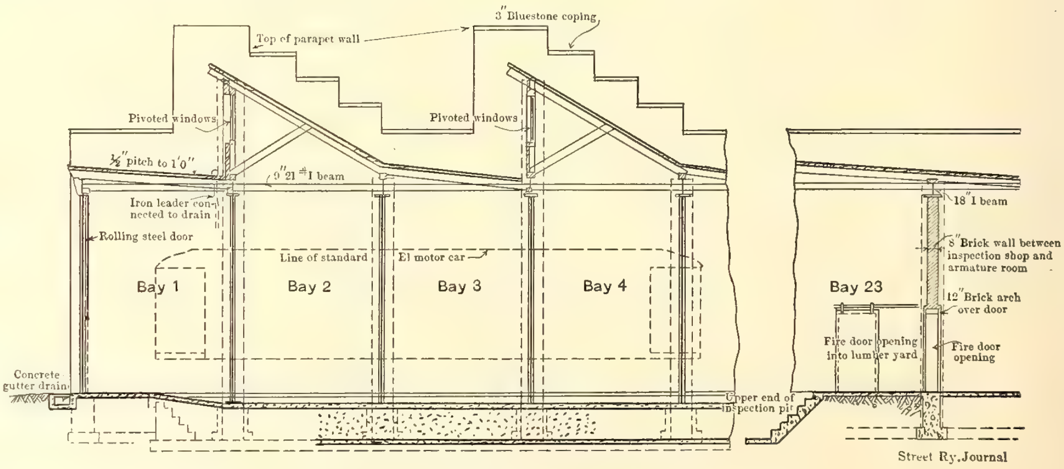


FIG. 16.—PART LONGITUDINAL SECTION OF THE INSPECTION SHOP AND ADJACENT ARMATURE ROOM

This shop is really a complete building, as it is open only on the side entered by the eight inspection tracks from the storage yard, and even this side may be closed by lowering the one double and the six single steel rolling doors. The work done here covers almost everything that can be done without the aid of machinery, such as the inspection of the air-brake mechanism, including the compressor and hose connections; of the electrical wiring, motors and controllers throughout the train; brake rods and shoes; third-rail shoes; chipped flanges on wheels, broken axles, gears, etc. This inspection is divided among specialists in each line, so there is no difficulty in finding the man responsible for any particular defect which may later show up in service.

Each inspector is supplied with a pad of the motor and trail car forms shown in Fig. 17, on which he writes the numbers of the cars inspected and then returns the form with any remarks relative to work that requires special attention. It is customary for the man signing these forms to give his time-card number, as the latter indicates at once to the recording clerk what class of labor has been performed on the car. The reports from different men who worked on one car are then transferred to a motor-car record similar to the one for trailers, reproduced in Fig. 18, the classification covering practically every mechanical and

Form N. S. 639 100 Books. 5-13-5 O-82067

THE BROOKLYN HEIGHTS RAILROAD CO.
ELEVATED DIVISION.

30 DAY
MOTOR-CAR OVERHAULING REPORT

..................Shop. Date..................190

CAR NO.	CAR NO.	CAR NO.	CAR NO.	CAR NO.

General Remarks..................

Original (white) to be forwarded DAILY to the Mech. Eng.'s Office.
Duplicate (yellow) to be left in book.

FIG. 19.—REPORT ON MOTOR-CAR OVERHAULING (NOW DONE EVERY SIXTY DAYS)

N. S. 405. 500 Pads. 10-3-06. O-85217

The Brooklyn Heights Railroad Company
ELEVATED DIVISION

..................190....

Inspect the following **MOTOR** cars for

and put in good condition.

I have inspected and put above in good condition, except the following, which must have special attention

(Sign)..................

FIG. 17.—ORDER COVERING THE INSPECTION OF MOTOR (OR TRAIL) CARS

electrical feature in connection with rolling stock.

At the present time it is customary to overhaul motor cars every sixty days, although the form reproduced in Fig. 19 calls for thirty days. This report is made out in duplicate, the original being forwarded to the office of the superintendent of equipment, where detail records are kept of all shop matters relating to equipment.

An important function of the inspection shop is the help it affords the claim department by giving it a complete account of the condition of a car before a certain accident, what was done to repair it and the probable cause of the trouble, whether due to defects in equipment or crew. This system will be clearly understood by reference to the accompanying reproduction in Fig. 20 of the report made out by the foreman of the eastern elevated division on Aug. 9, 1906, on motor car No. 653. It will be noted that the condition of the car before the accident is determined from the records already given, which show that the car

L DIVISION — MONTH OF
GENERAL INSPECTION OF TRAILER CAR NO.
SHOP — FIRE EXTINGUISHER NO

CLASSIFICATION	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23	24	25	26	27	28	29	30	31
Car Bodies																															
Gates-Railings																															
Trucks Brakes																															
Lights-Wiring																															
Air Brakes																															
Journal Oiling																															
Receptacles																															

FIG. 18.—TRAIL-CAR REPORT ON GENERAL INSPECTION

Form N. S. No. 99. 25M. 8-24-05 O-66476

INSPECTION OF CAR.

REPORT.

Car No. 653 Line Canarsie Date of Accident Aug. 19th, 1906.

Date of Inspection August 19th, 1906

Claim Agent:

DEAR SIR:—The following facts are, to the best of my knowledge and belief, a correct and full statement of the condition of Car No 653 previous to and after the accident of August 19th, 1906

CONDITION OF CAR BEFORE ACCIDENT.

From Motorman's report of car when last turned in. (Give name, date and report.)

Last inspection and repairs previous to accident. (Give date when inspected, night or day, when repairs were made and what they were.)

Motor 653 - In for Gen. Inspection Aug. 14th, 1906
Overhauling " 10th, "

CAUSE OF ACCIDENT.

(If any part of the mechanism of the car, either electrical or mechanical, is found to have been out of order at the time of the accident, state whether they could or could not cause the accident.)

The 10:46 P.M. train from Canarsie Terminal, consisting of cars Nos. 618, 757, 751 and 653, in charge of Motorman McCann, trolley pole left trolley wire and struck span wire, bending same and in the rebound, cut hole in roof.
Cause of accident - trolley pole leaving trolley wire while train was in motion.

FIG. 20.—FIRST PAGE OF INSPECTION REPORT ON CAR INJURED IN ACCIDENT, SENT TO THE CLAIM DEPARTMENT BY THE SHOP FOREMAN

CONDITION OF CAR AFTER ACCIDENT.

(Examine carefully and report on all parts of car, truck, motors, wiring, etc. Give especial attention to those parts which may have been or are claimed to have been the cause of the accident.)

Motor 653 - Given a general inspection and found O.K. in every respect, with the exception of the foregoing.

(If any part is found to be out of order after the accident, state whether the accident could have been the cause or not.)

Additional information,

Cost to repair Motor 653: Material -- $3.00
Labor ----- 2.00
Total -- $5.00

Respectfully submitted,

..................*Name.*

Foreman East. El. Div. *Occupation.*

II
WGG

FIG. 20—(CONTINUED).—SECOND PAGE, CONTINUING THE REPORT ON CAR INJURED IN AN ACCIDENT

had been inspected on Aug. 14, 1906, and overhauled on Aug. 10, 1906. Under "cause of accident" a summary is given of the operating features in connection with this car, a description of the accident and its cause. Following this, under "condition of car after accident," the report shows that with the exception of the parts injured by the accident, the rest of the car was O K. Hence, in this case no defect in the car itself was responsible for the trouble. It will be noted that the estimated cost of repairing the damage is also given.

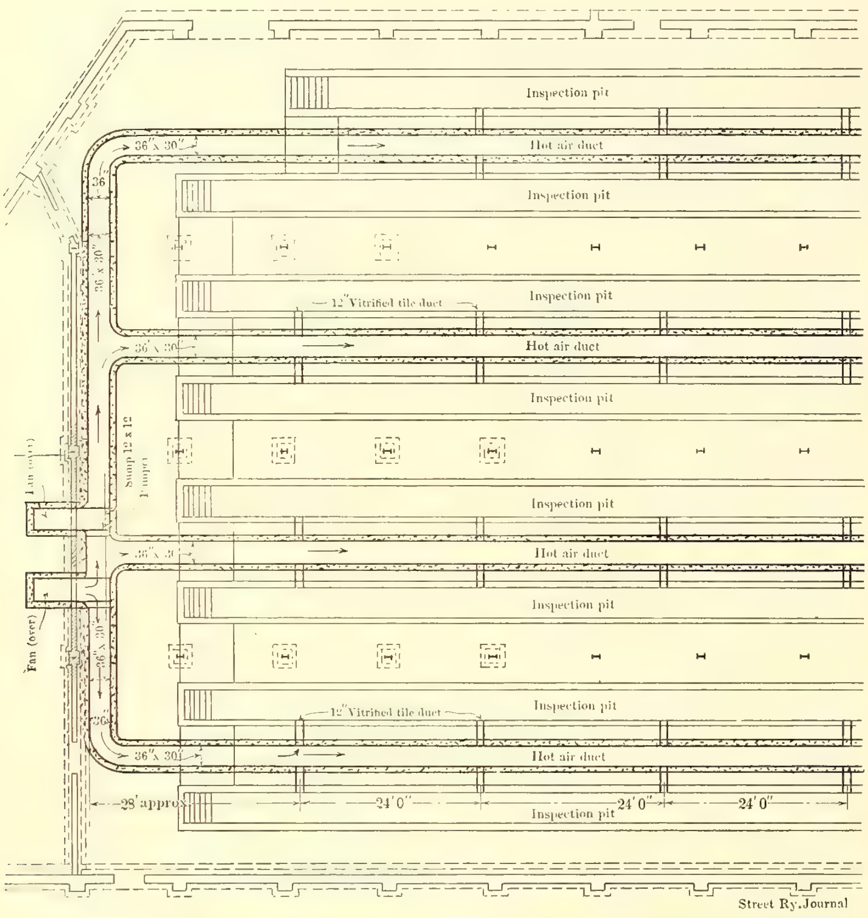


FIG. 21.—PART PLAN OF INSPECTION SHED, SHOWING METHOD OF HEATING THE PITS

Every track in the shop is provided with a concrete pit 4 ft. 3 ins. deep throughout the entire length. The concrete steps at the ends of the pits are reinforced with metal tubes at the edges to prevent chipping by the fall of heavy brake-shoes, etc. These pits are heated by air conveyed from two heaters in the armature room through 12-in. vitrified ducts with openings in the pit walls placed 24 ft. apart, as shown in Fig. 21. When desired, this heat can be cut off by dampers.

The superiority of this method of pit heating over the use of steam pipes is so obvious as hardly to require comment. There are no leaks from bad piping connections, so that the pits are always dry; no projections or narrow gaps between pipes and the pit walls to catch all manner of dirt and other refuse, thus keeping the pits clean; nor is there any hindrance to the free movement of the pit man, as he is in no danger of coming into contact with hot pipes, and the presence of the dampers also enables him to regulate the amount of heat to suit his personal convenience. Of course in the summer time it is just as easy to convey cold air to the pits, so that this method of distribution is of equal value for the workers' comfort throughout the year. While the first cost of a heating installation of this character is more than the direct steam heating method, the cost of maintenance is far less, and the convenience to the men so much greater that the difference in outlay is easily balanced by the better work secured.

The pits are illuminated by incandescent lamps spaced 10 ft. staggered and grounded on the rails. As shown in Fig. 22, the lamps are set in recesses of the concrete pit walls. This arrangement fully protects the lamps from breakage, besides offering a good reflecting surface. At the head of each inspection track will be found a large can for the deposit of oily waste so that there is no excuse for leaving inflammable material scattered around loose to litter up the pits and cause possible fires.

A valuable kink noted in this department is the novel wall-rack for storing twenty-five trolley poles with their wheels and harps complete. The rack is shown in Fig. 23. It consists of hooks turned in to hold the pole, which can be moved only slightly to the right or left and yet can be lifted out easily by raising it a few inches. When in position on this rack the poles take up very little room, since they are parallel with and almost touch the wall. This method also makes it easier to keep track of the number of poles on hand than if they were stacked up in corners or encumbering the floor.

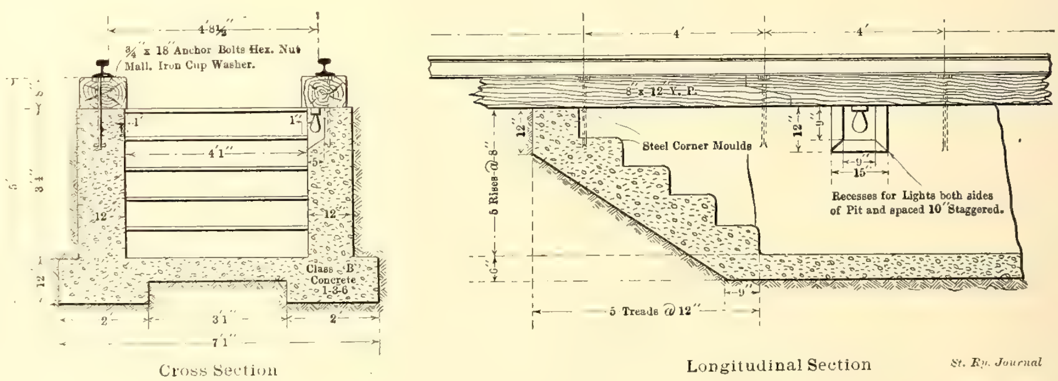


FIG. 22.—DETAIL OF STANDARD INSPECTION PIT FOR ELEVATED CARS, SHOWING THE LIGHTING

THE ARMATURE ROOM

The armature room is placed directly behind the inspection shop, from which it is separated by a brick wall. Owing to the shape of the lot at this point, this room forms a right-angle triangle with the longest side facing Bushwick Avenue. This side is furnished with the same style of windows as the Gillen Place side of the main shop, and as in the latter the work benches are placed along the wall where the light is best.

The heaters which furnish hot air for the inspection pits are installed in this room on the side nearest the inspection shop, so that no light is cut off from the work bench. To economize space, all of the apparatus is mounted on a platform supported by steel columns. The heating plant consists of two groups of steam coils, which are supplied from the 3-in. pipe running through the blacksmith shop, and two 48-in. diameter fans which force the heated air into the ducts leading to the pits. The fans are belt-driven from two 12½-hp Northern Electric motors. The latter are of the variable-speed type to enable the fan speeds to be changed as heating conditions demand.

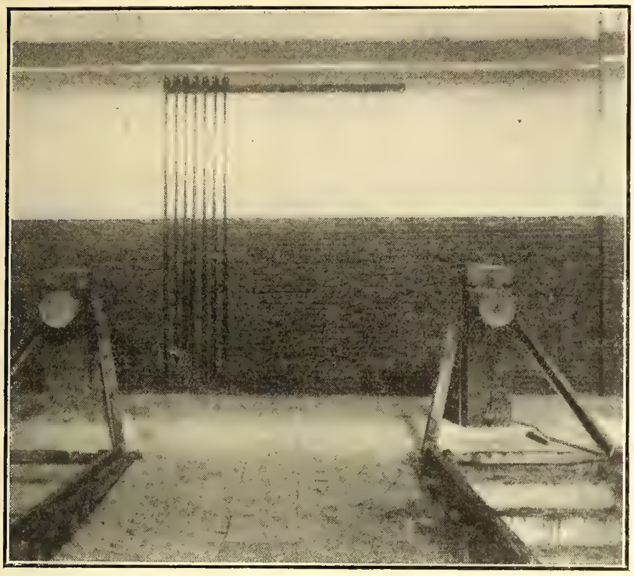


FIG. 23.—VIEW FROM HEAD OF THE PITS, SHOWING STEPS AT THEIR ENDS, BUMPERS, AND ALSO WALL RACK FOR POLES

The armature oven in this room is a two-story brick structure placed in the northwest corner, with a stairway leading to the upper level. Both floors are made of iron gratings and are served by I-beam cranes for the transportation of heavy armature coils or fields in and out of the oven. Where the I-beams intersect in the interior, the continuity of either track is obtained by operating a switch to shift in the proper direction the piece common to both beams, forming, as it were, a trolley turntable. This arrangement allows coils to be put in at one door and taken out at the other. Reference should be made to Fig. 26 for the full construction details of this interesting armature oven.

Winding work has not yet been started in this shop, but two armature banding lathes have already been furnished by the American General Engineering Company, of New York. These lathes are driven from a line shaft by a 5-hp Northern Electric motor, which forms a part of motor-group E. At present all rewinding and other armature repairs are made at the Fifty-Second Street shops of the company.

TRUCK-OVERHAULING SHOP

When a car is in need of overhauling it is brought in from the yard on one of the two trucks on the second floor of the main shop. If only work on the car body is needed, the car comes in on the outer track so it will not interfere with cars whose trucks are to be removed. Cars requiring truck repairs come in on the inner track, which leads to the elevator connecting with the truck-overhauling shop below. Originally there was no intention of installing pits for these tracks, but despite their location, directly over the chief crane runway of the truck-overhauling shop, it was

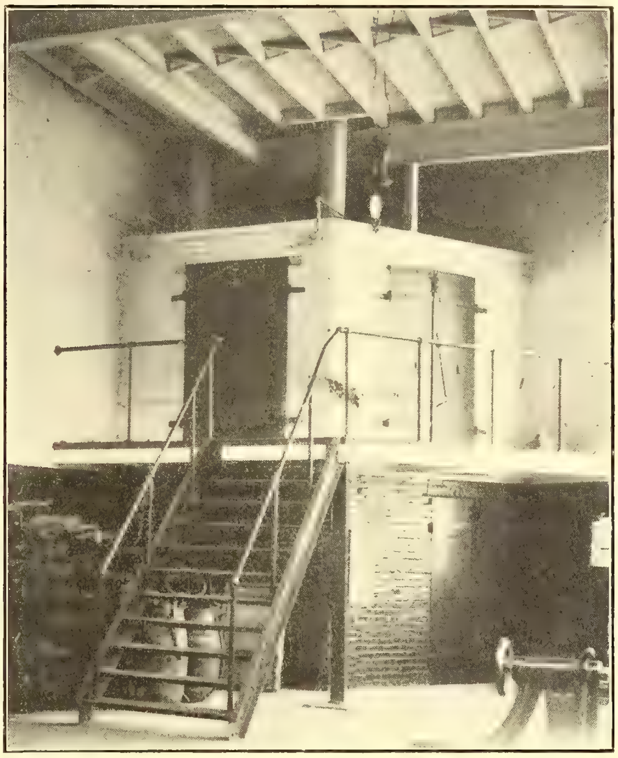


FIG. 25.—THE TWO-STORY ARMATURE OVEN

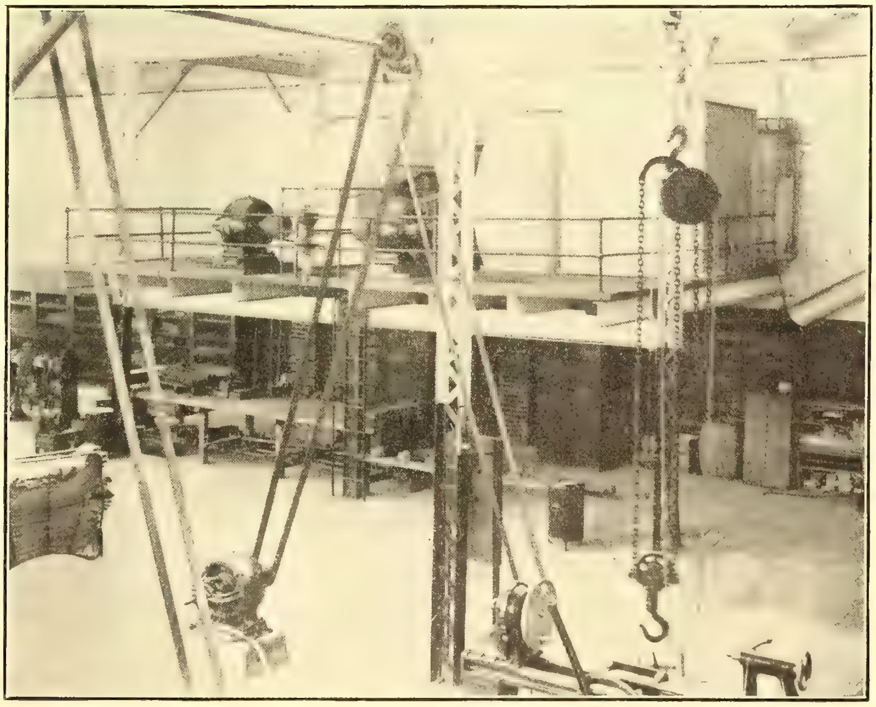


FIG. 24.—A VIEW IN THE ARMATURE ROOM, SHOWING THE PIT-HEATING PLANT MOUNTED ON A PLATFORM, BELTED MOTOR FOR ARMATURE-BANDING LATHES, CHAIN HOIST, FIRE HOSE, ETC.

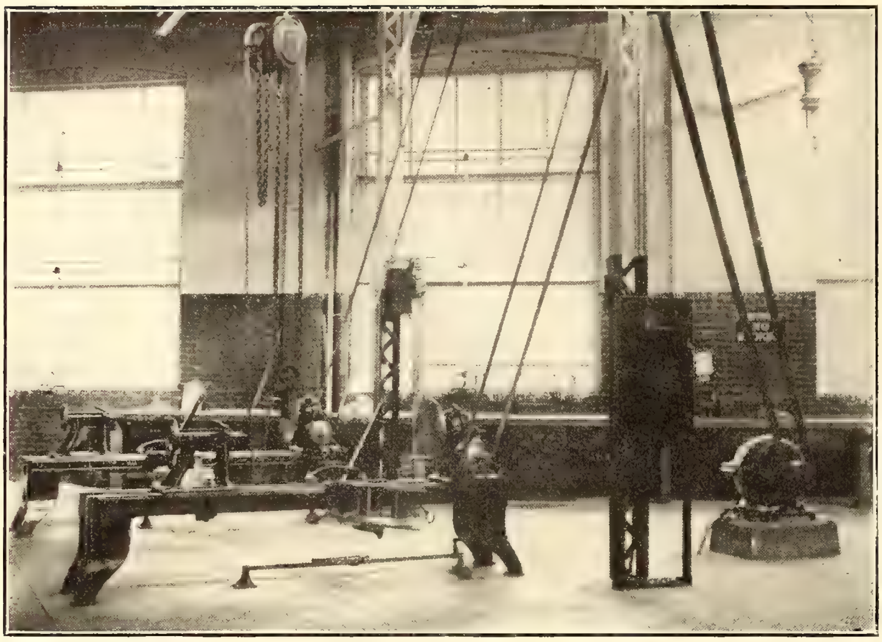


FIG. 27.—ARMATURE-BANDING LATHES AND BELTED MOTOR DRIVE

found that pits could be built to a depth of about 24 ins. These shallow pits are very convenient for connecting or disconnecting brake rigging, examining journal boxes and doing other light work on trucks.

It is customary by 7 a. m. every morning to have four to six trucks lowered to the overhauling shop, thus providing plenty of work for the overhauling men until the full number of trucks is in the hands of the ten truck-repair gangs. The earlier trucks are usually ready to be returned by noon so that the day is occupied by lowering trucks in the forenoon and raising them in the afternoon. Consequently this scheme of handling the work avoids contrary motion of trucks and permits the best exploitation of the elevator throughout the day.

To remove a truck one end of the car is run over far enough to

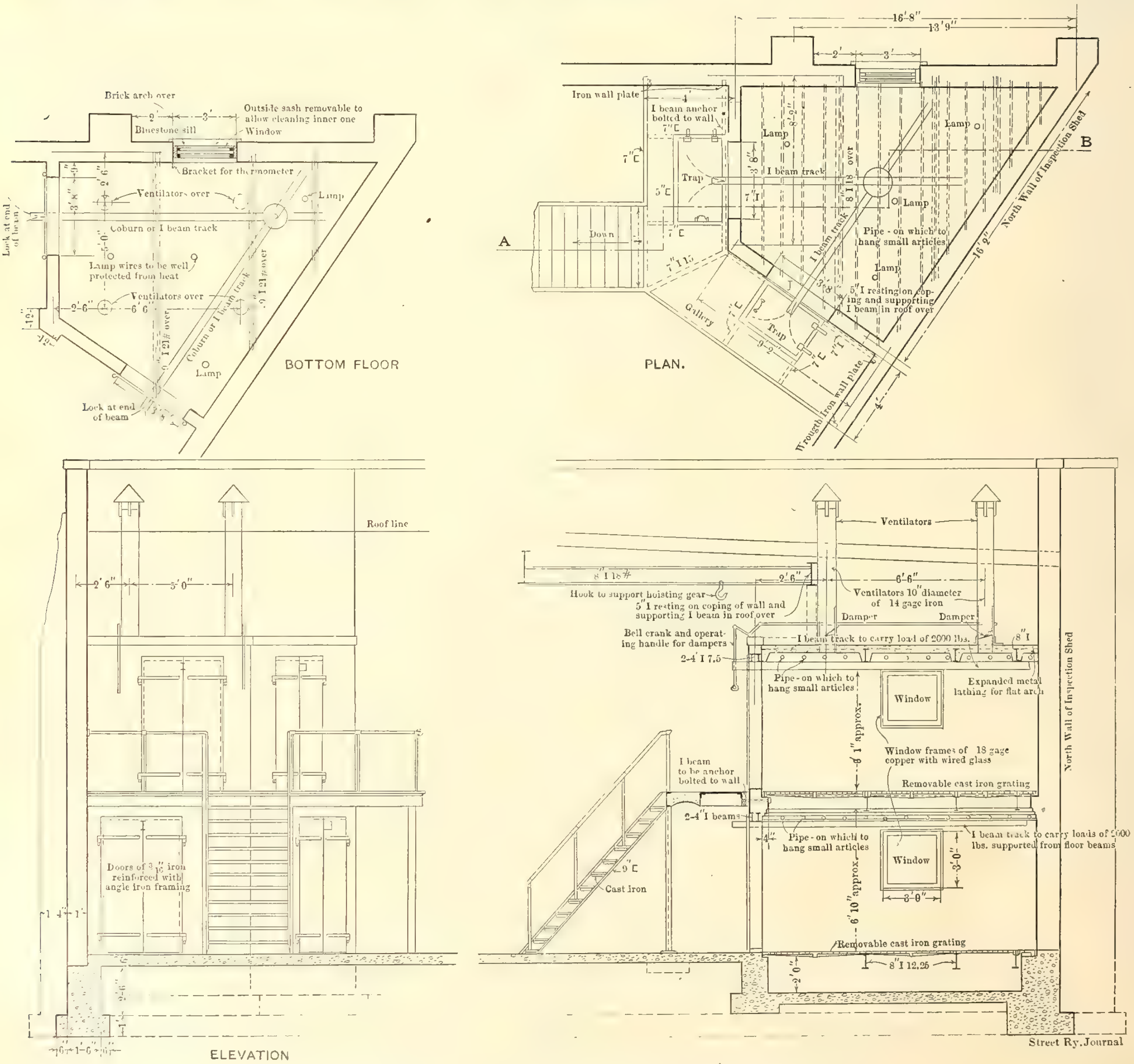


FIG. 26.—ELEVATION, SECTION AND PLANS OF ARMATURE OVEN

have the trucks rest on the elevator. The elevator is raised slightly; the struts shown in Fig. 29 are then swung under the car body to hold the same in position, thus permitting the truck to be lowered to the overhauling shop. A dummy truck is then sent up to enable the car to be run off the elevator. The car is then shifted to a convenient side track and not returned to the elevator until the original truck has been overhauled and returned. The dummy trucks are of iron and steel and are very substantial. Ten of them are in use—enough for easily handling ten to twenty cars in a ten-hour day. The elevator for this work

FIG. 28.—THE TWO TRACKS ON THE SECOND FLOOR OF MAIN SHOP BUILDING; THE INNER TRACK LEADS TO THE ELEVATOR

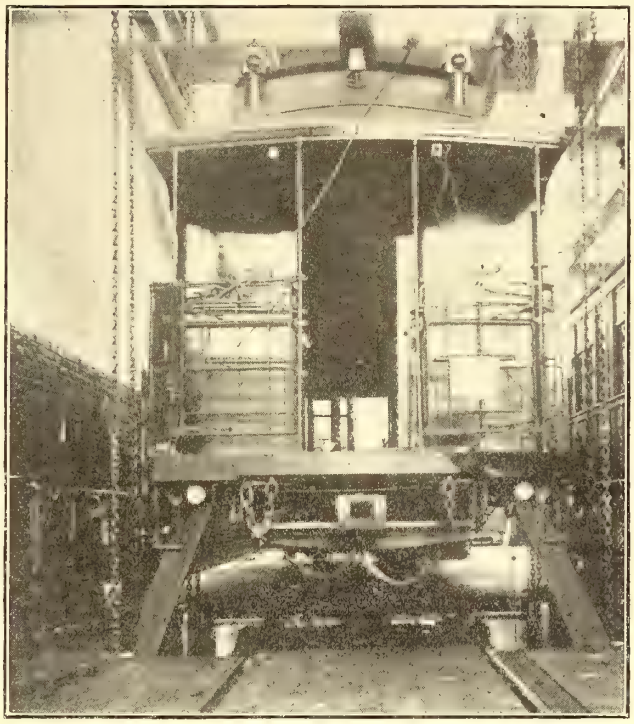


FIG. 29.—WOODEN STRUTS USED IN THE EAST NEW YORK SHOPS TO HOLD UP CAR OVER ELEVATOR WHILE TRUCK IS BEING REPLACED BY A DUMMY

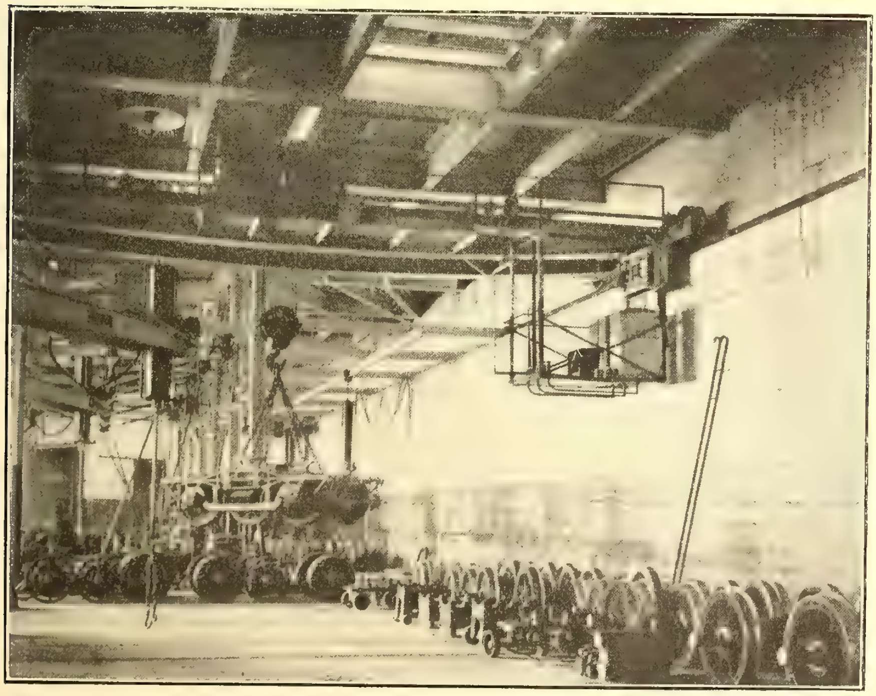


FIG. 30.—PART OF THE TRUCK-OVERHAULING SHOP, SHOWING A TRUCK BEING RAISED OVER THE OVERHAULING TRACKS, THE WHEEL-STORAGE TRACKS, ETC.

is of the Otis plunger type, 24 ins. diameter by 25-ft. lift and is operated by a 60-hp Otis motor and a Quimby rotary pump.

The truck-overhauling shop proper is on the lower floor, extending for a distance of 235 ft. parallel with the machine shop and forming the west bay of the main shop building. Along this side and in line with the elevator there is a double track which runs the entire length of the shop. The outside-inside rails are 22 ins. apart so that almost as many wheels and axles can be stored as on two pairs of rails, each taking up the space required for a standard-gage track. This space is large enough to prevent the flanges of one pair of wheels coming into contact with the axle bearings of another pair.

This double track is served by a Shaw 25,000-lb. electric traveling crane, which handles complete trucks, armatures, wheels and axles as well as other heavy parts. From the southern end of the crane travel, there is a runway about 100 ft. long for a pneumatic hoist to carry wheels to a grinder placed at the end of these wheel storage tracks.

For transmitting power to move motor trucks along the tracks leading to and from the elevator, a K-14 controller furnished with 28 Westinghouse resistance grids is placed on the wall near the elevator shaft. In circuit with this controller there is a flexible cable with three contacts conveniently arranged for connection with the leads of one of the truck motors. By this simple but effective scheme a motor truck can be moved by its own power for a distance of 50 ft. or more from the elevator.

In addition to the wheel storage tracks in the truck overhauling shop there are twelve stub tracks running at right angles to the long double tracks. When a truck is taken off the elevator to be overhauled, the large crane is used to carry it to the most convenient stub-track. This track arrangement is much better than having the trucks

repaired on one or two long tracks. Every truck can be overhauled on its own track, and the gang working on it will therefore not be inconvenienced by having trucks or other apparatus moved over their heads while they are at work. Five of these stub-tracks are also valuable in another way as they terminate within 8 ft. to 12 ft. of the be incurred if all heavy parts had to be moved by the single large crane.

One of the interesting features of the overhauling shop in the way of space, economy and equipment protection is the type of armature racks of which the construction details are given in the accompanying Fig. 31. At present

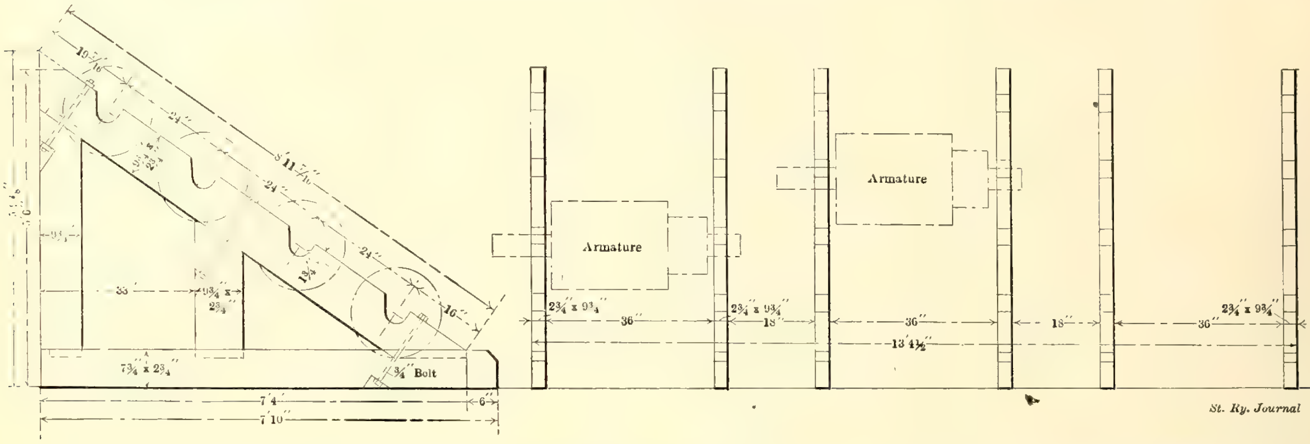


FIG. 31.—TYPE OF ARMATURE RACKS USED IN THE EAST NEW YORK SHOPS, SHOWING HOW THE DIFFERENCE IN THE SPACING OF THE MIDDLE RACK PERMITS CLOSER STORING OF THE ARMATURES

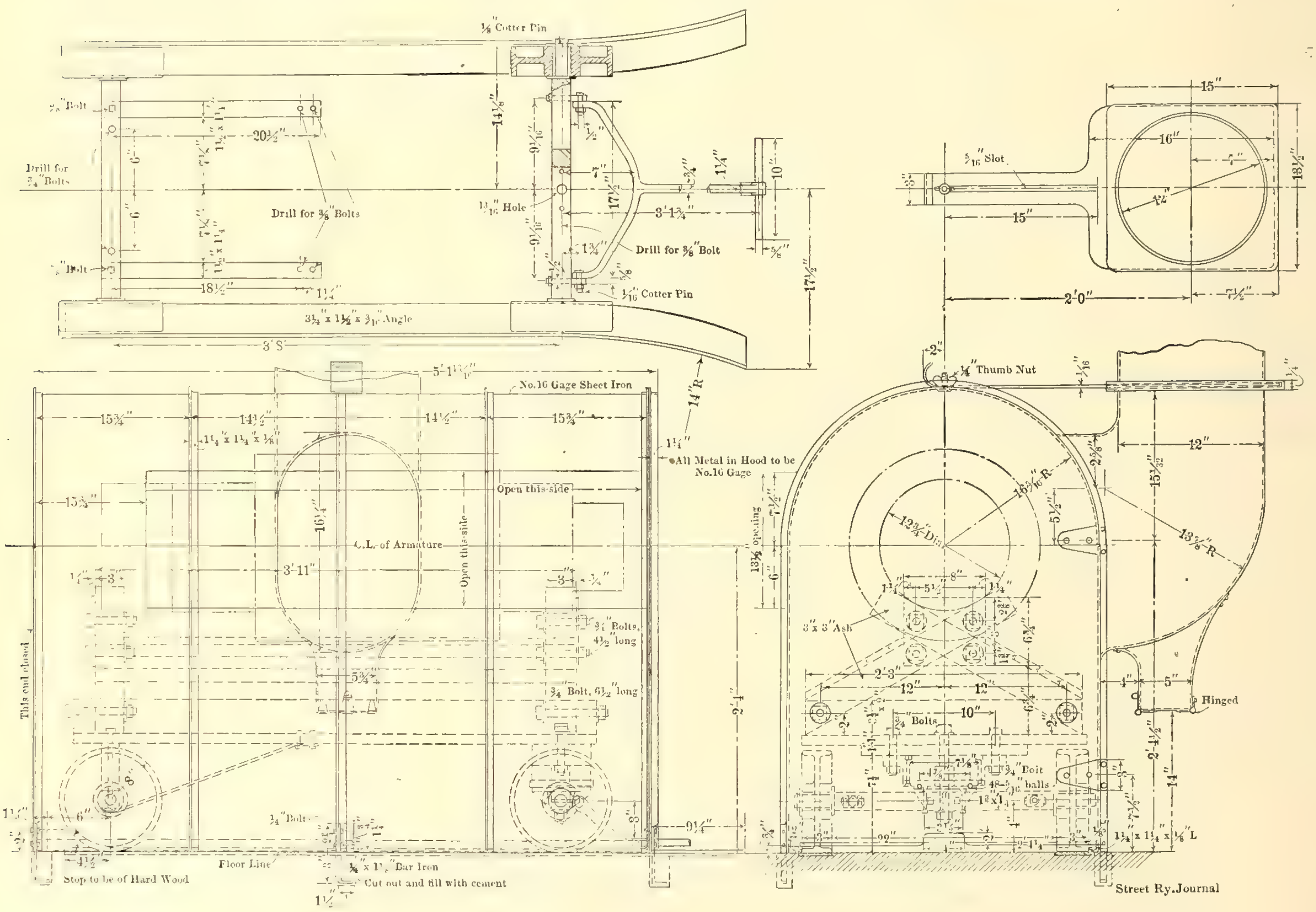


FIG. 32.—CONSTRUCTION DETAILS OF ARMATURE TRUCK AND SECTION SHOWING POSITION OF TRUCK WHEN THE ARMATURE IS IN THE EXHAUSTER

wheel lathes in the machine shop, thereby saving considerable labor in handling wheels and axles.

These stub-tracks are served by five Pedrick-Ayres two-ton jib cranes, fitted with the latest type of safety air hoist, for handling motor shells, armatures, wheels, etc. This auxiliary crane equipment avoids the loss of time that would three racks are in place near the elevator, two holding four Westinghouse No. 50 armatures each and the middle rack three more armatures of the same type. The middle rack is made for three armatures only, so that the projecting shaft of the armature on the other racks will have the necessary clearance, also enabling the racks to be placed closer

to each other. The storage of armatures in this manner is also an excellent way to keep them from the injury they would be subjected to if allowed to remain on the floor.

The method used here of driving all dirt and metallic dust out of armatures is a simple but absolutely effective combination of the compressed air and vacuum processes. The armature to be cleaned is placed on a small hand truck with

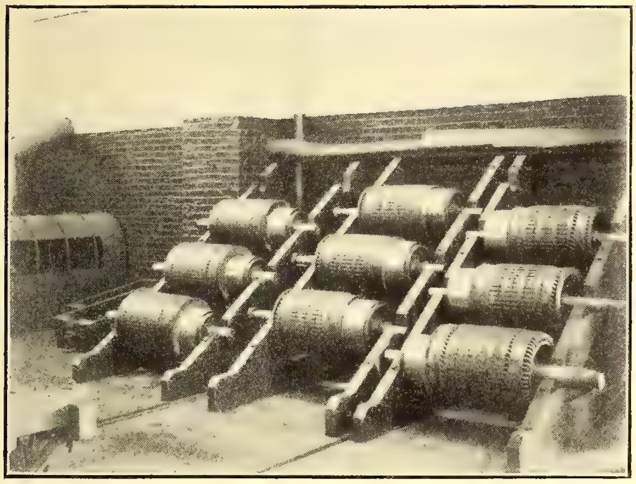


FIG. 33.—ARMATURE RACK AT EAST NEW YORK, SHOWING THE DIFFERENT SPACING OF THE MIDDLE RACK TO ALLOW THE AXLES TO OVERLAP. PART OF THE ARMATURE EXHAUST IS SHOWN AT THE LEFT

wooden saddle and is then carried into a low oval-shaped exhaust chamber near the armature racks. Here every part of the armature is treated with compressed air directed at about 85 lbs. pressure from a hose held by the operator, the exhauster immediately carrying away the released particles through a 12-in. pipe connected to the exhaust system of

Form N. S. 407. Eagle —[illegible]—9-19-06—10M

THE BROOKLYN HEIGHTS RAILROAD COMPANY. ELEVATED DIVISION ______ SHOP

MOTOR AND TRUCK REPORT.

Motor / Trailing *Truck No.* ______ *Taken from Car No.* ______ *Date* ______ 190

REPAIRS NEEDED:

REPAIRS MADE:

REMOVED.		CAUSE.	PUT IN.	
No. 1 Motor No.	Arm. No.		Motor No.	Arm. No.
No. 2 Motor No.	Arm. No.		Motor No.	Arm. No.
No. 3 Motor No.	Arm. No.		Motor No.	Arm. No.
No. 4 Motor No.	Arm. No.		Motor No.	Arm. No.
Wheel Nos.			Wheel Nos.	

Put Under Car No. ______ Date ______ 190 Inspected by ______

FIG. 34.—STANDARD MOTOR AND TRUCK REPORT, INCLUDING MOTOR AND ARMATURE DETAILS

the mill room on the floor above. Fig. 32 gives the complete construction details of the armature truck and also its position in the exhausters.

In the shop a covered tank which can hold about 100 gallons of oil and 100 lbs. of waste has been installed for storing packing for the armature axle journal bearings. In this tank there is a screen about 18 ins. from the bottom and covering about one-half the area. Waste is first put into the lower part of this tank and allowed to soak for 24 hours, after which it is placed on the screen long enough to drain sufficiently before it is placed in the different bearings on the truck. By this practice all good waste removed from journals is soaked with new oil and used several times. Consequently the amount of new waste required daily is comparatively little.

Fig. 34 shows the style of motor and truck report sent by the truck-overhauling shop to the office of the superintendent of equipment, covering repairs needed and made. Space is left on this form for similar references to motors and armatures.

CAR DESIGN FOR RAPID TRANSIT SERVICE DISCUSSED IN ENGLAND

The comparative failure of the Metropolitan District Railway, of London, to achieve the results expected by its promoters from its electrification has led to a great deal of speculation in London as to the causes. The facts are that the operating expenses, number of passengers carried and receipts have increased but the two latter items have not grown in the ratio desired or predicted. In an article on this subject which appears in a recent issue of the London "Electrical Review," Phillip Dawson, the prominent electrical engineer, attributes the greater part of the trouble to the design of car used. This car is known in England as the "American" type, that is, it has end platform doors with a single side door, in distinction from the usual side-door compartment car used on the steam lines. Other reasons given for the poor results secured are the competition from the tremendous number of motor omnibuses which have been installed in London during the last few years, and the competition of the tramways. The most important factor, however, according to the writer, is the design of car used, which in his opinion militates very much against rapid filling and entering and encourages strap hanging. Mr. Dawson's preferred design for a car of this class of service is one which he recommended in an article in the Street Railway Journal for April 7, 1906. It is the same as used on the Prussian state railways for its Hamburg and Berlin service, and is also practically the Illinois Central car with vis-a-vis cross seats on one side of the car and an 18-in. aisle on the door side. The car is not reversible, but must always be run in the same direction. Its multi side doors can be made sliding and be opened and closed by pneumatic pressure if it should seem desirable. Mr. Dawson does not think this necessary, however, with single-phase traction, owing to its comparative slow acceleration. He therefore recommends swinging doors which can be closed by the platform guards as a train pulls out of the station. Such a car, according to the author, should have from eight to ten doors, would seat from 30 to 40 per cent more passengers in the same area than the center-side-door car, and would be very much quicker at stops.

Officers of the Spokane & Inland Empire Railway Company and the Washington Water Power Company have contributed $9,500 to the Spokane Y. M. C. A. building fund. The first company gave $5,000 and the other $4,500.

PAVING BETWEEN STREET RAILWAY TRACKS AND RAILS *

BY B. J. T. JEUP, OF INDIANAPOLIS, CITY ENGINEER

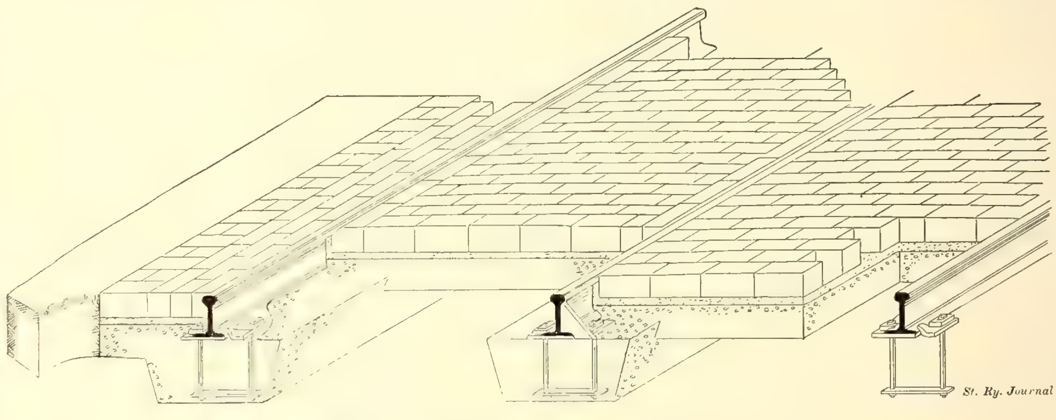
Most franchises granted in recent years to street railway companies contain provisions describing in general terms the kind of rail and the paving between the tracks. By the terms of the franchise granted to the Indianapolis Street Railway Company in 1899, for instance, the company agrees that "The tracks of the said company shall at all times be kept in repair, provided with the most modern and improved rail of sufficient size and weight"; and the same franchise and contract require the company to pave the space between the rail and the space of 18 ins. outside of the outer rails with the same material and in the same manner as the remaining portion of the street, or to improve said space with other materials in accordance with the specifications prepared by the Board of Public Works of the city. Owing to the improvements that are being made in rails and in the methods of track construction and in paving, the provisions in franchises covering the kind of rails are usually and naturally indefinite. This indefiniteness has, however, given rise to clash of opinions between street railway officials and municipal authorities as to the kinds of rail which comply with the terms of the contract and franchise. After years of controversy opinions still differ as to the kind of rail best suited for our streets. To illustrate:

In the STREET RAILWAY JOURNAL of Jan. 5, 1907, an article is printed on "Track Construction and Other Improvements of the Tri-City Railways" (Rock Island, Moline, Ill., and Davenport, Ia.) in which appears the following: "As the city ordinances in all three of the cities did not permit T-rail construction, girder rails were at first employed in the new work. However, permission was obtained from the City Council at Davenport to lay 800 ft. of double track with T-rails in paved streets in order that the advantages and disadvantages of this construction might be observed. The location chosen for this strip of track was a point where it would receive the hardest usage from crossing wagons. It is interesting to note that within three weeks from the time permission was obtained to lay the strip of track the T-rails were ordered, were rolled and were on the ground. After a trial section had been in use for a few months and after frequent inspections had been made by the members of the Council, permission was granted to use T-rails in all the new track work in Davenport. It is expected that permission will be obtained from the city authorities in Rock Island and Moline to use the same rails."

In the same number of the STREET RAILWAY JOURNAL we read an account of a discussion of the rail question by J. L. Adams, general manager of the Western Division of the Indiana, Columbus & Eastern Railway Company on the one hand, who advocated the use of T-rails, and City Engineer of Hartford, Conn., on the other, who appeared for the city, advocating grooved rails. In Columbus the traction company is very firm in its determination to use T-rail on account of the greater safety in running its cars, so that the question of the kind of rails in Columbus will probably have to be settled in the courts. Here we see the municipal authorities of the two cities arriving at diametrically opposite conclusions.

RAILS

Without going into a history of the development of the rails for street railways, it may be said that various modifications in size and shape have been made from time to time, which has resulted in three prevailing types: First, the T-rails, the rail used in steam railroad practice; second, the girder rail; third, the grooved rail, reaching into its state of perfection, it is said, in the Trilby rail used in Philadelphia, and weighing 137 lbs. per yard. This grooved rail is, strictly speaking, a development of the girder rail. All of these three types vary in height and weight according to various practice. With the advent of large interurban cars into cities upon tracks of the street railway companies much track had to be rebuilt, and considerable rail of the girder type became practically useless. I recall that on one of the lines in this city the interurban cars entered the city on the wheel flanges, and I remember seeing the tram of a comparatively new girder rail worn through in a very short time by the grinding action of the flanges of the interurban cars. The old type of grooved rail was found also to be useless for interurban cars with their deep flanged wheels.



ISOMETRIC VIEW OF T-RAIL CONSTRUCTION

Railway companies advocate the use of a T-rail, and the arguments they present in favor of this section over grooved rails are the following: First, less resistance to tractive force; second, ease of and better installation; third, long life of rails; fourth, greater safety of traffic; fifth, minimum track expense. In the above arguments the one that appeals to the city authorities is the safety of traffic. High-speed interurban cars have deep-flanged wheels. The tendency of the times in wheel construction of these cars is for the adoption of the M. C. B. flange of steam railroads. Serious danger has developed on operating these cars on city tracks where these tracks are of the ordinary girder type, or the old standard grooved rail. The railroad companies further object to the grooved rail on account of trouble in keeping the groove clean.

From the standpoint of a city, it makes little difference as to the kind of rail which is used where the streets are wide and where there is no teaming on the space occupied by the street railway tracks. But in cities where the streets

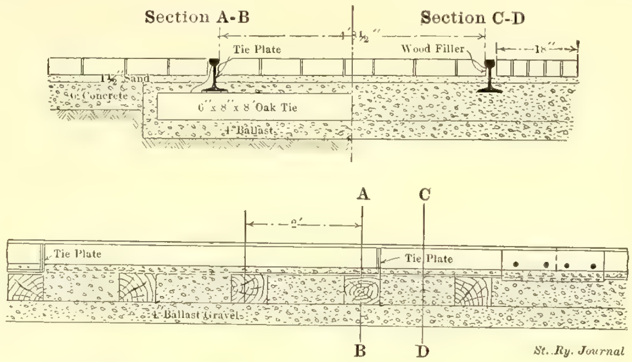
* Paper read at the Indianapolis meeting of the Indiana Engineering Society, Jan. 17, 18 and 19, 1907.

occupied by street railway tracks are narrow, the municipal authorities rightfully demand a rail which offers the minimum obstruction to teaming and which will cause the least derangement and deterioration of pavements along the rail, and at the same time a rail which will be safe for the traveling public.

To remove the objection made by this city to the ordinary form of T-rail used by interurban companies, and to combine the advantages of both the T-rail section and the advantages of the grooved rail, a method of construction was agreed on between the city and the railroad companies which I will describe. A heavy T-rail section of special design was rolled weighing 91 lbs. to the yard, heavier than is usually used for many of the steam railroad tracks. The depth of the rail is 7 ins. It, therefore, has the advantage of the rigidity and stability of girder rail. A deep groove is formed by the use of a large nose block placed as a stretcher along the inside of the rail. The space between the nose blocks is paved in the ordinary manner with vitrified paving block in courses at right angles to the nose block. Vehicles turn out of the space between the rails as easily in this form of construction as out of grooved rails. There is some evidence of wear on these nose blocks, and as an improvement I would suggest a form of asphalt block of similar design which would have toughness rather than the brittleness of brick and would wear by matting rather than by chipping. The use of this heavy, deep T-rail with a large nose brick is a construction which has met with the approval of a large number of engineers who have visited the city. It is a form of construction which has all the advantages of a T-rail as ordinarily used, and possesses such features of the grooved rail as are desired by city authorities.

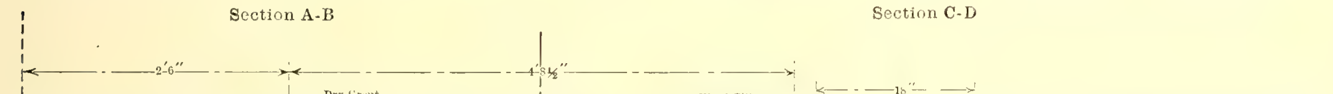
PAVING BETWEEN THE RAILS

For terminal tracks used by interurban cars, the best and heaviest construction is none too good. In this city such rails have been laid on Portland cement base, with concrete stringers, the rail being anchored to the concrete at intervals of 3 ft. 4 ins., and ties being spaced about 10 ft. apart for the purpose of maintaining the track in position during the laying of the concrete. In parts of this city where the tracks are used by the city cars, and by one or two lines of interurban railways, oak ties are used and the concrete is placed between the ties. We have many forms of paving



T-RAIL CONSTRUCTION ON 4-IN. BALLAST AND 6-IN. CONCRETE

construction in this city: Asphalt between the tracks, with a stretcher of brick or granite on each side of the rail, a header of brick, with two stretchers of brick alternating; asphalt placed against the rail and against a Haydon block on the inside of the girder rail, with brick or stone block pavement. The practice has been in this and other cities to put in nose brick or nose block, or a cast-iron block on the inside of the rail, with the paving between the rails laid in courses at right angles to the rail. The paving of the 18-in. strip on the outside of the rail has been either of brick or stone block, laid in courses at right angles to the rail, or in courses parallel to the rail. Some cities are still using wooden block between the tracks laid in a manner similar to that of construction with paving brick.



DETAILS OF T-RAIL CONSTRUCTION WITH CONCRETE AND SAND

The experience of this city is opposed to the use of creosoted wooden block, however well they may be treated, as a paving material between tracks. It is only a question of a short time until sufficient oil has exuded from the blocks to enable them to absorb water, when they swell and seriously interfere with the alignment of the track.

Sheet asphalt, in fact any sheet pavement, as a rule, is very unsatisfactory for paving between the tracks, and has only given partial satisfaction with heavy grooved rail construction. It is now the generally accepted opinion that the paving between the track should be some form of block pavement, either brick or stone or asphalt block—a pavement which can be laid by the railroad company and taken up and replaced when joints, ties, bonds, etc., are to be renewed. Such a pavement can be repaired more promptly when so directed by the city, because the company need not await the pleasure or convenience of paving companies to make repairs. In the city brick is now almost universally used for paving the space between the rails.

I am of the opinion that a heavy T-rail construction with a large nose block forming a groove, and modified to remove some minor objections which have developed, together with a brick pavement laid on a well-built Portland cement concrete base, will be entirely satisfactory to city authorities on all streets which are to be permanently improved.

THE TELEPHONE IN TRANSPORTATION

The regular monthly meeting of the New England Street Railway Club was held at the American House, Boston, on the evening of Jan. 31, J. H. Neal presiding. The subject of the evening was "The Application of the Telephone to Transportation Service," and the speakers were Dr. C. J. H. Woodbury and his assistant A. B. Stetson, engineers of the American Telephone & Telegraph Company, of Boston. The lecture was illustrated by stereopticon views showing uses of the telephone in many different branches of railway and general transportation work, and several modern telephone equipments specially designed for railway use were shown to those present at the conclusion of the paper.

Dr. Woodbury emphasized the value of the telephone as practically the only electrical device which can be used without skill, and pointed out that electricity was considered for railway signaling long before the devices for its application were invented. On the whole, the application of electricity for the communication of intelligence in both directions appears to have originated on the Erie Railroad in 1850, as this work included the systematic dispatching of trains by telegraph. Of late years the telephone has taken the place of the telegraph to a very material extent, and its use is rapidly increasing. The facility which it furnishes for the instantaneous reply is of great value in emergencies. Simultaneous telegraphy and telephony is now practiced on the same circuits without interference, this dual use of the same wires for composite systems being accomplished in a simple manner by the insertion of choke coils at the terminals and also bridging condensers around the telegraph relays. These condensers will transmit the attending currents used by the telephone bells and the undulatory speech currents, but they do not conduct the direct currents used in telegraphy.

On the Mexican Central Railroad all the cabooses are equipped with telephones so that all freight trains may be at any time in communication with the superintendent's office, in the same manner that wrecking cars are equipped with telephones which can be attached temporarily to overhead wires by rods carrying suitable hooks. Dr. Woodbury cited the emergency use of the telephone in the accident on the Pennsylvania Railroad in 1905 when a passenger train near Harrisburg struck a car loaded with dynamite, whose explosion killed 21 and wounded 150; at the hospital a private branch exchange and patients' card index was set up, and free service, both local and long distance, was inaugurated by the Pennsylvania Telephone Company and American Telegraph & Telephone Company, so that the exact condition of the patients could be learned at all times from various parts of the country. Some of the leading express trains are equipped with telephones which are placed in service at terminals and certain intermediate points.

Dr. Woodbury stated that in the Boston Elevated Railway Company the number of stockholders is three-eighths of the employees, in the New England Telephone & Telegraph Company five-eighths. Great public service work has been established by the joint ownership of many people, capital being a collective noun as much as labor. The application of the telephone for train dispatching has resulted in a marked economy of both plant and operation in the ability of the superintendent to be informed as to the exact position of various cars. Single-track electric roads in sparsely-settled districts can be operated at an efficiency which would otherwise require a double-track road. Prompt cars can be directed to proceed to the next turnout in case the meeting cars are late enough. The advantages of the telephone with respect to the information which it gives as to the condition of the rolling stock, the location of snow plows, the need of wrecking cars, medical help, the transmission of details which may be of great importance in lawsuits, etc., were all touched upon. The efficiency of the telephone in times of emergency was illustrated last June by an incident on an interurban line in New York State, where the cars were limited to a single track, and to protect the block watchmen were placed at each end. One evening a car passed into the block at full speed with another car coming towards it in the single-track section. The watchman telephoned the power house to shut off the current, which was promptly done and a collision barely averted.

The three types of the telephone as applied to street railway dispatching are: Fixed telephone sub-stations in booths placed at suitable points along the lines; jack boxes at poles to which portable telephones carried in the cars may be hung and temporarily connected; and portable sets hung in the front of the car whose vestibule serves as a booth, connection being made with the jack boxes by flexible wires.

Portable sets are generally preferred to fixed sets for long mileage and few cars. There are several forms of these sets, one with its battery weighing only 13.5 lbs., though more substantial forms are considered preferable. Jack boxes must be shot proof and fool proof, and must not afford shelter for hornets or other insects, or a place for the lodgment of rain or snow. Telephone lines should be strung below lighting or power circuits, well insulated and transposed at least once in every eight poles to prevent disturbance from induced currents. When two telephone circuits are on the same line the transposition must be not only alternating the relative position of the wires of one circuit to another, but also of the two circuits. In the later forms of jack boxes for common battery service the plug is attached on the under side of an iron canopy, resembling a large petticoat insulator, the spring jacks being in the handle at the end of the flexible wires leading from the telephone set. Repeating coils and protectors should be used, either at jacks or instruments, to protect the equip-

ment from crosses with foreign circuits of high voltage, and special designs of spans and guard wires are needed at overhead crossings of high-tension and telephone circuits. Electric railway telephone sets must be clear and loud in transmission and be able to stand the jar of continuous transportation on a car.

Fixed telephone sets are found preferable on electric railways having a large number of cars and congested traffic, as they may be used more rapidly by connecting with the pole jacks through flexible wires than when it is necessary to take a telephone from the car and hang it upon the pole.

Dr. Woodbury concluded his paper by referring to the use of the telephone in war, in marshaling and directing parades, at San Francisco after the earthquake, where pairs of insulated wires were laid from a wagon in the cable slots of the street railways, in ranching, on shipboard and in lumbering. He strongly advocated the rental of Bell telephone service by street railways on account of the standardization of equipment and greater facility of repairs by men specially trained for the work. Mr. Stetson described the equipments exhibited at the meeting and answered questions which arose in the discussion which followed.

THE EXHIBIT OF SAFETY APPLIANCES

The exposition of safety devices and industrial hygiene, to which reference has been made before in the STREET RAILWAY JOURNAL, is now being held at the American Museum of Natural History, New York, daily, between the hours of 10 a. m. and 10 p. m., under the auspices of the American Institute of Social Service of New York, and will continue until Feb. 12. The exhibits consist of devices for safeguarding the lives and limbs of workmen and preventing accidents under the ordinary conditions of life and labor to which the general public is exposed, and includes "live exhibits," devices in operation and models, as well as photographs. The section of industrial hygiene includes improved dwellings; first aid to the injured, prevention of tuberculosis and other dread diseases harmful to the life of workmen; respirators and devices for supplying and maintaining pure air, and industrial betterment. As previously stated, the object of the exposition is to direct the attention of American public opinion to the necessity of doing something to lessen the causes of accidents to American life and labor, by means of a permanent museum of safety devices, where all problems of safeguarding life and limb can be studied in their working details.

In all there are about seventy-five exhibits, quite a number of applications being filed after the exhibition was formally opened. As classed under the head of industrial hygiene may be mentioned the reports and photos loaned for exhibition by the museums of safety devices in Berlin, Munich, Paris, Stockholm, Vienna, Amsterdam, Zurich and Moscow, which represent the progress made toward ideal industrial conditions in Europe, and the exhibits of photographs of such American companies as Brown & Sharpe Company, of Providence, the Westinghouse Companies, of Pittsburg, and others which show industrial conditions as they are in these plants. The Brown & Sharpe and the Westinghouse exhibits are, however, especially elaborate. In this connection the exhibit of the Paris, Lyons & Mediterranean Railway, of Paris, is worthy of special mention. It consists for the most part of photographs of workmen's dwellings, baths, reading rooms, dispensaries and stations. Statistics also have been made available by the company of the various forms of industrial betterment of its personnel. The exhibit of the McGraw Publishing Company includes the chart issued by "The Electrical World" for posting in central stations, etc., giving directions for resuscitating persons shocked by electricity.

Among exhibits bearing on the street railway industry may be mentioned devices shown by the Grip Nut Company, J. K. Wright, John Quern, A. L. Freed, S. F. Hayward & Company, Westinghouse Companies, Consolidated Engine Stop Company, General Electric Company, Sterling-Meaker Company, Edmund Mather and C. N. Washburn.

The Grip Nut Company shows in its exhibit various applications of a one-piece steel lock nut which it is impossible to jar from the bolt.

J. K. Wright has on exhibit a model of his safety engine stop and speed limit.

A. L. Freed, of New York, shows a complete line of goggles for the protection of millers, stone masons, motormen and others subjected to unusual exposure of the eye to flying particles in the air.

The Westinghouse Companies' exhibit, besides the photographs previously mentioned, comprises model flat cars, automatic couplers, coupler and draw-bar, buffers, and a new self-locking angle cock. An interesting feature of this exhibit is the detail drawing of the air-brake equipment.

The Consolidated Engine Stop Company, of New York, shows one of its stops in actual operation in the isolated plant of the museum.

The Norton Grinding Wheel Company, of Worcester, Mass., had several of its machines in operation, fully protected by safety guards.

The Sterling-Meaker Company, of Newark, N. J., has its Sterling brake, Giant brake, Berg fender and Sterling fender all on exhibition, attached to suitable platforms.

The Stillman Safety Lamp Company, of New York, has on exhibition a complete line of its safety lamps, including its railroad lanterns. Among the latter is a new type, intended for electric railway use, with an insulated handle affording protection in third-rail work against possible contact with the rail. The interior of the Stillman lamp is provided with a raised perforated metal false bottom and a vertical perforated wick chamber, the intermediate space being packed with wool, leaving an open space at the bottom for free oil. The wool absorbs the oil, holding it in suspension, and when the wick is lighted there are always slight drippings of oil into the lower open space whereby the wick continues to feed oil to the flame.

FINANCING RAILWAY EXTENSIONS

A large amount of money will be needed the coming year in making improvements and extensions to electric lines. It seems that the plan taken to get this money for the most part is the issue of short-time notes. The Northern Ohio did this some time ago and was followed by the Lake Shore Electric with $550,000 notes at 6 per cent. The Detroit United came next with $2,000,000 of the same kind of notes. These notes may later be replaced by bonds. It is not known what plan will be adopted to secure money for financing the Eastern Ohio, but in all probability provision for that will be made in the usual way. Had this action been taken a year ago, its accomplishment would probably have been much easier than now.

NOTES ON SPEED TIME CURVES

BY TRACY W. SIMPSON

At any instant during the acceleration of an electric car, the tractive effort due to the flow of current through the motors is overcoming the resistance to motion. The resistance to motion is divided into two parts, the train friction at the instantaneous speed considered, and the resistance caused by the acceleration of the car and the rotating parts.

With a series motor equipment, tractive effort decreases as the car speeds up; and as train friction increases at the

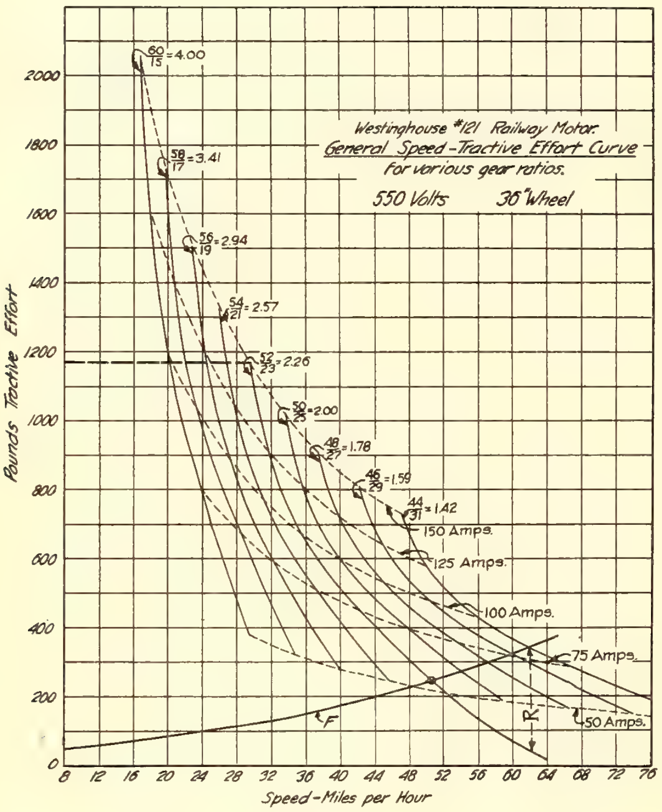


FIG. 1

same time, a speed is soon reached at which all the tractive effort is used in overcoming train friction. At this speed there is no excess tractive effort to cause further acceleration. Any change in the train friction, caused by grade, curve or head wind will disturb the balance and necessitate a readjustment of tractive effort and speed until a new balance is produced. A considerable length of time is required to produce these balances, and usually they are never completed, due to the continual change of train resistance conditions. Thus the speed of the car is continually changing, due to the attempt to adjust itself to new conditions of grade and alignment.

It is convenient to express that part of tractive effort that overcomes inertia and accelerates the car as "Accelerating Effort," designated herein as pounds per motor by the letter A. This quantity at any speed is evidently equal to the algebraic difference between tractive effort and train friction for the particular speed considered. On down grades A is usually greater than the tractive effort. The value of A for any condition of gear ratio and current with a particular motor may be found by means of curves similar to Fig. 1.

Fig. 1 shows a series of speed tractive effort curves for a modern railway motor. These curves are plotted from the characteristic curves of the motor as published by the manufacturer. It is believed the arrangement shown is much more advantageous than the usual one of plotting the curves against current input. For information regarding efficiency and heating capacity the latter method is preferable; but for problems regarding train dynamics the curves as shown possess many advantages. All the curves for the different gear ratios are plotted on one sheet, and the points on each curve that correspond to a particular current value are connected by dotted lines.

This arrangement makes it possible to determine at once any two of the four variables, gear ratio, current, speed and tractive effort, when the other two are assumed. If, then, a curve of train friction showing the pounds per motor required to propel the car at various speeds be plotted on the sheet as F, much interesting data regarding the motor equipment as applied to the car are at once available.

The point of intersection of this curve F with each of the tractive effort curves gives the maximum speed of the car for the various gear ratios, and reference to the dotted lines shows the current taken by the motor at each of these maximum speeds. By this means the proper gear ratio can be approximately found. As a rough rule, applying to conditions requiring fairly long runs, the proper gear ratio is such that will cause a current to flow through the motor, when the maximum speed is reached, that is equal in value to the rated continuous capacity of the motor at 550 volts.

The continuous rating of the motor shown is 80 amps. at 300 volts and 75 amps. at 400 volts, corresponding to a rating of about 67 amps. at 550 volts. Applying the rule to this case, 1.78 would seem to be the proper gear ratio for this motor and equipment. This would give a maximum speed of 57 m. p. h. As a matter of fact, curve F is plotted for a four-motor equipment, single-car operation, 35 tons weight. The motors are rated at 85 hp. The maximum speed is therefore quite consistent with present practice on the interurban railways of the Central West.

In the case considered here, a lower gear ratio (2.26) was chosen on account of the generally hilly country to be traversed, long grades of 2 and 2½ per cent being prevalent. The only accurate method of determining the proper gear ratio is to plot a series of speed-time curves for different gear ratios of a run that can be considered as typical of the entire system; and to determine the proper ratio by balancing in their most economical proportion the schedule speed, energy consumption, and temperature rise of the

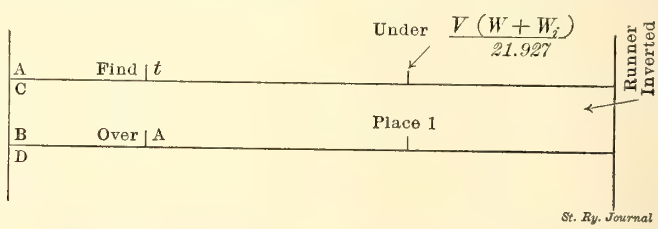


DIAGRAM OF SETTING OF SLIDE RULE FOR VALUES OF "t," "A" as VARIABLE

motor, all of which vary with the gear ratio. However, the rule given above is ample for preliminary assumptions.

The starting current for this motor is about 150 amps., corresponding to a tractive effort of 1170 lbs. per motor and a speed of 29.5 m. p. h. Up to this speed the current and tractive effort will be kept constant by means of the controller. The value of A in pounds per motor will at any speed be equal to the difference between the ordinate of curve F for that speed and the ordinate of the

tractive effort curve for that speed. A pair of dividers will step off this difference at once.

Knowing the value of A for any speed, it is possible to calculate the time required to change this speed to a higher value. The interval between the two values of speed considered must be small enough to allow the assumption that during it A is constant. From the formula for uniformly accelerated motion (force $\times$ time $=$ mass $\times$ velocity) we derive, by reducing from absolute units to practical units,

$$t = \frac{V\ (W + W_1)}{21.927 \times A} \qquad \text{when } g = 32.16$$

In which,

$t =$ the time interval in seconds required to produce a change of V miles per hour in the speed of the car.

$V =$ the arbitrary interval of speed during which A is practically constant.

$A =$ the mean accelerating effort in pounds per motor during the speed interval V.

$W =$ the total dead weight of the train in pounds divided by the number of motors on the train.

$W_1 =$ the weight in pounds per motor that is equivalent in effect to the added resistance to acceleration due to the inertia of the rotating parts. This is usually equal to about 3 to 8 per cent of W.

This formula can be set on the slide rule so as to read directly the value of t for different values of A. V is best chosen at about 5 m. p. h. for the low speeds, and 2 or 1 m. p. h. as the maximum speed is approached.

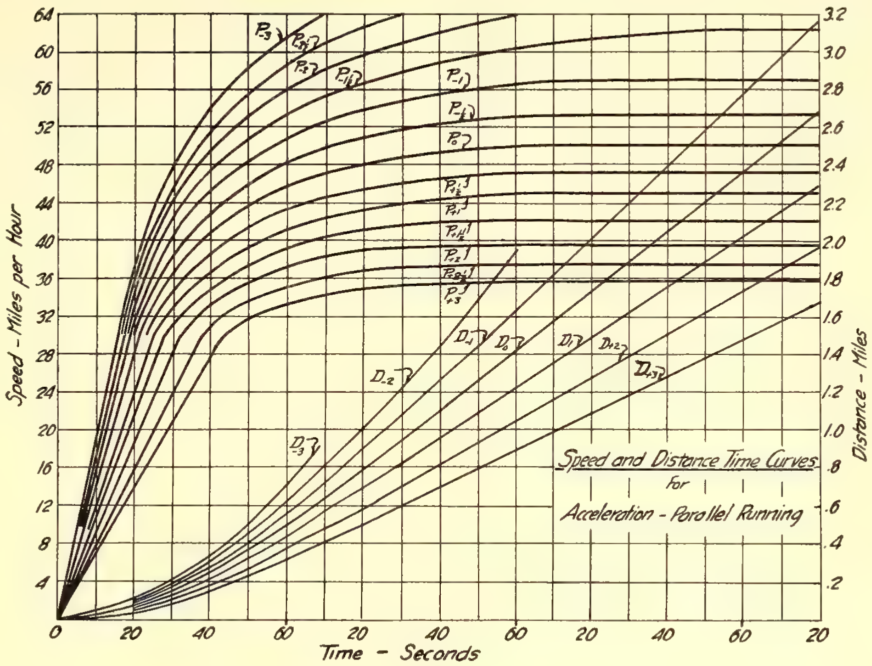


FIG. 2

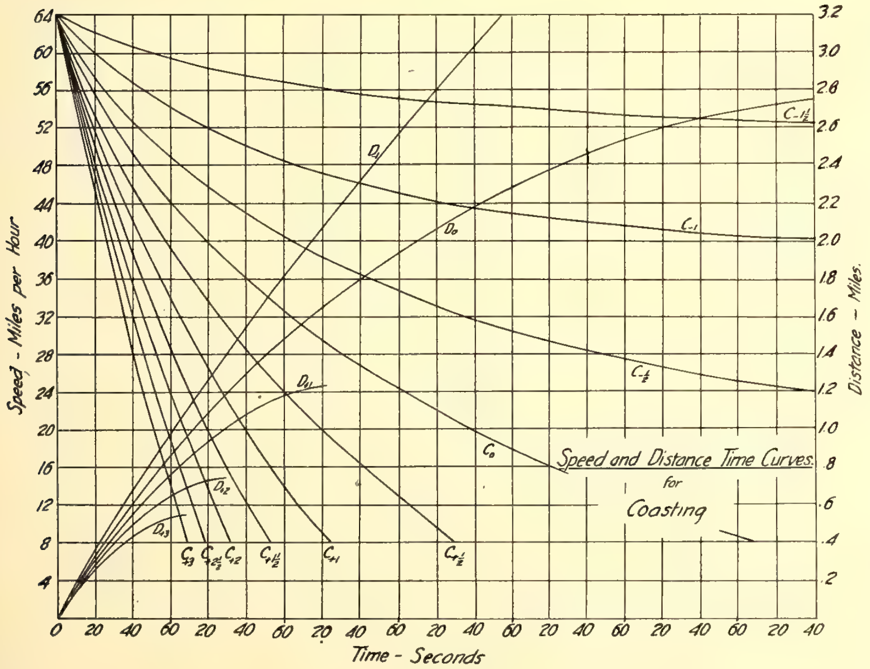


FIG. 3

The process of plotting a speed time curve of the equipment whose friction curve and motor speed-tractive effort is shown in Fig. 1 is as follows: During the acceleration period from 0 to 29.5 m. p. h., $A = 1100$, $V = 29.5$, $(W + W_1) = 18{,}375$, for 5 per cent inertia of rotating parts, therefore $t = 22.5$ seconds. This determines the first point of the curve (P, Fig. 2). The initial acceleration is seen at once to be 1.26 m. p. h. per second. The next interval considered will be that in which the speed increases from 29.5 to 30.0 m. p. h. This is 0.4 seconds. The speed is now 30 m. p. h. and the total time from start is 22.9 seconds. From now on the interval V will be considered constant at either 1, 2, or 4 m. p. h., depending on the accuracy required. The slide rule can now be set to read directly t for different values of A. This setting is shown below, where A, B, C and D represent the four scales of the instrument shown on page 244.

The curve is then readily plotted (P, Fig. 2). When the car is accelerating on a grade, the effect is to change curve F (Fig. 1). The values of train friction are increased or decreased 20 lbs. per ton for each per cent of grade, depending upon whether the grade is up or down. This will give a new value for A for each speed resulting in a different speed time curve. These curves are plotted as P_{-3} to P_{+3} (Fig. 2), the subscripts referring to the per cent of grade for which the curve is plotted.

The area under the speed time curve up to any point is proportional to the distance traveled up to any point. Hence for each speed time curve a corresponding distance time curve is plotted, D_{-3} to D_{+3} (Fig. 2).

During coasting, the retarding force A is equal to the train friction, hence F (Fig. 1) becomes the curve of A.

The speed time and distance time curves during coasting are shown on Fig. 3. The curves are plotted in the same manner as those on Fig. 2, remembering, however, that as F is minus, the value t is the time required for a retardation of V m. p. h. rather than an acceleration. These curves are shown to a smaller scale of time than those on Fig. 2

in order to exhibit the changes and still keep the diagram down to a small size. In practice, it is best to make the curves all of the same time scale even though some of the sheets be very long.

During braking, the retarding effort is assumed constant throughout. This is not strictly true. With the same brake-shoe pressure A is greater at low speeds than at high. However, a skilful motorman can apply the brakes in such a manner that the retarding effort will be quite constant, and the speed time curve during braking will very closely approximate a straight line. Assuming this retarding effort or A to be 120 pounds per ton, we have curves as in Fig. 4.

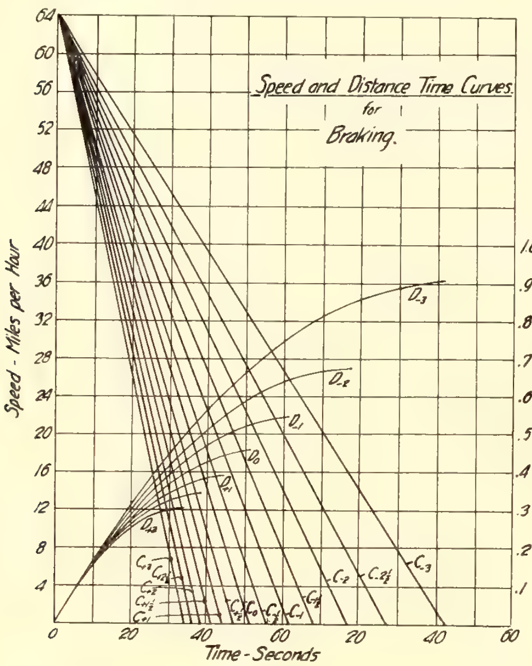


FIG. 4

Fig. 5 shows curves of retardation with motors connected in parallel. These curves show the effect of taking a run at a grade. For instance, suppose the car has been traveling on a down grade for a considerable length of time. According to Fig. 2, the car will have attained a speed considerably in excess of normal. If the car now strikes an up grade, its maximum speed for this grade will be less than the speed at which the car approaches the grade. The speed of the car will gradually lessen until the maximum value for this grade is reached. The rate at which this is done is shown on Fig. 5. The value of A for this case is evidently equal to the distance R on Fig. 1 when F is the friction curve.

Curves of this type are of great interest in considering the operation of freight trains by electric locomotives as compared with the hauling of the same train with a steam locomotive. If the minimum speed of a freight train to prevent stalling be found by experience to be a certain value (about 10 m. p. h.), curves of this type would show immediately the length of a grade of certain per cent that a train would surmount without its speed falling below this value of 10 m. p. h., if its initial speed at the foot of the grade were a certain other value greater than 10 m. p. h.

If then curves of this type are plotted for an electric locomotive and for a steam locomotive of approximately the same continuous rating and each hauling a similar train, the effect of the superior characteristics of the electric locomotive for this service would be shown in a graphic manner. The train hauled by an electric locomotive would be able to surmount a much longer steep grade without its speed falling below 10 m. p. h. than would the train hauled by the steam locomotive. Hence, by the use of electric locomotives, the maximum grades can be greatly increased in steepness, or the present maximum grades could be much increased in length without altering the maximum grade of the virtual profile; and conversely, with a given profile now operated by steam locomotives, the effect of substituting electric locomotives of the same continuous capacity would be to lower the ruling grade, thus enabling greater train loads to be hauled.

Fig. 6 shows curves which are similar to those of Fig. 2. In this case the controller is stopped at the series notch. The e. m. f. impressed on the motor is 275 volts. For any given value of tractive effort, the speed is one-half that shown on Fig. 1. The new speed tractive effort curve can be readily plotted and the value of A determined as in the case of Fig. 2.

Fig. 7 shows curves of acceleration on down grades when the car is coasting. The value of A for this case is shown by curve F (Fig. 1); but on down grade F falls below the base line for the greater part of its length. This is because the acceleration due to the grade is greater than the resistance to motion. The maximum speed for this case occurs at the point where the F curve crosses the base line.

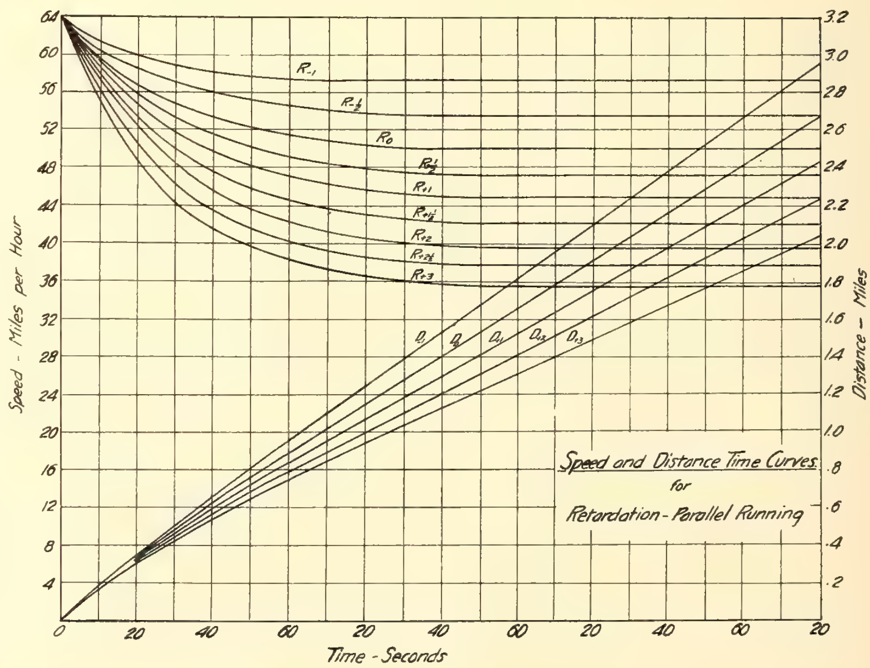


FIG. 5

The extra resistance on account of a curve can be reduced to an equivalent grade. For each degree of curvature the resistance is approximately equivalent to that of a grade of 0.05 per cent. We have, therefore, a set of curves in Figs. 2 to 7 that show the performance of this equipment under any condition either by direct reference or by interpolation. Fig. 8 shows a speed time

curve of this equipment over a particular profile. It is entirely made up of portions of the curves Figs. 2 to 7. Each portion of this curve is found by reference to the figure that corresponds to the conditions for the portion of the run, and by noting the speed at which the car leaves the last portion of the run. Further details regarding the exact process of plotting this final speed time curve from curves similar to Figs. 2 to 7 can be found in "Electric Railway Economics," W. C. Gotshall, pp. 159-175. The only puzzling point in regard to it is the determination of the point at which to start braking in order that the total distance traveled will correspond to the actual distance between stations. The best method is to plot the speed time curve from start and cut off at the proper point to correspond to the total distance between stations, considering the braking curve to be a vertical line. This point is easily determined.. Then sketch in the actual braking curve so that the area of the total curve is the same in both cases. This will determine the approximate point at which to start braking. Then plot in the curve accurately and see whether the area is still the same. One trial is usually sufficient. A current time curve is also plotted on the same sheet, enabling energy determinations to be made. The values of current for different speeds are found on Fig. 1. It is to be observed that in the construction of Fig. 8 each type of curve on Figs. 2 to 7 is used.

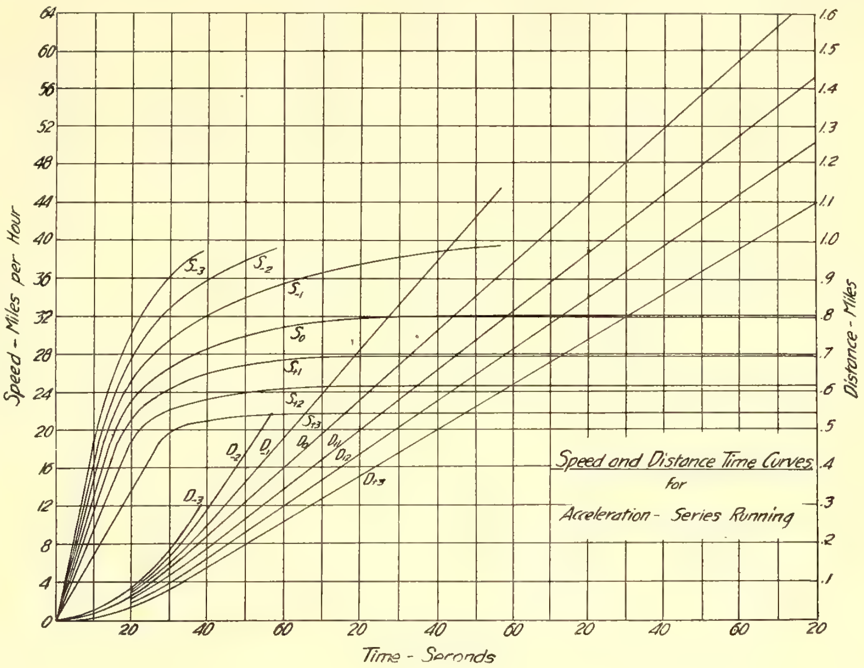


FIG. 6

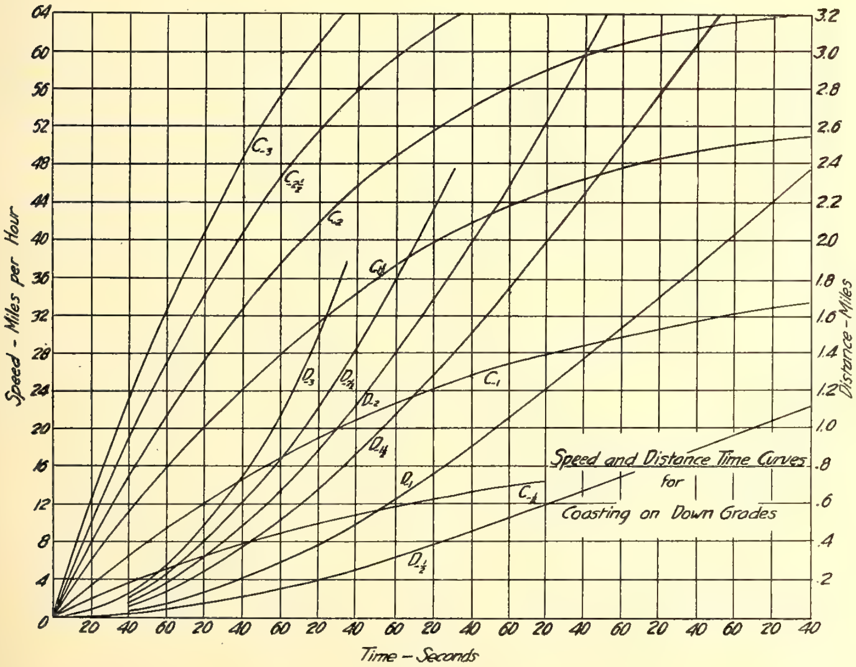


FIG. 7

In case only one speed time curve is to be plotted, it is unnecessary to plot a complete set as shown in Figs. 2 to 7. The value of A can be found at any instant as the sum of all the forces due to grade, curve and motor tractive effort at that instant. This method is described in "Electric Railways," Ashe & Keiley, pp. 37-46. However, when a number of speed time curves are to be plotted for one equipment, the method shown herein will be found the quicker.

There may be some doubt in the minds of electric railway men as to the necessity for any such analysis of motor equipment that requires speed time curves. The manufacturers of electric motors have plenty of information as to what an equipment will do, and they are always willing to supply this to the user of electric railway apparatus; but this information is made up largely on the basis of a "typical run" analysis and is of little value when applied to anything but preliminary determinations, such as choice of motor and of gear ratio. After the motor and gear ratio are determined a complete set of curves Figs. 2 to 7 should be plotted. If possible this should be done before the final location on the ground is made. The curves are invaluable in determining such questions as—

1. What is the most economical grade for the approaches to an overhead crossing?

2. What will be the speed at a certain point where a curve is necessary, thus determining the sharpest safe curve that can be used?

3. How long can a certain down grade be made in order that the motorman need not apply the brakes to keep the speed of the car below dangerous limits?

In order to reduce energy consumption the keynote of an electric railroad should be "Use the brakes as little as possible." With the aid of a set of these speed time curves this criterion can be met with accuracy.

In the gradual relocation of present interurban lines, with a view to increased schedules and reduced energy consumption that is being made by most of the progressive companies at present, a set of these curves for the type of equipment used on their lines is most useful. They enable the problems to be solved on something other than a guesswork basis.

Similar considerations have led steam roads to analyze

most minutely their equipment by means of curves similar to Figs. 2 to 7, these and more are used in their location problems. To be sure the steam roads have a somewhat different sort of problem, theirs being to haul as long a freight train as possible; and a mistake in location is far more serious than a similar mistake in electric railway location where passenger service only is the rule. The flexible operating characteristics of the series railway motor enable the equipment to negotiate almost anything in the way of grades, stops, and accelerations; but it is often overlooked that it costs money to do these things, and by a proper analysis the same schedule speeds could be maintained by slight changes in location, the energy consumption at the same time being decreased.

In conclusion, the writer claims nothing radically new for this method of plotting speed time curves. It is the same as the "interpolation method" introduced by C. O. Mailloux, Trans. A. I. E. E., 1902* However, several differences of procedure are incorporated. A simple slide rule setting takes the place of Mr. Mailloux's "Chart of Reciprocals," and the "General Speed Tractive Effort Curve" is also new. In regard to this last, the writer has found it so useful that he has plotted these curves for all the modern railway motors, thus enabling definite comparisons to be made for an equipment having a certain friction curve.

Other methods of plotting these curves are used. L. A. Freudenberger ("Electrical World and Engineer," Vol. XLII., pp. 96-97 and 219-221) has shown an important development with regard to Mr. Mailloux's method which tends toward a solution by an algebraic method of most speed time curve problems. H. S. Knowlton has also used a method of speed distance curves for the analysis of conditions on the Boston Elevated Railway ("Street Railway Review," October, 1904). However, for all-around usefulness I believe the method herein is as good as any other.

*See also STREET RAILWAY JOURNAL, July 7 to Aug. 30, 1902.

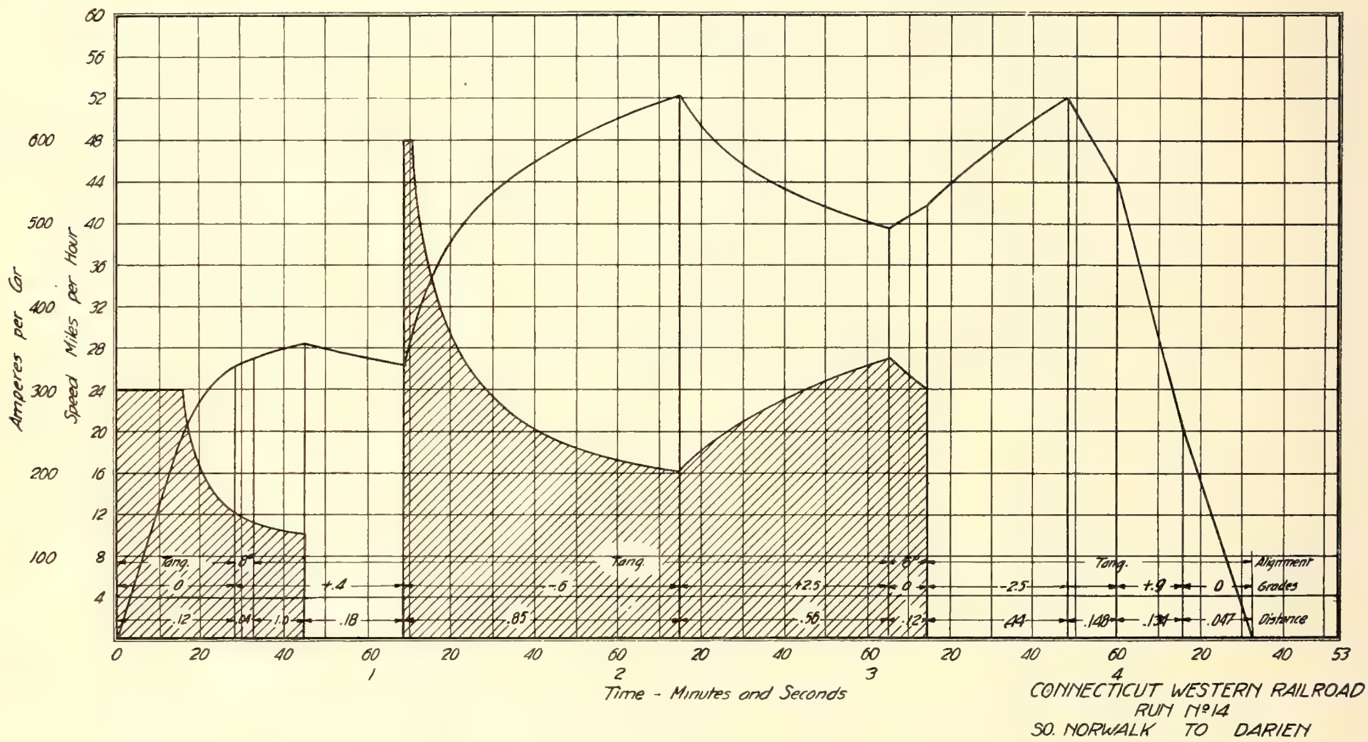


FIG. 8

STEAM ROAD ELECTRIFICATION IN NEW ENGLAND

The New York, New Haven & Hartford Railroad Company is reported to be making substantial progress in its task of electrifying stretches of its steam tracks in Central Connecticut. It is expected that the electric service between Middletown, Berlin and Meriden will be established in May. Power will be supplied from the Berlin power plant. It is probable that the service will be extended to New Britain. The electrification of the Highland Division tracks for the interurban trolley service between Hartford, Rockville and Melrose will probably be completed in March. A large amount of work has already been accomplished. Electric energy will be furnished by the Hartford Electric Light Company, which is now constructing a sub-station at Burnside. A cable to carry 9500 volts is being strung. A dispatch from Boston says that beginning next June the whole passenger service between Stamford and New York will be equipped electrically.

A letter to the Massachusetts Railroad Commission from Vice-President Van Etten, of the New York Central, was made public Feb. 6, and contains the first official statement as to the plans of the company in regard to the electrification of the Newton Loop. It discusses the proposed removal of the passenger terminal to the old Park Square station, which Mr. Van Etten advocates as a means of relieving the freight situation, and the electrification of the Newton circuit, but says: "The electrification of the circuit and the acquisition of the Park Square property mean an expenditure of $10,000,000 or more, and I think you will agree with me that our people are warranted in being absolutely positive that they are doing the right thing before undertaking to expend this large sum."

The Mahoning and Shenango Valley Railway & Light Company has established an inspection and instruction department.

CORRESPONDENCE

ON THE SUBSTITUTION OF THE ELECTRIC MOTOR FOR THE STEAM LOCOMOTIVE

New York, Feb. 5, 1907.

Editors STREET RAILWAY JOURNAL:

Referring to some statements made by various speakers in the discussion of the Stillwell-Putnam paper at the last meeting of the American Institute of Electrical Engineers, which statements in one breath described the perfection of results attained by 25-cycle motors, and yet complained of their lack of capacity, I was reminded of a sign that I often see in the subway cars: "We could not improve the powder, so we improved the box."

My criticism of the single-phase a. c. 25-cycle motor was not because of the potential at which the trolley line must be operated. The relations of potential to size of conductor are really of such common knowledge that it is hardly worth while to discuss that particular feature. Obviously, if alternating currents are to be used then just as high potentials as the physical facts will permit should be adopted, and there is nothing revolutionary in the use of 11,000 instead of 3000 volts, but why stop there?

Capacity is the keynote of a railway equipment, and this is not measured alone by that of conductors, but ultimately also by that of motors. The testimony of the evening bore out my criticism that the present 25-cycle motor does not under like conditions approach the direct-current motor in this respect. It is proposed to increase this capacity by lowering the frequency. This, also, in itself is not a novel proposition, for it has been discussed for a number of years. It involves a good many questions, some of them going back to the central station. It may be advisable in the end to adopt for a. c. operation about this periodicity, and months ago I ventured to predict that the largest 25-cycle railroad enterprise now being installed would adopt a lower frequency.

However, in view of the fact that reduction of frequency, which brings a motor more nearly to d. c. conditions, is now advocated as essential, I find some difficulty in reconciling myself to that subtle reasoning which holds that because a motor is to be run on a part of its route from a direct-current supply it is better that it should be designed for the higher frequency.

I am in entire sympathy with every practical development, I care not by what means or along what lines, but I have opposed, and will continue to oppose, any basis of comparison which accepts in fullest measure every claim made for single-phase alternating motors, while denying the possibility, practicability or importance of known improvements in the direct-current field, whether used with overhead or third-rail construction.

Rightly or wrongly, my name seems now to be particularly identified with the efforts toward higher direct-current operation. It is not the first time I have advocated seemingly radical improvements, and I willingly accept the sponsorship of this development. In answer to Mr. Arnold, I venture to assert that, so far as public sentiment or restrictions are concerned, while it is quite possible that the continued introduction of an exposed top-contact third rail will be condemned, as it ought to be, it is quite as likely that high-voltage overhead lines, often in close proximity to highway bridges and crossings, and in dangerous proximity to the general public at city terminals, will come under the ban, as that a well-protected under-contact third rail will do so. Neither is free from objections.

Contrary to the authors' assumptions, operation at 1200 to 1500 volts by direct current has not been proposed by me as the "substitute" for high-pressure alternating currents for heavy electric traction, or as the only means available for this purpose; it has been advocated as a practical advance along existing lines, which under many conditions and with the present development of the 25-cycle alternating motor, offered possibilities of railroad operation denied to the latter.

I prefer to define my own position rather than to have it determined by others for me. I do not profess to know what the ultimate developments in this art are going to be, nor will I enter into any rivalry in predicting that a specific type of equipment must be universally adopted, for I feel sure that the selection of a system by any road must be largely individual, and determined by its own necessities.

There are many opportunities and possibilities for alternating-current equipment, but these are surely not the only methods worthy of serious consideration by such trunk-line divisions as may now reasonably consider the possibilities of electric operation.

Many of the critics of the direct-current development are not as familiar as they might be with what has been recently accomplished in this line, especially in commutating pole construction and gearless motors. The former one of my early babies and now a vital feature in single-phase alternating motors, has been reduced to practice with direct-current motors with such success that I fully confirm Mr. Potter's statement as to its efficiency. Within my personal knowledge, four-pole motors of this type, varying from 40-hp to 240-hp, normal hour capacity, will operate, so far as commutation is concerned, at excess voltages of 75 or 100 per cent with entire freedom from all commutator disturbance. This improvement alone is one of the most important in electric motor construction in recent years; and directly dependent upon it is the possibility of a return to my earlier methods of varying speed and torque of a motor by varying the field magnet strength, a principle now in common use in variable-speed shunt motors, and which is equally applicable to series machines. This addition of a shunt to the series field has an important bearing upon the comparisons made by Mr. de Muralt, for the series motor is no longer a machine with a fixed curve, but one with a very wide range of speed and torque control.

In connection with the other important development, it would be unjust to omit mention of that modest engineer in the railway department of the General Electric Company, Mr. Batchelor, who by one bold stroke has created a remarkable departure in gearless machines, individual to direct-current work, which has received its very practical proof and demonstration, much to the surprise of many critics, in the locomotives recently built for the New York Central Railroad.

In these gearless machines the previously accepted axiomatic principle of fixity of relation between field and armature has been abandoned, the latter being mounted directly on the axle, and the fields being carried upon and forming an integral part of the locomotive frame, supported by its springs and hence moving freely, irrespective of the armature. Not only gears, but armature and axle bearings are all dispensed with, and the acme of simplicity in motor construction

reached. If desired, the armatures of course can also be spring borne.

In may interest those who have somewhat cynically questioned 1200-volt d. c. operation to know that the General Electric, the Westinghouse and the Electro-Dynamic Companies have all either taken, or bid for contracts requiring the use of motors at this potential.

On the matter of standardization perhaps I can add a few words. To a certain extent some things take care of themselves. The height of a trolley wire is dictated by the necessity of a clear height above a man on a freight car, and is about 22 ft. There can, of course, be considerable variations from this without interfering with actual operation. The location of the third rail, with center 28¼ ins. from the gage line, and with a working surface from 2¾ ins. to 3 ins. above the rail, has been practically accepted, as per a suggestion sent out a long time ago by Vice-President Wilgus, of the New York Central & Hudson River Railroad, chairman of that road's Electric Commission.

I suppose I ought to feel flattered to see the universal testimony to the benefits of multiple-unit operation, but some of the speakers out-did the parent in love of his child, and committed themselves to recommendations of an extreme character. Here, too, there is little to be said in the matter of standardization. I settled that nine years ago, when I created a train line composed of sections carried upon and terminating in couplers on each car, joined by reversible jumpers between the cars, all constructed, connected and located so that cars could be connected up in any required order, number or sequence, and indifferently as to end-relation; and the master controllers connected therewith had like characteristics with reference to track movement. One of the essential features of this train line is the relative location of speed and direction controlling wires, the former unchanged in any connection, and the latter reversed in connection when cars are reversed. Would-be improvers departed for a time from the essential five-wire system, abandoned automatic control, and introduced additional individual wires for various rheostatic steps in the speed control, as on the elevated road in this city, but the progress of events is carrying them all back to the original lines which I laid down. Practical experience, however, leads me to oppose the introduction of a train line of wires for trunk-line connections, heating, lighting or brake control.

I am not able to get up any enthusiasm about a proposition to equip the freight cars of the country with train lines. While the control of two distantly placed freight locomotives would at times be useful, it is not vital, nor are there the same reasons which make simultaneous control of motor cars in passenger trains essential. Certainly no train operation would be conducted without competent men on locomotives which are distantly removed from each other. Moreover, in view of the universal interchange of freight cars, even if the majority of them were equipped with train lines, the introduction of a single one without such equipment could easily make useless the balance, or make necessary a very objectionable amount of yard switching. It would seem that the possible advantages of adding train lines to freight cars would be much more than offset by the great cost.

It is my intention, in the near future, to present more fully before the Institute sundry technical facts bearing on the general problem of electric trunk-line operation by the various systems. FRANK J. SPRAGUE.

Schenectady, Feb. 2, 1907.

Editors STREET RAILWAY JOURNAL:

The observation made by "Steam Engineer" in your last issue, that electric roads pay because they earn more money and not because they save money, strikes me as very pertinent and reaching to the very root of the whole question of the electrification of steam lines. The electric motor is replacing the steam locomotive in certain instances because it can do something which is impossible with steam locomotive operation. The electrification of steam lines is being carried out with the intent of providing for greater comfort to the passengers and hence to increase gross receipts by making traveling more desirable. The electrification of the terminal roads centering in and around New York is taking place from no motives of economy, and though certain substantial savings will undoubtedly be effected, they are of no degree to warrant the expenditure of the millions of dollars required to effect the change in motive power. In one instance it may be the smoke nuisance, in another the congestion of the terminals, in another case other reasons of a compelling nature which make it desirable to change to the cleaner, quieter and safer electrical system of operation. But the attendant savings have not yet proved so enormous and assured as to warrant such a change, though later comparisons may easily prove that the savings in operation may be great enough to show a comforting return on the capital expended.

Having this fact strongly in mind, it is with some hesitancy that the writer ventures to comment upon the very excellent paper upon "The Substitution of the Electric Motor for the Steam Locomotive" read before the A. I. E. E. by Messrs. Stillwell and Putnam. Indeed, the first part of the paper outlined in no uncertain manner the various benefits secured to the operators of electric lines and showed why their success was secured in the face of steam competition. But the impression left with the careful reader of the complete paper is that the electric motor is ready to replace entirely the steam locomotive because of certain economies effected in its operation,—economies not possible with the continued use of its steam competitor. This was certainly the view expressed within the hearing of the writer by not a few steam locomotive experts present, and because a similar feeling is quite general among steam road operators at large, attention is directed to certain facts that may help to bring about a common understanding of a situation that will be of benefit alike to electrical engineers and steam operators.

There are two classes of steam service which are open to modification in operation, provided a motive power is adopted which possesses broader qualifications than the present steam locomotive.

The passenger traffic into and around our large cities is best cared for by the electric car or train operating at frequent headway and with many stops, a method of operating not possible until the coming of the electric motor. Further comments on this class of passenger service are unnecessary.

For a long-haul service, either freight or passenger, new qualifications are demanded of the motive power. Locomotive operation is perhaps imperative, and the advantages offered by the electric locomotive for this class of service have hardly yet received general appreciation. No such problem as the electrification of a through steam line, either in whole or in part, can be approached by the electrical engineer from the standpoint of saving in operating expenses with the expectation of receiving more than a courteous

hearing on the part of the steam road management. Small items of economy when accompanied by the necessity of expending millions of dollars do not arouse a steam operator to enthusiasm, but new methods of operation giving increased tonnage capacity to his tracks, the elimination of the dreaded "ruling grade" and any suggestions as to the relief of the present congestion and danger in operation will command a very attentive ear.

It is idle to imagine that the electrification of a through line will be attended by any large reduction in fare or headway of train, warranting expectations of great increase in passenger traffic. It surely will not stimulate freight traffic unless methods of operation are introduced which will permit the lines to carry more tonnage on their present overcrowded tracks by reason of increasing the size, speed and safety of trains of all classes and eliminating some of the reasons for the present delays at terminals and congested points en route.

The electric locomotive does offer such a means of improving present methods of steam railroad operation, and small possible economies are lost sight of in the larger question of improvements of the most far-reaching character. As the receipts of our through steam lines are made up largely from the movement of freight, it is the problem of moving freight to the best advantage of both operator and shipper that the electrical engineer has to do with if he hopes for the ultimate adoption of the electric motor, and not the search after possible economies in operation while duplicating present steam operating methods. Electrical operation has not followed the lines of steam operation in the past, in fact it would never have reached its present enormous proportions had it not made good use of its greater possibilities. It is reasonable to expect, therefore, that the introduction of the electric locomotive will be attended by changes in handling through freight and even passenger traffic that have not been adopted to date because of the barrier imposed by the limitation of the steam locomotive.

Taking this broad view of the situation, it is hard to see the advantage of forcing the adoption of any electrical standards at the present time. At best the standardization of apparatus or methods is attended by the constant danger of Chinese stagnation. And, too, no piece of apparatus or method is ready to be standardized until its continued use has shown it to be the survival of the fittest. Surely it is premature to attempt the standardization of 15 cycles when it is of benefit to only one type of motor, the single-phase a. c. motor. There is as yet no 15-cycle apparatus in operation in this country, not even an electric locomotive equipped with a. c. motors designed for any frequency. It is true that small a. c. motors have given sufficient commercial success to gratify the adherents of such a type of motive power. Promoters of high-speed interurban electric roads can confidently look to the a. c. motor as an assured success, and its continued development should result in the production of such larger motors as are required for the equipment of electric locomotives. Granting the assured success of the a. c. motor locomotive and the improvement resulting from the adoption of a lower frequency than 25 cycles, no responsible claim can be advanced for the standardization of this lower frequency with our present knowledge of the relation of the electric locomotive to the movement of heavy trains over long distances. The adoption of a lower frequency in an initial installation is good engineering, considering the benefits to be secured to the a. c. single-phase motor, but no attempt should be made to standardize a lower frequency until continued commercial operation has demonstrated the universal superiority of the a. c. motor over all other types better adapted to operate at the present 25 cycles.

The selection of a proper system of electrical operation for a given installation should always be determined after a careful study of the local requirements, and should not be influenced by adhering too closely to any arbitrary standards. If a 600-volt d. c. motor can be installed more cheaply, will offer greater advantages in operation or is to be preferred for other well-defined reasons, sound engineering would suggest its selection. The different local conditions of another proposed installation may call for the adoption of the single-phase a. c. motor or the 1200-volt d. c. motor or the three-phase a. c. type for equally strong reasons. Each type of motor has certain salient features making it especially adapted to perform certain classes of work, and no railway motor having universal qualifications has made its appearance or is even foreshadowed as yet.

Then why this undue haste to standardize a lower frequency with all the attendant complications, especially as the present or proposed d. c. systems have not failed to make good in heavy electric railroading, nor has the a. c. motor had opportunity to demonstrate its fitness for such a service. Why handicap the d. c. and three-phase a. c. motor systems with the additional expense of low-frequency generating and transforming apparatus for the purpose of standardizing another system as yet untried?

The writer admits a strong leaning towards the single-phase a. c. motor system for heavy work. Its simplicity, high efficiency and cheapness are strong arguments in its favor when the conditions of operation are favorable, but it must be admitted that the interests of certain installations can be best subserved by the adoption of one of the several other types of motors; hence this plea for time to prove the relative advantages of the different motor systems, until each has had a representative showing in practice.

After all, the main lesson to be drawn from the most interesting Institute discussion was the apparent readiness of the electrical engineering profession to engage upon the work of steam road electrification, either in whole or in part. It is to be hoped that future papers of similar character will be forthcoming, and that the challenge of "Steam Engineer" to be heard will not be ignored. A free discussion of the broad question of electrification, hearing from both sides, will prove of benefit to both sides, for if the electrical engineer sometimes fails in fully understanding present steam operating methods, surely the steam operator studies the possibilities of the electric locomotive with equal advantage.

A. H. ARMSTRONG.

New York, Feb. 5, 1907.

Editors STREET RAILWAY JOURNAL:

I am glad that the very interesting paper by Messrs. Stillwell and Putnam has been published in your journal, and also in some of the other technical papers, as it gives the fraternity at large an opportunity to discuss some of the points which were only lightly touched upon when the paper was presented before the American Institute of Electrical Engineers. The actual discussion at the time of its presentation was limited principally to the frequency of the alternating current, as the paper bore more particularly upon single-phase apparatus than upon direct-current systems, but near the opening of this paper the authors ask the question: "Will it pay to electrify?" and the prominence which is given to this introduction would indicate

that it was to constitute the principal burden of their paper. This in fact is found to be the case upon a careful perusal of the document itself, and the question of frequency is more of an incidental or subsidiary character.

While the subject of electrification of steam lines is of very great interest at the present time from a scientific standpoint, it is no less so from a financial one, and this latter phase of the question will really be of more general interest to the railroads the world over than the strictly technical discussion of voltage, kind of current, frequency, etc.

Will it pay to electrify? In order to consider this question in its various bearings we must first decide what is meant by "paying." There are two ways in which a device may ordinarily be expected to pay for its use. One is by decreasing the present costs, and the other is by increasing the returns without a proportionate increase of cost. There is no intention whatever to combat the advantages obtained by electric traction under many conditions, and in fact they are so obvious that they hardly need reference. The various items which are enumerated by the authors, such as frequency of service, speed, general comfort of passengers, safety, reliability of service, increased capacity of line, frequency of stops and convenient establishment of feeder lines, are so clearly presented, even to the lay mind, in regular suburban work, that there is no question that electricity at the present time is the only real suitable power for suburban work. By this, of course, we mean a service that is composed principally, if not wholly, of passenger transportation, as people will no doubt travel by that line which is most comfortable and gives them the greatest facilities for the same or less money. The density of the traffic is of prime importance in estimating whether the electrification of a suburban or interurban line will pay, and by density of traffic is meant not only the existing traffic but such traffic as may be attained with the additional facilities offered by electric service. Under such conditions we would no doubt have the second side of our question, namely, that the increased revenue produced by the improved traffic conditions would more than pay for the expense of electrification.

While this is true in populous districts where the passenger traffic greatly predominates, it certainly cannot be expected to apply to a large section of this country and upon those roads whose freight traffic is their principal source of revenue, and it must be borne in mind that a very large proportion of the railroad mileage throughout this country is such that there could not be any material increase expected in traffic by changing the motive power. Suppose, for instance, a railroad like the Norfolk & Western, whose main business is the transportation of coal from the mines to the seaboard. Considering that the service in each case is ample to transport the coal produced, it is difficult to see where any argument could be made for the electrification of such a line unless it could be demonstrated that the operating cost would be reduced, and as the authors have referred to the railroads of the country as a whole and have based their calculations and assumptions upon the total mileage of the country, it is perfectly legitimate to discuss this phase of the question and attempt to discover if it will pay to electrify lines and portions of lines that are not in the populous district whereby a large amount of traffic would be induced by a pleasanter method of propulsion. It will be noted in this connection that at the last International Railway Congress Mr. Aspinall, of the Lancashire & Yorkshire Railway, stated that the reason that they had adopted electricity on some portion of their line was not to save money but to make money, and this must really be the keynote of suburban or interurban electrifications. Our remarks, of course, must not be confused with such cases as the New York Central, where the absence of smoke and steam in a tunnel line and the increased acceleration of multiple control units produce certain advantages that could not be obtained with steam; nor on the other hand where some natural water power takes the place of fuel which must be purchased at a comparatively high cost, as it goes without saying that in such cases electricity is the power "par excellence."

In connection with the cost of substitution the authors seem to have taken only the electric apparatus actually needed for propulsion of trains, and do not seem to have considered the very great contingent expenses which accompany the electrification. This was brought out two years ago at a meeting of the New York Railroad Club, when Vice-President Wilgus stated: "That the cost of electrifying the suburban service will be about one-quarter of the total amount we will have to expend to secure the full value and benefit of electrification"; and again, that "We have not looked at this question of increased cost from the view of decreasing cost of operation, but rather from the standpoint of being able to build up an increase of business."

Let us now briefly touch upon some of the points where the authors expect to make their gains in economy and see which of them would actually hold good under the ordinary traffic conditions of the great bulk of American railroads.

The question of having freight cars equipped by roads not using electric traction, with train lines and couplings at a cost of from $50 to $75 a car from some one, or at the most two lines which might possibly use their cars in the interchange of freight several times a year, has been branded as outside of the scope of present consideration, but it would certainly be the wildest kind of a "pipe dream" to expect that such influence could be brought to bear upon roads not using electric traction. This would largely prevent the placing of locomotives at any point but at the head of the train unless they were operated by individual crews, in which case the conditions would be practically the same as a steam locomotive sandwiched in between the cars, so that the freight operation would necessarily have to be conducted in a manner practically identical with that now obtaining upon the steam roads. It is expected also that one electric locomotive would do the work of two steam locomotives, but this would only depend upon the amount of power which the locomotive was able to produce, and the same would hold true for steam or any other kind of motive power.

At the Master Mechanics' Convention of 1905, a committee report was presented on the "time service of locomotives," in which it was shown that the actual percentage of the time in which a locomotive was held at the round house for running repairs was a comparatively small proportion of the total; in fact the tables presented showed that this might be anywhere from 3 to 28 per cent of the time, and a record obtained for a single locomotive for one month showed that 23 per cent of the time it was under control of the motive power department at the round house, and 77 per cent of the time in the transportation department. The time in which it was under the control of the latter department was spent in making up trains, switching, passing, orders, delays at crossings, wrecks, waiting for orders, etc., and it is difficult to see how any of these items could be reduced one particle by the change from steam to electric power. It is ordinarily assumed that a steam locomotive

should have a lay-over of from four to six hours between trains, and many locomotives are operated in passenger service with even a shorter lay-over than this; and while there are some operations that would not be necessary with the electric locomotives, there is no doubt that a certain time would be required, and if an armature were to be repaired in many of the types used it would require at least several hours to make the necessary repairs and changes. We see, therefore, that there is little prospect of one electric locomotive taking care of the work of two steam locomotives, assuming that in each case the locomotives are as large as can conveniently be used by the railroad operating them. It must also be borne in mind that electric locomotives cost practically double the amount paid for steam locomotives, and under these circumstances it is natural to expect that wreck repairs would also be more expensive.

The question ot operating through trains by one man in the locomotive is also discussed, but we believe that for long runs the argument given would not be applicable. It is practically inconceivable, for instance, that a man should remain three or four hours in one position with his hand on the controller, as would apparently be necessary with the automatic safety arrangements proposed. The various auxiliaries of the locomotive would certainly require attention, and it would be necessary for the engineer to have more or less freedom of movement around his machine. With motor trains making frequent stops this condition is so entirely different that it hardly bears any analogy to the long-run proposition above referred to. It is questionable also whether other considerations would not be equally important in dispensing with the services of the additional man on the engine, and it hardly seems likely that any reduction of pay could be expected if we judge from indications which are presented to our notice practically every day.

The fuel question is another one of very great importance, as the fuel expense of a railroad runs from 10 per cent to 12 per cent of the total cost of operation. The continuous service given on the elevated railroads is certainly very conducive to a small fuel account, and we could not expect such satisfactory results from overland freight traffic. The tests made at the St. Louis Exposition indicate that under favorable conditions a locomotive may operate with a consumption of about 2 lbs. of coal per horse-power hour. But there are many cases, as where heavily-loaded freight engines are ascending a steep grade, in which the consumption may be two or three times that amount; therefore we believe that some advantage will accrue in the cost of fuel for train operation, but by the time we allow for the transmission losses and develop at our locomotive only 70 per cent of the power produced at the central station, it is apparent that we cannot expect such a ratio of improvement as 3 to 1, which has been suggested, or even possibly 2 to 1. Besides, our power house must be kept in continuous operation ready for sudden drafts of power, and if the units are large enough to carry a fair working load there will be many times when they will be working on a very small hourly load factor. Of course we will save the coal that is consumed when standing on side tracks waiting for orders, and which amounts in some cases to from 25 to 50 lbs. per locomotive an hour, but our power plant with its auxiliaries must be kept in operation at all times whether traffic is light or heavy, and when we consider that the average service for the United States is, as stated, seven trains per day passing a given point in each direction, a moment's reflection will show the great irregularities in traffic which exist upon roads whose business is principally the transportation of freight.

The cost of fuel has been practically cut in half in making the comparisons between the steam and electric operation, and this is further demonstrated by some diagrams which are reproduced on page 199 of your issue of Feb. 2. The method of constructing these diagrams has not been given in detail, but as far as I have been able to check them up, it seems as if they were based upon the movement of trains upon a level only, and that no allowance has been made for the adverse effect of rising grades. The average resistance of a freight train at the speeds commonly used is probably 5 lbs. or 6 lbs. per ton, and this is equal to the grade resistance due to a rise of 15 ft. per mile, which would really be a very low grade for practically 99 per cent of the roads in this country, in many cases the grades being double and quadruple this amount. It must not be assumed that an undulating profile will require no more power than a level division, because the work of ascending a grade is a very severe and heavy draft on the power, whatever it may be, and which is not compensated by the following run down hill, even if this should be as great in amount as the ascent. Under these conditions we should say that the amount of power needed for general operation in this country would be at least double that which has been assumed by the authors. This would practically double their figure for power or make it $152,000,000 per annum in place of $76,000,000,—a figure which is very close to the present cost of fuel as obtained from the Interstate Commerce Reports and which is given as $156,000,000 for 1905. Even if it be contemplated that regeneration by producing current from the motors when running down hill will assist in the up-hill runs, we would have the line losses to consider in both cases; besides many divisions are up grade entirely in one direction, and with single-track roads the tendency now-a-days is to send freight trains in "fleets" in one direction on account of being able to get them over the road more quickly and with a smaller number of "meet orders." This would apparently put the cost of power under both assumptions on nearly the same basis.

The size of plants to supply the railroads of the country as a whole has been based upon an output of 12,500,000,000 kw-hours per annum, but we have just indicated that this is probably altogether too small. Considering a 70 per cent drop or loss in power from the power house to the locomotive, the 2,800,000-kw capacity of power plants needed for the entire country would give only about 50 per cent more power than the average requirements, basing it on the figures assumed by the authors of 12,500,000,000 kw-hours per annum. The New York Central electric installations provide over three times the amount of power which is used on the average during the day, even without trespassing on the overload capacity of the generators; besides the average of seven trains per day for the country will give an idea of what a variation may exist on any division, especially when we consider that eight or ten freight trains might be sent out at ten or fifteen-minute intervals to ascend a heavy grade, and that in the next eight or ten hours there might be little or no movement upon the line, as is the case with stock runs. We have indicated above that the required output is likely to be double that which has been suggested, and under these circumstances it would certainly be necessary at least to double the size of the power houses required, which would probably increase the average cost per mile from $10,320 to $12,000 for the electric equipment, and if we take our interest and depreciation at 5 per cent and 3

per cent, respectively, we have a charge of $960 per mile against the capital cost of our electric installation. If, as above stated, we assume that the cost of power in each case will be equal, our electric operating expenses for the United States as a total would be increased from $5,255 to $5,607 per mile, leaving a decreased cost of operation due to electric power of $802 instead of $1,154; and when we see that our interest and depreciation are likely to amount to $960 per mile, we have little argument to induce us to electrify the average railways of the country on the theory of reducing our cost of operation.

Moreover, we must refer again to the remarks of Mr. Wilgus in which he stated very clearly that the actual cost of electrification was only about one-quarter of the total cost of expenses made necessary by that electrification.

G. R. HENDERSON.

THE BOW TROLLEY IN GERMANY

BERLIN, Germany, Jan. 28, 1907.

EDITORS STREET RAILWAY JOURNAL:

Your issue of Jan. 19 contains a letter by Mr. Eugene Eichel, in which he criticises certain statements in my article in your issue of Jan. 5, but his remarks show that he has been misinformed as to the real condition of affairs in this country. The superiority of the bow for German conditions is no longer a question of individual opinion, as Mr. Eichel intimates. Recent statistics, compiled under entirely unbiased auspices, show that while the cost of both types of current collectors is practically the same so far as the wear of the collectors is concerned, the trolley wire wears out much faster, under the same operating conditions where wheels are used than where the bow is employed. Besides this, the sliding bow sets itself automatically in the proper direction when the car is being switched, never leaves the wire, and does not require that the wire should be exactly over the center of the track. Its greatest points of superiority as demonstrated after ten years' experience are therefore safety in operation because the collector cannot leave the wire, and a considerably reduced wear on the trolley wire.

The instance of the Charlottenburg street railway, given by Mr. Eichel as an example of change from bow to wheel, has no bearing on the question. The true reason for the change was the purchase of that line by the Grosse Berliner Strassenbahn, which was using the trolley wheel on the rest of its system, and naturally did not care to have two types of current collection. The mixed overhead and accumulator system of the Charlottenburg company was also abandoned at the same time. It is interesting to add that when this mixed system was in use almost twice as much current was collected by the bows as was afterward required by means of the wheels.

Among the lines which so far have changed from the wheel to the bow may be mentioned the street railways in Wiesbaden, Plauen and Aibling-Feilnbach. On the last named road the wheels left the wires so often in going around the curves at high speed that it was impossible to keep the schedule. In Amsterdam, after two lines had been equipped with trolley wheels, it was decided to adopt bows for the entire system. The cities of Düsseldorf and Nurnberg, as well as the Essen street railway, have also been contemplating changing from the wheel to the bow. The government of Saxony demands the use of the bow on all the street railways in that kingdom.

In all of these cases operating expenses were the deciding factor in the change. This fact I cannot state too clearly, and in Germany there is not an independent electrical engineer who prefers the wheel to the bow. The reason for the more extended use of the trolley wheel is simply that ten years ago, when most of the German street railways were electrified, the bow had not yet been fully developed, hence the wheel, which had already been adopted in America, was chosen in preference to the still almost unknown sliding bow. Another reason is that Siemens & Halske was the only company to adopt the bow while all the other electric companies used the trolley wheel, and, as previously mentioned in your columns, Siemens & Halske electrified only a small part of the German street railways.

Mr. Eichel is equally in error in his statement regarding horn lightning arresters. They are used not only on the Siemens roads, but also on the following: Bergische Kleinbahnen Neviges Elberfeld; Munich Lokalbahn; the tramway systems of Hamm, Augsburg, Nürnberg, Braunschweig, Nordhausen, Jekaterinoslaw (Russia) and Charleroi (Belgium), the Berlin-Charlottenburg street railway, and on the Swiss railways equipped by the Oerlikon Company. It should be stated, however, that the lightning arresters with magnetic blow-outs furnished by the Allgemeine Elektricitäts Gesellschaft have been found to work very well.

American street railway managers naturally look somewhat askance at the bow collector, because there is no possibility in the United States of comparing both systems, but since Mr. Eichel has brought up the subject of German conditions and practice, I cannot but repeat that no unprejudiced railway man in Germany any longer believes in the superiority of the trolley wheel. The conclusions in the articles in "Elektrische Bahnen und Betriebe," referred to by Mr. Eichel in the footnote to his letter, were erroneous and were supposed to prove that the bow touches the trolley wire at only one point, whereas the wheel touches the wire in a series of points or a line.

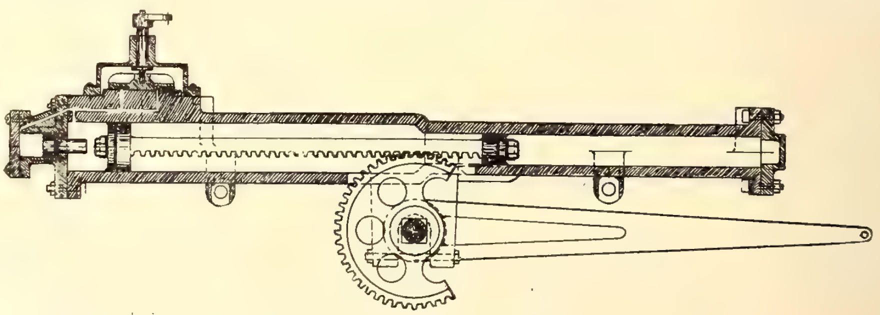
GERMAN ENGINEER.

PNEUMATIC DOOR OPENERS

Chicago, Jan. 31, 1907.

Editors STREET RAILWAY JOURNAL:

I wish to take exception to some of the statements by Mr. Fox in your issue of Jan. 12 in regard to the inefficiency of made by Mr. Fox regarding perfect and inefficient mechan-



SECTION OF NO. 3 OPENER

my No. 3 machine, which is typical of all of the sizes made by me, is shown in the accompanying engraving. It is simple in construction and very positive in action, is controlled electrically, pneumatically or by hand, uses but one measure of air for two movements of the door, and has an arresting cylinder to prevent the slamming of the door when it is connected to the main drum of the air-brake sys-

tem, dispensing with the reducing valve, which is an important item. As the pipe which supplies air to the small cylinder is out of center it is not shown in the accompanying section. The following is a statement to show the amount of air used for two movements.

This opener is designed for 70 lbs. initial pressure. The 1⅝-in. cylinder has a cross section of 2.074 sq. ins. The 2 5-16-in. cylinder has a cross section of 4.2 sq. ins. The door movement is 36 ins., and a 4-in. pitch diameter sector is used with an 18-in. lever. The piston displacement is 6½ ins.; 2.074×70 lbs. $=$ 145 lbs.; 4.2×70 lbs. $=$ 294 lbs.; 294 lbs. — 145 lbs. $=$ 149 lbs.; 145 lbs. $\times$ 2 ins. (one-half pitch of sector) equals 290 lbs.; 290 lbs. divided by 18 ins. (length of lever) gives 16 lbs. push on door; 4.2 sq. ins. x 6.5 sq. ins. equals 27 cu. ins. of air used for two movements.

In the 90-lb. pressure No. 3 machine and 44-in. door movement a 22-in. lever is used, and 18½ lbs. push and pull at the door is secured. The consumption of air is 27 cu. ins. for two movements of the door.

In the construction of this machine, stuffing boxes, set screws and keys are not used, consequently three items that cause trouble have been disposed of.

J. E. OSMER, Master Mechanic.
Northwestern Elevated Railway Company.

A HOME MADE CONSTRUCTION CAR

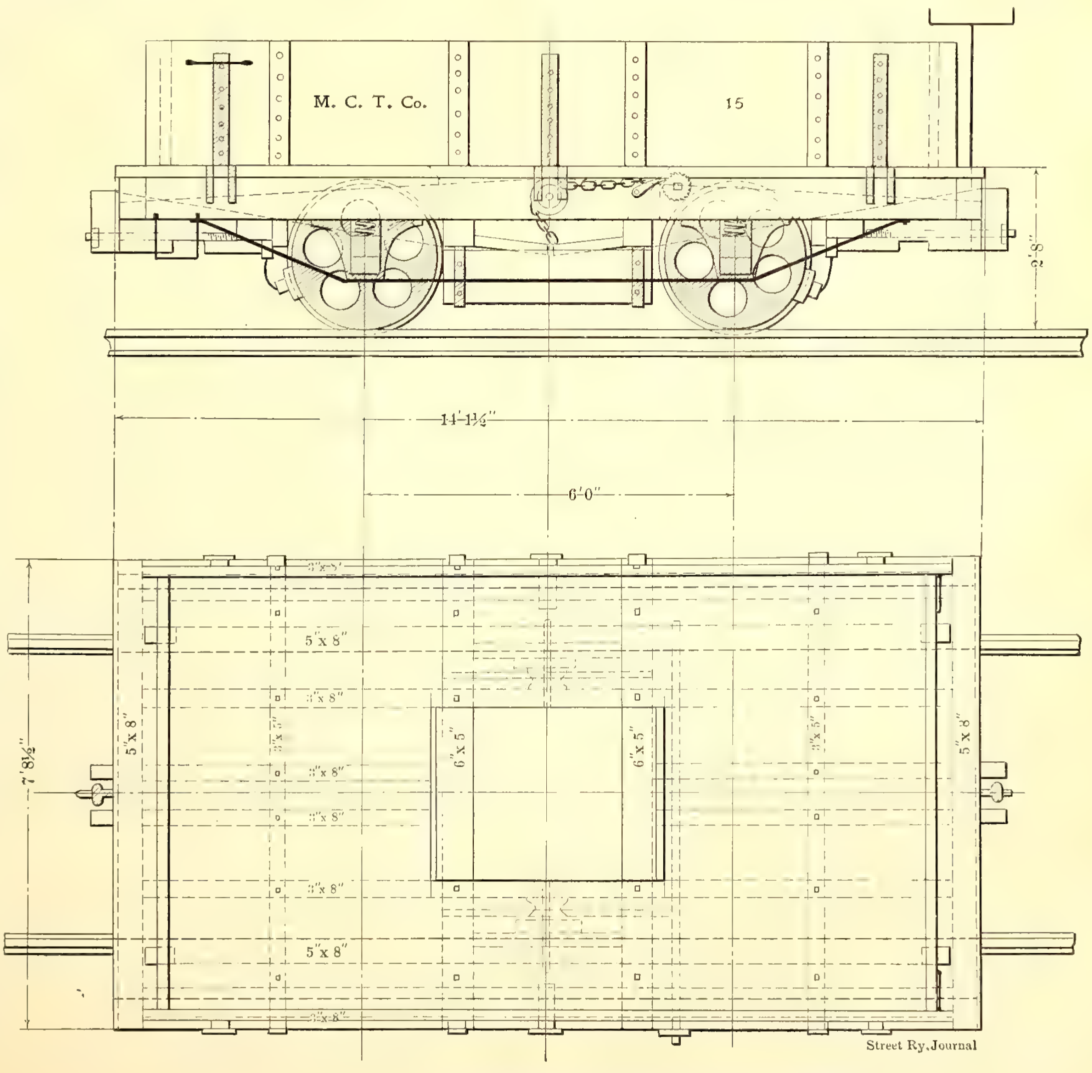
As noted in the STREET RAILWAY JOURNAL of Jan. 12, 1907, the Morris County Traction Company is building an extensive inter-suburban system in New Jersey territory contiguous to New York. Some difficulty was found in securing at reasonable cost construction cars substantial enough to carry the heavy ore-bearing ballast used on these lines, so the company decided to build its own cars.

Each car holds 6⅝ cu. yds. level full, 7 cu. yds. when loaded with sand, or about 10 tons of crushed stone. The car is built for standard gage and is mounted on a Brill four-wheel truck with 6-ft. wheel base. Hand brakes are used. The car body is 14 ft. 10½ ins. long and 7 ft. 8½ ins. wide. The floor is made of 2-in. plank and is 2 ft. 8 ins. above the head of the rails. The sides are also made of 2-in. plank and are hinged to the floor with three sets of hinges for each of the sides which are dropped when the car is to be unloaded. The hinge straps are of 3-in. x ½-in. iron and act as additional braces to the sides. When closed the sides are hooked on the outside to the ends. The latter are made of 2-in. plank and, like the sides, may be easily removed in case a flat car is desired.

There are eight longitudinal sills, 13 ft. 2 ins. long and 3 ins. x 8 ins. or 5 ins. x 8 ins. in width and depth as shown on the plan drawing. These are joined at the ends by two 5-in. x 8-in. sills, 7 ft. 8½ ins. long, through which are bolted six ¾-in. diameter longitudinal iron rods under the sills. There are also four crossbeams which are symmetrically placed with regard to the center of the car and clear the rail by 1 ft. 6 ins. They are 2 ft. 11 ins. apart on centers and 7 ft. 8½ ins. long. It will be noted that the end pair is 3 ins. x 5 ins. and the middle pair 6 ins. x 5 ins.

For use as a dump car, the center is furnished with a double drop door worked from the side by a ratchet wheel through a 2-in. diameter axle and 1-in. diameter wrench bar. The chains fastened to the ends of the doors coil up on this axle as the wheel is turned to close the door; in dumping, the weight of the material is sufficient to open the doors after releasing the ratchet. When open these doors clear the top of the rails by 2 ins. The chains are guarded from rock, etc., by 3-in. planking down to the doors. Outside of the chains are 1-in. board guards coming down to 5-ins. above the rails. The dump opening is 4 ft. x 3 ft. at the top. The doors are about 1 ft. below the floor level and are 1 ft. 2 ins. x 3 ft. 9 ins. They have hinge connections to the adjacent cross-beams. The door opening is 2 ft. 5 ins. x 2 ft. 10 ins. The total cost of material and labor for one of these cars was $302.25, made up as follows:

Eight hundred and fifty ft. B. M. lumber, at $35, $29.75; iron, including bolts, drawheads, brakes, shoes, hinges,

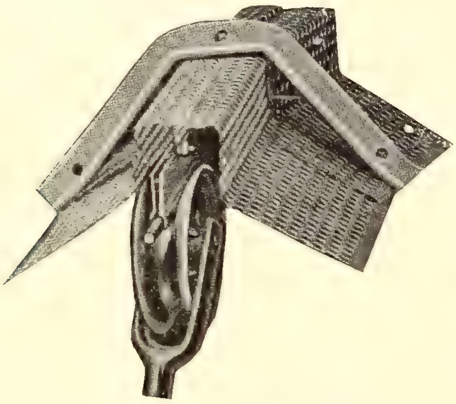


CONSTRUCTION CAR MADE BY MORRIS COUNTY TRACTION COMPANY

chains, etc., except the truck itself, 2000 lbs., at 2½c. per lb., \$50; carpenter work, \$75; blacksmith work, \$50; paint and painting (three coats), \$7.50; and truck, estimated at \$90.

A GUARD FOR STEAM RAILROAD CROSSINGS

A device designed to guard electric cars from becoming stalled on steam railroad crossings which, besides performing this vital function is simple in construction and combines a number of other important advantages, is being placed on the market by the Automatic Trolley Guard Company, of Buffalo, N. Y. It is known as the Automatic Trolley Guard, and as shown in the accompanying engrav-



GUARD AS INSTALLED

ing consists of a trough which makes it practically impossible for the wheel to leave the wire, and insures the return should it by chance jump. The channel in which the wire is centered, it will be noted, is of sufficient width to allow the wheel to rotate freely without the harp or wheel striking the sides of the wheel. The guard is in sections for easy handling and erection, and is as light as is consistent with perfect rigidity and strength. While no material that can unravel is used in its construction, still the guard is so built as to admit of the easy escape of locomotive exhaust. The guard is adaptable to any curve. Another feature of it is that it cannot arc or burn. A. B. Weeks, of Chicago, is the Western agent of the company.

SEMI-CONVERTIBLE CARS FOR CENTRAL PENNSYLVANIA TRACTION COMPANY

The Central Pennsylvania Traction Company, which operates all the lines in Harrisburg, Pa., has received within a year three lots of Brill semi-convertibles, one of the cars to be shipped last month being shown in the engraving. The company advocates plenty of standing room for its patrons. The cars shipped last spring and those just completed carry out this idea to the extent of having longitudinal seats at the four corners extending the length of three windows. The company also operates semi-convertibles having longitudinal seats entirely, and both the arrangements mentioned are somewhat unusual in cars of this type, and indicate that the majority of passengers carried will be short trippers.

The new cars are longer by one window than cars having the same seating plan shipped previously; the platforms are also a trifle longer. The cars measure 30 ft. 8 ins. over the end panels and 41 ft. 1 in. over the vestibules; other dimensions are standard and the bottom framing is also the standard found in this type of construction. No doors are provided at the entrances, the Brill folding gate being utilized. The car bodies are mounted on the Brill No. 21-E

INTERIOR OF CAR FOR HARRISBURG

truck with a wheel base of 4 ft. 6 ins. There were five cars in the shipment.

NEW ROLLING STOCK FOR QUINCY, ILL.

The American Car Company, of St. Louis, included in its shipments of last month six 18-ft. closed cars for the Quincy Horse Railway & Carrying Company, which operates an electric road in Quincy, Ill. The accompanying engraving shows one of the new cars in operation on the streets of Quincy. It will be seen that the new cars have only one entrance on each side, the passenger entering the car through a door of the familiar Brill "Accelerator" type. Natural quartered oak forms the finish of the cars and the seats are arranged longitudinally. The builders have used their own type of sand box, and the angle-iron bumpers, signal bells and alarm gongs are of the Brill manufacture.

SINGLE-ENTRANCE CAR IN USE IN QUINCY

The truck employed is the Brill No. 21-E, and two motors of 35 hp each were installed on each car. The chief dimensions are: Length over end panels, 18 ft.; over vestibules, 28 ft.; width over sills including sheathing, 7 ft.; size of side sills, 4¾ ins. x 7 ins.; sub-sills, 3¾ ins. x 4 ins.; end sills, 3¾ in. x 6 ins.

"LIMIT" CAR HOUSES OF CHICAGO UNION TRACTION COMPANY DESTROYED BY FIRE

The southeastern portion of what is known as the "limit" car houses of the Chicago Union Traction Company was destroyed by fire early Thursday morning, Jan. 31. The loss in cars was confined to about twenty-five single-truck cars, of which ten were old cable trailers. The total loss was about $100,000. None of the new double-truck cars recently purchased by the company were consumed.

THE RUINS OF THE CHICAGO CAR HOUSE

The fire started from an explosion of the Pintsch gas tanks used in charging the lighting systems of the old cable cars, and the flames spread so rapidly that the efforts of the firemen were confined mainly to the saving of adjacent repair shops. The three bays which the fire reached were used for the storage and inspection of cars and were entirely consumed, only the roof trusses of the northernmost bay and walls remaining. The car houses were originally built for cable cars and were not provided with any automatic sprinkler system.

Very little delay in the operation of the lines was occasioned by the fire, as divisions in other portions of the city were each called upon to furnish a few cars to take the place of those burned.

General Manager Roach has given out a statement to the effect that one hundred new cars are now being built for the company, and that he believes the receivers of the company will give another similar order for cars within a short time. Early on the morning after the fire gangs of men were put to work cleaning up the ruins, and in all probability new and modern car houses will be erected at once.

The cars of the Rhode Island Company, which operates in Providence, Pawtucket, Central Falls and other places in Rhode Island, are all to be equipped with vestibules.

BAGGAGE AND EXPRESS CARS FOR ILLINOIS SYSTEM

The increased mileage of the Illinois Traction Company's system has necessitated from time to time additions to the rolling stock. During the earlier portion of last year three large buffet cars and several passenger cars built by the St. Louis Car Company were put in service on the line, and this car company has just completed several additional cars for the system built much in accordance with the plans of some of the cars furnished last year.

The new cars, which are constructed with baggage and passenger compartments, measure 51 ft. 6 ins. in length over all and are 8 ft. 6 ins. wide over the siding. They are intended for operation in one end only. The motorman's cab is located in the left corner of the forward or baggage compartment, and entrance is gained to it either from the outside of the car through a narrow door or from the baggage compartment through a door about 3 ft. high in the side of the partition separating the cab from the baggage compartment. The rear of this partition contains a switch cabinet in which are placed all of the switches for the type-M multiple-unit control system, for the pump motor and for the lights, and also a cabinet for the emergency tools. This latter cabinet is provided with a glass door which opens out into the baggage compartment. The toilet room is located in the rear of the car on the left side of the rear door. Opposite it is the hot-water heater.

The car is mounted on St. Louis Car Company No. 61 trucks having wheels 33 ins. in diameter and with 4-in treads. The car is designed to take a curve of 42-ft. radius. In addition to the air brakes an 18-in. vertical brake lever is provided. The fact that the cars are built along the same lines as cars already in service indicates that this style of car is well suited for interurban service.

EQUIPMENT DAMAGED BEYOND REPAIR

FINANCIAL INTELLIGENCE

The Money Market

WALL STREET, Feb. 6, 1907.

A somewhat firmer tendency developed in the local money market during the past week. Money for day to day use was in abundant supply at rates ranging from 4 to 1¼ per cent, the latter figure being the lowest rate for call money recorded in many months. In the time loan branch, however, the tone was decidedly harder, and asking rates for all maturities were fully ¼ per cent higher than those heretofore ruling. Sixty-day money commanded 5¼ per cent, ninety days 5½ per cent, four to six months 5¾ per cent, and nine to twelve months 6 per cent. The higher rates were due in part to the continued demand for fresh capital on the part of corporations. During the past week announcements of several issues of short time notes were made, the most important of which was that of $50,000,000 made by the New York Central and affiliated lines. Other important factors working in favor of higher interest charges were the sale of $30,000,000 bonds by the city of New York on Feb. 1, and the repayment by the banks of the special deposits of Government funds, made by Secretary Shaw to relieve the money stringency which prevailed during the closing months of last year. A feature of the week was the sharp fall in rates for sterling exchange of 110 points, as a result of the purchases of short-time railroad notes and other securities in the local market by foreign investors. The offerings of bills against these purchases carried sterling to a point permitting the importation of gold from Europe at a profit, but it is doubtful if our bankers will be able to secure any considerable amount of the yellow metal for shipment to this side. Thus far $1,000,000 has been engaged for import, and while additional amounts may be secured in the London open market from time to time, the general opinion in banking circles is that as soon as the movement shows signs of assuming large proportions, London bankers will find effective means of checking the outflow in this direction. The bank statement published on last Saturday was better than expected. The net loss in cash was only $500,000, or about one-third as large as the preliminary estimates, but, on the other hand, loans increased $11,800,000, owing to the shifting of loans from other institutions to the clearing house banks. The reserve required was $2,427,100 larger than in the preceding week, thus reducing the surplus reserve $2,928,700. The surplus now stands at $12,734,100, as against $15,562,800 in the previous week, $11,127,625 in the corresponding week of last year, and $19,841,925 in 1905.

The Stock Market

The growth of pessimism was the distinctive feature in connection with the stock market during the past week. This was all the more pronounced for the reason that prices have been on the downgrade ever since the announcement that the Union Pacific had been placed on a 10 per cent dividend basis, and also on the ground that liquidation has been of a broad character from the Wall Street point of view. The selling has been not so heavy as persistent, and each rally merely serves to bring more stock on the market. The reasons for this downward movement are not obscure. They include, first of all, the monetary situation, which is far from satisfactory, notwithstanding the renewal of gold imports; the destruction of confidence by the continued attacks upon corporations by Federal and State authorities, and the large demand for new capital through the issue of short-time notes by railroad and industrial companies. Perhaps the attack upon the Union Pacific interests has had a more widespread effect than any other development, but it is a period of adverse rumors, and sentiment has shifted strongly to the selling side of the market. Interest continues to center in the so-called Harriman group, and the illness of the head of this system doubtless had no little influence in bringing about lower prices for all these shares, especially Union Pacific. Southern Pacific held up remarkably well, and this may be due to the large earnings which the company has reported and the favorable outlook for even larger totals. The weakness in the coal and iron stocks is not to be accounted for by any decrease in earnings, present or prospective, while the lower prices for the United States Steel shares does not appear to be justified, as the earnings of the company for 1906 were of record volume, and the amount of new business booked is larger than can readily be handled. The copper stocks slumped pretty badly, but the copper metal situation has not changed, and the demand is still far ahead of possible production for the next six months. The decline in Amalgamated has been rather more than expected, and the lack of support in this stock had an unfavorable influence on the entire list. Foreign interests have been buyers of nearly all the international shares and also of the short-time notes issued by railroads. The Hill stocks have not been weak but have followed the general market, instead of, as usual, being leaders in the price movement. These companies are under legal fire, but they are in a strong position and already have had a decline, which would appear to discount all unfavorable conditions. The local traction stocks have suffered like all others. Summing up the situation little is found that is encouraging, but it will not do to ignore the fact that the market has passed through a period of drastic liquidation, that weak holders have been shaken out and that a large short interest has been created.

Among the few redeeming features of the situation are the undoubted fact that the Federal administration is inclined to withhold any further hostile measures for the time, and a general disposition to "discount" the adjournment of Congress, though that event is still some weeks off.

Philadelphia

Trading in the local traction stocks was comparatively quiet during the past week and prices generally displayed a declining tendency. Interest centered almost entirely in Philadelphia Rapid Transit, which was under pressure practically throughout the entire week. After selling at 21⅝ at the opening, it ran off more than a point on sales of about 10,000 shares. Philadelphia Traction, after selling at 96, dropped to 94¼, and Union Traction declined from 58 to 57½. Other sales included American Railways at 50⅝, Philadelphia Company 45½ and 45, Philadelphia Company preferred at 47, United Companies of New Jersey at 254, Union Traction of Pittsburg preferred at 47½ and Railways General at 6½.

Baltimore

The market for tractions in Baltimore was generally quiet, but prices as a rule showed very little change from those prevailing at the close of last week. United Railway issues were very firm except the incomes, which lost nearly a point to 57⅜. The 4 per cent bonds sold at 89⅝ and 89¾, the refunding 5s at 86½, and the free stock at 12¾. Knoxville Traction 5s brought 106¾ and Richmond Traction 5s sold at 105⅜. Other transactions included City & Suburban 5s at 108¼ and 108½, Baltimore Traction 5s at 111, Baltimore City Passenger 5s at 110½, and Norfolk Railway & Light 5s at 98 and 97.

Other Traction Securities

The most important development in the Chicago traction situation during the week was the action of the Chicago City Council in passing the Chicago City Railway and Chicago Railway's (Union Traction) ordinance by a vote of 56 to 13. It is expected that Mayor Dunne will veto the ordinance, but the large majority in the Council in favor of the measure insures the repassage of the ordinance over the Mayor's veto should it become necessary to do so. The ordinance, however, does not take effect unless the question is ratified at the general election to be held on April 2. The passage of the ordinance failed to stimulate trading in the stocks of the surface lines, but prices for all of the issues held decidedly firm. Other sales were: Metropolitan Elevated common at 26, Metropolitan Elevated preferred at 69 and 70, and South Side Elevated at 86¼ and 87. The Boston market was very quiet. Boston Elevated, after selling at 151 broke 2 points, and later recovered a small fraction. Massachusetts Electric common and preferred were steady, with sales at 19 and at 69, respectively. Boston & Worcester common sold at 27 and 27½, West End common at 94 and 93, and West End preferred at 108¾.

Quite a little activity has been shown in traction securities on

the Cleveland Stock Exchange the past week. Between 900 and 1000 shares of Cleveland Electric stock changed hands, while 200 shares of Northern Ohio, 100 of Cleveland & Southwestern and 370 certificates of the Washington, Baltimore & Annapolis were sold. Cleveland Electric showed quite a little decline for some reason, while other securities about held their own. It is expected that Cleveland Electric will be variable until the announcement of the finding on the holding plan. Forest City Railway stand 95 bid and 99 asked. Cleveland Electric 63½ bid and 64 asked.

Security Quotations

The following table shows the present bid quotations for the leading traction stocks, and the active bonds, as compared with last week:

	Jan. 30	Feb. 6
American Railways	50⅜	50½
Boston Elevated	150	149½
Brooklyn Rapid Transit	72⅞	73½
Chicago City	160	a180
Chicago Union Traction (common)	4⅞	4¾
Chicago Union Traction (preferred)	16	16
Cleveland Electric	—	63½
Consolidated Traction of New Jersey	75½	75½
Detroit United	a79	77
Interborough-Metropolitan	34¼	35½
Interborough-Metropolitan (preferred)	71⅛	71¼
International Traction (common)	—	59
International Traction (preferred), 4s	—	80
Manhattan Railway	141½	142¾
Massachusetts Electric Cos. (common)	19¼	19
Massachusetts Electric Cos. (preferred)	69	69
Metropolitan Elevated, Chicago (common)	—	a26
Metropolitan Elevated, Chicago (preferred)	—	67¼
Metropolitan Street	104	104
North American	81	81½
North Jersey Street Railway	40	40
Philadelphia Company (common)	45¼	45
Philadelphia Rapid Transit	20¾	20¾
Philadelphia Traction	94¾	94¼
Public Service Corporation certificates	—	68
Public Service Corporation 5 per cent notes	—	96½
South Side Elevated (Chicago)	—	86
Third Avenue	117½	117½
Twin City, Minneapolis (common)	103	103
Union Traction (Philadelphia)	57	56½

a Asked.

Metals

According to the "Iron Age" the movement east of the Allegheney Mountains was lighter during the past week. The demand for early and late delivery is light, and a canvass of the different sections of the trade indicates considerable indifference at the present level of prices. The protest against making the advance in rate of freight from Southern furnaces of 25 cents per ton effective on Feb. 1 has been successful, and March 1 is now named as the date. The steel market is easier east of the Allegheney Mountains, the Western mills being willing to deliver at $32. Eastern steel works are not generally meeting that price, and are cautious as to commitments for the second half. Comparatively little business was put through in steel rails. The demand for sheets and steel bars continues lively.

Copper metal continues decidedly strong, with lake quoted at 25 and 25¼c., electrolytic at 24¾ and 25c., and castings at 24¼ and 24¾c.

BOSTON ELEVATED TAKES LAND FOR WEST SIDE ROUTE

The Boston Elevated Railway Company has made the land takings necessary to give it the entire line recently authorized by the Massachusetts Railroad Commission between the North Station and the Charles River Dam. The extension of the structure in this direction is a requirement of the Cambridge Subway act passed by the last Legislature, and the route begins at the head of the incline at the northerly portal of the present Tremont Street subway, follows Causeway, Billerica and Lowell Streets across private land and parallel to Leverett Street, crossing the edge of the Boston & Maine freight yard on the site of the dam. Construction must be begun by June 22, and finished within three and one-half years.

A. S. & I. R. A. MOVES ITS OFFICES

Secretary B. V. Swenson, of the American Street & Interurban Railway Association, has issued a notice to the effect that the headquarters of the association will be moved on Tuesday, Feb. 12, from 60 Wall Street, to the Engineering Societies' Building, 29 West Thirty-Ninth Street, New York. The association in its new home will have more commodious offices than heretofore, and it is believed that the plan of having the headquarters of all the national engineering and allied societies in one building will work out most advantageously to the general interests and welfare of these associations.

NO DEVELOPEMENTS AT MEETING OF THE COLUMBUS COMPANY

At the annual meeting of the stockholders of the Columbus Railway & Light Company, of Columbus, Ohio, Jan. 29, there was no indication that negotiations were pending for change of control of the system as reported recently. All of the old directors and officers were re-elected. The only business out of the ordinary that was transacted was the ratification of the terms by which the Central Market Railway system of Columbus is to be leased to the Columbus Railway & Light Company by the Columbus Traction Company. The latter company recently purchased the system from A. E. Locke, of Boston, who bought it at receivership sale a year ago for the Morgan-Dolan-Schoepf traction syndicate. The lines are leased for fifty years with the right of renewal, making it in effect a perpetual lease. In case the Columbus Traction Company fails to secure a renewal of its franchise, the lease will terminate. Preferred stock amounting to $500,000 of the Columbus Traction Company is delivered to the Columbus Railway & Light Company. Of this $250,000 is returned to the Columbus Traction Company for its treasury. This stock, however, can only be sold to the Columbus Railway & Light Company. Of the common stock, $400,000 is to be delivered to the Columbus Railway & Light Company and also $90,000 in money. The cash represents the 1000 shares of stock which were subscribed and paid in for the organization of the company. Of the $100,000 received for this, $10,000 is retained in the treasury of the Columbus Traction Company for expenses of that organization.

The preferred stock when issued is to be paid dividends of the rate of 1¼ per cent quarterly by the Columbus Railway & Light Company. On the common stock, dividends of 1 per cent are to be paid in January and July, 1908, and January, 1909; 1½ per cent in July of 1909 and January of 1910; 2 per cent in July of 1910 and January of 1911; thereafter 1¼ per cent quarterly. The Columbus Railway & Light Company does not assume the payment of the Central Market bonds, but only the interest charges of $25,000 a year on them.

President Robert E. Sheldon read the annual report, which showed the gross earnings of the company to be $1,931,088, which is an increase of 7 per cent in the railway department and a good increase in the lighting and power department over 1905. The net earnings were $784,667. The surplus earnings for year of $207,265, which, added to the surplus carried over from the preceding year of $85,432, made a total surplus of $292,697. Out of this $69,419 was paid for depreciation and renewal, leaving a net surplus account of $223,178. Out of this two dividends of $50,000 each were paid, leaving the total net surplus at the close of the year $123,178. Deducting the amount paid out for renewals and depreciation, the net surplus of the stock for the year was $137,846. The renewal and depreciation charge for the year was very heavy and should have been spread over several years, but as the money was all expended in 1906, it was all charged out of the earnings for that year. This showed about 4.1 per cent for the stock without taking out this large charge. The number of revenue passengers carried during the year was 42,329,204; transfer passengers, 11,600,432; total passengers, 53,929,686, an increase of 4,045,656 over 1905.

The members of the directory who were re-elected are R. E. Sheldon, E. K. Stewart, G. W. Sinks, Theodore Rhoads, Clarence M. Clark, C. H. Lindenberg and Carl J. Hoster. The board organized with the same officers, R. E. Sheldon, president; E. K. Stewart, vice-president, treasurer and general manager; C. M. Clark, second vice-president; P. V. Burington, secretary and auditor; Linden G. White, general superintendent.

CHICAGO TRACTION ORDINANCES PASSED BY THE CITY COUNCIL

The Chicago traction ordinances were passed by the Chicago City Council at 4 a. m. Tuesday, Feb. 5, after a session which began at 8 p. m. Monday, Feb. 4. This action by the Council means that the traction question, which has been before the people for ten years, is settled forever, or that it will have to be taken up anew. The result of the election in April, when the ordinances are to be submitted to a referendum vote, will settle this question. No matter what may be the result of the April election, according to the promises of the traction companies, service is to be improved at once.

The ordinances were passed with an amendment which assures the voters that if they do not approve of them at the April election the measures become null and void, and if there be no referendum on the ordinances they are to be void anyway. This last clause was adopted to allay the fears of those who believed that since the April election is not a "general" election no referendum can be taken at that time. Attempts of the opposition to delay the passage of the ordinances resulted in the presentation of many amendments. Some of these, which were lost, were to compel the companies to sell six tickets for 25 cents at all times and eight for this price during rush hours; one containing provisions for financing the proposed subway, and one providing that the city's share of the net receipts should never fall below 8 per cent of the gross earnings. An amendment was passed providing for the interchange of transfers between the Chicago City Railway and the South Chicago and the Calumet Electric Railways, as soon as the franchises of the two minor companies expire.

The question of the referendum vote in April is still in doubt, although 184,000 names, or about double the number required, have been signed to the petitions circulated, asking that the traction question be submited to the people. Many of these names it is generally admitted were obtained illegally, but the fact that the faction in favor of the ordinances was willing to adopt the amendment providing that the ordinances be declared void if no referendum is taken is evidence in itself that there will be no attempt to prevent a referendum by an investigation of the signatures on the petitions. If those signing the petitions for a referendum should vote against the ordinances they will be declared void, as the signers to the petitions, assuming no fraudulent names are on them, constitute a majority of the voters.

As previously stated in the Street Railway Journal, the ordinance adopted provides briefly that the city shall issue twenty-year franchises to the Chicago City Railway Company and the Union Traction Company, with the understanding that on six months' notice at any time the city may purchase the street railways controlled by the companies for $50,000,000, plus the cost of rehabilitation. The companies are at once to reconstruct and re-equip all the lines under the supervision of three experts, one to be appointed by the city and two by the street railway companies. Under the new ordinance the street railway companies for the usual fare will grant universal transfers to all parts of the city.

That portion of the ordinance which provides for division of the receipts is especially interesting. Briefly, settlements are to be made between each company and the city once a year, on or before April 15, for the previous year ending Jan. 31. From the gross receipts are to be deducted all expenses of operation, including maintenance, repairs and renewals; all percentages set aside as special funds for maintenance, repairs, renewals, depreciation and personal injury claims; all taxes and assessments on the property of the company, including capital stock or franchise taxes levied after the year 1906; all salaries and expenses of the board of supervising engineers, and "a sum equivalent to 5 per centum per annum for said preceding year upon the amount of the cash purchase price which the city would then be obliged to pay" for the property if it were purchasing it for municipal operation on such Jan. 31, interest being adjusted as to items added to the purchase price during the year. A deduction for a special fund may be made in the case of the Union Traction receipts to protect the city against interest charges on bonds. The net receipts remaining after these deductions is to be divided in the proportion of 55 per cent to the city and 45 per cent to the company. Under specified conditions of not perfecting title and removing liens and incumbrances the Union Traction share of net receipts may be suspended.

AFFAIRS IN CLEVELAND

At the McKinley Day banquet of the Tippecanoe Club in Cleveland last Tuesday evening, Circuit Judge F. A. Henry surprised the friends of the holding plan by roundly scoring both the plan and those who are advocating it. As a result, the Cleveland "Press," organ of the city administration, struck back at the Judge with the assertion that he had no right to pass judgment on the plan, as some of the questions relating to it may later come before his court. However, the expression from Judge Henry seems to have come in the line of criticism of some of the things that are holding the city back and retarding movements for better things instead of encouraging them. He is quoted as follows:

"If this holding company plan goes through, it will be because of the glamour of the 3-cent fare and the desire for peace; not because of any real advantage to the people. In the first place, the security franchise ought to be on at least as favorable a basis for the people as the seven-for-a-quarter offer already made. And this is because there is a high possibility that the holding company and the 3-cent fare will be short lived. There is not and cannot be any advance assurance that so complicated and unprecedented an arrangement will stand the test of the courts. There is not and cannot be any advance assurance, except mere opinions, that 3-cent fare will pay—especially where ownership stimulus to economy is wanting. A holding company trying to operate on 3-cent fare, amid high and rising prices of material and labor, and with only a public interest in its success, may well be foredoomed to failure.

"If the persons in charge of the holding company shall, directly or indirectly, owe their appointment or tenure to the Mayor, or to any other elective representative of the people, what law is there to hinder the street railways being used as a political machine? To what depths of disreputableness and inefficiency may it not fall, uncontrolled and unrebuked?

"Do we not now have dirty streets and the highest tax rate ever known? Yet we can remove our public servants if we choose. Not so of the holding company, though it give us dirt and discomfort to any extent its irresponsibility may carry it. The holding company plan, if it persists, has every evil of municipal ownership, without any of its safeguards, and if it does not persist, it remits us to a higher rate of fare than the highest that has been considered in this whole controversy. I have pointed out the responsibility of supporting what must remain a fundamentally vicious arrangement will rest upon the present city administration."

President Andrews, of the Cleveland Electric, and President Du Pont, of the Municipal Traction Company, have spent much time the past week in the work of getting together data upon which to base conclusions on the holding company proposition. The value of the unexpired franchises is giving the two presidents considerable trouble. This is especially true of the franchises in the suburban villages. They have perhaps spent as much time on this feature of the work as any other, but feel they have been making rapid progress toward a conclusion.

W. B. Colver a few days ago tendered President A. B. Du Pont, of the Municipal Traction Company, $6,000 for joint use of the Forest City Railway tracks on East Fourteenth Street by the Low Fare Railway Company. It was refused, Mr. Du Pont telling Mr. Colver that he could do nothing until the expiration of the agreement made with the Cleveland Electric not to assist in the invasion of its tracks while the truce lasts. It is said that the Low Fare Railway Company has made tenders of sums aggregating $35,000 for the use of its tracks on Euclid, Superior and Detroit Avenues and West Twenty-Fifth Street, all of which has been refused. Under the franchises granted by the City Council, it is said that the company is now free to commence the operation of its cars, although it may be stopped by injunction. Secretary Colver stated that his company is not bound by the armistice, but declined to state his intentions as to operating his line.

President Du Pont has announced that the Municipal Traction Company has placed an order for fifty new cars. They will not be of the double-end pattern, but will have very large rear platforms.

It is possible that the result of the negotiations on the holding plan may be announced within a week, but there is nothing definite in regard to the time. The work is being done in a most thorough manner, and requires time on each point.

ELEVATED RAILWAY PROPOSED FOR SAN FRANCISCO

The plan of having an elevated railway along the water front of San Francisco, which has been suggested before, has again been broached. The present plan, as reported, is to build an elevated railroad for the transportation of freight and passengers from the northern end of the city to the southern end, the project involving an expenditure of $5,000,000. Under existing conditions, it is very difficult to get freight from the North Beach district across Market Street; it is also exceedingly difficult to have freight handled within the city limits except by drayage or by water. Passenger transportation between the north and south sections is also greatly hindered by the present condition of the streets. It is to relieve these conditions that the new road has been proposed. The route of the proposed road will be along North Beach, through the wholesale district, crossing Market Street on a viaduct, following the water front, through the Potrero and down south as far as Visitacion Valley. It is purposed to handle passengers over the elevated tracks during the daytime and freight at night. Owing to the freedom from obstruction the trains will be able to make fast time and will afford a ready avenue for freight exchange.

THE ANNUAL MEETING OF THE IOWA STREET & INTERURBAN RAILWAY ASSOCIATION

The announcement has been made that the convention of the Iowa Street & Interurban Railway Association for 1907 will be held at Lafayette Inn, Clinton, Ia., April 19 and 20. As yet the program for the convention has not been completed, so announcement of it in detail cannot be made at this time. It is understood, however, that the program will include among its numbers a paper dealing with the steam motor car and its value for interurban service, and that other subjects will be assigned, such as Freight Handling by Electric Lines; Amusements—How should this Feature be Handled by the Operating Companies? Modern Train Dispatching Methods for Electric Railways; Handling the Peak of Rush-Hour Traffic on City and Interurban Lines. This is the fourth convention of the association, and a feature of it will be the attendance of the trade, ample space having been provided for suitable exhibits. In connection with the announcement of the meeting, L. D. Mathes, secretary and treasurer of the association, says that the paper presented at the last meeting entitled "The Adoption of Gasoline Motors for Street and Interurban Service," by F. W. Hield, has provoked considerable discussion since its presentation and has resulted in a great many inquiries from outside sources for copies of the paper. Inquiries regarding the hotel reservations and other matters in connection with the convention should be addressed to P. P. Crafts, general manager of the Indiana & Iowa Railway Company, Clinton, Ia. The officers of the association are F. J. Hanlon, president, Mason City, Ia.; P. P. Crafts, vice-president, Clinton, Ia.; L. D. Mathes, secretary and treasurer, Dubuque, Ia.

SOME INTERESTING FIGURES FROM PENNSYLVANIA STATEMENTS

In his forthcoming annual report Secretary of Internal Affairs of Pennsylvania, I. B. Brown, will give some interesting statistics showing the growth of the street passenger railway business in Pennsylvania during the past twenty years. The following comparison is submitted:

	1887	1907	Gain in 20 Years
Companies reporting....	67	238	171
Capitalization	$25,588,811	$163,653,441	$138,064,630
Cost of road and equip..	12,326,069	140,916,435	128,590,366
Operating receipts	10,025,906	41,039,186	31,013,280
Total trackage (miles)...	519.85	3,325.33	2,805.48
Passengers carried	184,835,994	949,647,802	764,811,808
Killed by street railways.	11	224	213
Injured by street railways	63	4,681	4,618
Cars in service..........	2,207	8,484	6,277

Secretary Brown states that electric cars were not in use in Pennsylvania twenty years ago, and points to the fact that the percentage of increase in the number of passengers carried, capitalization, etc., is much less than the percentage of increase in accidents.

"One of the most remarkable features connected with these transportation companies," continues the report, "is that there is scarcely a vestige left of their physical or tangible affairs which were utilized only two decades ago. The motive power has entirely changed except that there may be in some isolated cases a few cars which are hauled for a short distance by horses, and there may also be some localities where the cable is still in use, but the prevailing power is that of electricity. The transition from one condition to another has been not only rapid but effectual. Of the old conditions existing twenty years ago there is practically nothing left but the bare rights and franchises."

PRESIDENT MELLEN ON RAILROAD MERGERS

President Charles S. Mellen, of the New York, New Haven & Hartford Railroad, addressed the committee on railroads in the Senate chamber at Hartford, Conn., Jan. 30, in reference to House petition No. 20, which calls for a change in the position of certain convertible debenture bonds. He presented to the committee a substitute bill for the measure already requested, and referring to the second section of it he declared that he desired an absolute merger of certain properties which the New Haven road and its closely affiliated company, the Consolidated Street Railway Company, have purchased recently. The petition on behalf of which Mr. Mellen spoke will give holders of convertible debenture bonds equal rights in subscribing for shares of the capital stock, which are to be issued at a future date, under authority already held by the company.

Mr. Mellen described the recent development of the New Haven system and the purchase of certain electric property. He declared that the new issue of stock was made imperative by the great growth of business, and said that already contracts had been made for new rolling stock to the amount of $21,500,000, to be delivered within fifteen months. He said that one item was 17,000 freight cars. He held that the latitude of a company in the issuance of stock should not be restricted. He referred to the purchase of the Ontario & Western road as an instance wherein the New Haven Company was able to thwart the designs of the roads that were trying to control the anthracite coal traffic, which would have meant the increase of price of coal to New England manufacturers.

He explained some of the reasons which had impelled him to purchase trolley properties, and he said that it was the intention to merge all these roads, as far as they are able, and wipe out their corporate existence. Mr. Mellen said that the public press had criticised him for the purchase of the stock of the Connecticut Railway & Lighting Company, but he said the criticism did not justly lie against the New Haven road. In reply to a question from a member of the committee as to the merger of roads in Massachusetts, President Mellen said he had received authority for every merger that he had asked for.

CALIFORNIA RAPID TRANSIT RAILROAD

Mention was recently made in these columns of the incorporation of the California Rapid Transit Railroad Company. This company was incorporated at Phœnix, Ariz., with a capital stock of $10,000,000. The route of the proposed railway is as follows: Commencing in the city of San Francisco, and running thence along such route as may be selected through or near Burlingame, San Mateo, Redwood City, Palo Alto, San Jose, Monterey, and thence to the southerly shore of Monterey Bay, thence to Carmel River, a distance, as near as may be, of 140 miles. At some point near San Jose a branch is to commence that will run through Alameda County, via Alameda, Oakland and Berkeley, thence to Point Richmond, and terminating at Martinez, Contra Costa County, a distance of 75 miles.

Commencing at a point near the lines of the main track at Redwood City through Palo Alto, to connect at or near with the line at San Jose, a distance of 22 miles. It is contemplated to build a line from some point between Redwood City and Palo Alto, thence east to the Bay of San Francisco, and cross at Dumbarton Point, thence to the city of Niles, the branch mentioned to be 13 miles in length. The total aggregate mileage of the railroad and its branches is 250 miles.

The life of the corporation is to be twenty-five years, and may be prolonged in additional periods of the same length perpetually. The incorporating directors are as follows: William G. Alberger, L. E. Lee and William Minto, all of San Fran-

cisco. The temporary officers elected are: William C. Alberger, president and chief engineer; L. E. Lee, secretary; William Minto, vice-president; W. H. H. Hart, treasurer. It is certified that $250,000 of the capital stock has been subscribed for by the following persons: W. J. Morgan, H. C. Cutting, W. H. H. Hart, A. H. Butler, M. D. Eddy, H. P. Bowie, C. W. Clark, L. E. Lee, William C. Alberger, William Minto and the California Tunnel Company.

REPORT OF SOUTH SIDE ELEVATED FOR YEAR

The earnings of the South Side Elevated Company in 1906, as reported to the stockholders at their annual meeting Thursday, Jan. 31, show an increase in gross but a decrease in net, as compared with the figures of the preceding year. The amount available for the stock, after the payment of operating charges and interest on only $750,000 of the company's bonds, was $547,900, or 5.4 per cent on the outstanding issue, as compared with $626,000, or a shade more than 6 per cent, in 1905. As noted elsewhere in this issue, Leslie Carter retired from the presidency of the company and was elected chairman of the board of directors.

Following is a comparison of the earnings and expenses for 1906 with those of preceding years:

EARNINGS	1906	1905
Passenger	$1,721,213	$1,647,987
Other earnings	63,591	62,662
Miscellaneous	4,171	2,698
Total earnings	$1,788,975	$1,713,347
EXPENSES		
Maintenance of way	$77,984	$72,175
Maintenance of equipment	144,318	141,078
Conduct. transportation	534,946	437,934
General expenses	191,658	165,519
Loop rental	258,363	236,256
Total expenses	$1,207,269	$1,052,962
Net earnings	581,706	660,385
Bond interest	33,750	33,750
Balance	$547,956	$626,635
Dividends	409,177	409,165
Surplus	$138,779	$217,470

The balance sheet as of Dec. 31 compares as follows:

ASSETS	1906	1905
Cost of property	$12,238,803	$12,255,944
Cost of property—construction and extensions	6,367,591	3,989,900
Capital stock in treasury	92,400	92,400
Materials and supplies	126,314	137,879
Due from individuals and companies	11,489	15,905
Due from agents	5,855	9,242
Current assets	67,027	23,443
Cash	142,396	154,059
Cash—construction and extensions	83,135	949,250
Totals	$19,135,013	$17,628,023
LIABILITIES		
Capital stock	$10,323,800	$10,323,800
Funded debt	7,110,000	5,610,000
Current liabilities	255,049	336,839
Depreciation	50,000	50,000
Reserve	1,396,163	1,307,384
Totals	$19,135,013	$17,628,023

The balance sheet shows that $1,500,000 of construction bonds were delivered during the year. This increase is more than balanced by charges against new construction and extensions. The item of "construction cash" was reduced about $850,000.

REPORT OF THE PRESIDENT

In his final report to the stockholders Mr. Carter said:

"Gross earnings of the company from passenger traffic increased during 1906, 4.44 per cent. The net earnings decreased 11.9, or $78,678. Causes of the decrease in net earnings were: Increase in taxes, in wages and in the price of materials and supplies; increased competition of the surface lines; cost of operation during construction; the cost of operating short portions of new lines.

"Coal, for example, increased in cost for the year $26,753, and was the leading single item in the decrease of net. The second cause is one which we have long been expecting and, taken in connection with the third, is probably felt as much now as it will be. The building of the new lines and the construction of the third track were undertaken partly to meet the expected improvement of service on the surface lines. It is impossible to say how much reduction of patronage during the last few months is due to this competition, and how much to operating under the difficulties of construction. The unavoidable interruptions caused by the necessities of construction have undoubtedly deprived us of the patronage of some of our friends until construction on the third track ceases—a time not far distant.

"The strike of the structural iron workers, which delayed the construction of the road's extensions 228 days, cost the company in interest alone $158,000. Since the resumption of operations, May 23, 1906, a large amount of work has been accomplished, resulting in the completion of the third track—only excepting the straightening of the curve which we have so long desired to remove at Twelfth Street. This will be completed in about six weeks. The completion of the new steel constructed yard at Sixty-First Street; the completion of the Englewood main, or westerly, line, and such substantial progress on the south branch, Englewood, that our chief engineer believes that we will have that work finished by July 1.

"The Chicago Junction Railroad is progressing rapidly with its elevation, and its chief engineer hopes to turn over—ready for operations—the east line to Lake Michigan in the early summer, and the stockyards line in the autumn of this year.

"We feel sure that the whole construction, including many necessary and valuable additions, will be finished within the amount of the bond issue. The progress already made with the Englewood main line is encouraging, and promises a profitable business when it is all opened. In addition to the three stations opened last year, the station at Harvard Avenue and Sixty-Third Street was opened in November; Parnell Avenue and Halsted Street stations, opened in December, are doing well. Center Avenue station and Loomis Street station will soon follow. The south branch, Englewood, is now being erected, and we hope to open Sixty-Fifth Street station, Sixty-Seventh Street and Sixty-Ninth Street stations, successively in the spring, and to have them all in service by July. The express service and the through local trains to Englewood are well patronized."

SEVERE SNOW STORM

New York was the center last week of a severe snowstorm which affected transportation seriously and worked great hardship, especially upon those living out of the city and dependent upon the suburban steam lines. Delays in New York itself were not severe, however, the city lines almost to a unit operating continuously and frequently. The suburban lines in the Bronx, on Long Island and Staten Island suffered delays, but these were due to the openness of the country and the opportunity which such districts afford for the piling up of large drifts. Eleven inches of snow fell in all, the storm beginning Monday afternoon and continuing through the night. In Brooklyn traffic was practically normal, the "L" lines not being affected. The suburban surface lines in Brooklyn that suffered were those in isolated districts. It is said, unofficially, that the new type of surface car of the Brooklyn Rapid Transit Company demonstrated its superiority to the lighter car, equipped with maximum trucks. The storm proved that the gratings arranged for ventilating the subway which open into the street may be converted into a source of considerable annoyance in a severe storm such as the one just experienced on account of the snow drifting in. The Erie Railroad's trains on the local service were 20 to 40 minutes late, and the through trains from 2 to 3 hours. New York Central was not greatly affected. The locals were nearly all on time. The midnight train from Boston, No. 1, arrived 4 hours late. The New Haven trains ran about 15 minutes behind schedule time and through trains from 1 to 2 hours. The Pennsylvania Railroad was in about as good shape as any of the lines; all trains were from 1½ to 2½ hours late. On the Lehigh Valley Railroad all trains were late from ½ to 3 hours. The Delaware, Lackawanna & Western Railroad abandoned its coal and heavy freight traffic temporarily. Eastbound through trains were from 2 to 4 hours late and westbound trains also had trouble. Two-thirds of the suburban cars were in operation, but suburban trains were from 20 to 30 minutes late.

REPORT OF THE NORTH AMERICAN COMPANY

The pamphlet report of the North American Company for the fiscal year ended Dec. 31, 1906, has been issued. President C. W. Wetmore, in his statement to stockholders, calls attention to the fact that the company owns stocks of the par value of $43,818,897. The dividends received during the fiscal year were derived from stocks of the par value of $16,743,872. No distribution has yet been made of the surplus earnings pertaining to the remaining stocks—$27,075,025 par value. Continuing, Mr. Wetmore says: "The amount of dividends received during the fiscal year is less than the amount received during the fiscal year ended Dec. 31, 1905, by $233,133. In that year, in addition to the regular established dividends, paid quarterly or semi-annually, an extra dividend of $360,000 was received."

In explanation as to why the North American Company received no dividends from such a large portion of its stockholdings in other companies during the past year, the report says: "While the net income of the electric railway, light and gas companies in which the North American Company is interested, for the year 1906, after the payment of all dividends, was $1,195,066 (of which upon distribution the North American Company would be entitled to 82.2 per cent), it was deemed best not to distribute any part thereof, for the reason that the companies are all engaged in construction and development work, and the financial conditions, prevailing especially during the last six months of the year, have not been favorable for the sale of their interest-bearing obligations, which, as described in the last annual report have been created to provide for the capital requirements."

President Wetmore directs attention to the purchase by the United Railways Company, of St. Louis, of the St. Louis & Suburban Railway Company, for which it paid $4,000,000, par value, of United Railways Company preferred stock held in the treasury, which stock, however, is not to be entitled to dividends until after Jan. 15, 1908. It also assumes the indebtedness of the Suburban Company. This purchase was authorized in August, 1906, and consummated Dec. 31, 1906, the United Railways Company entering into possession of the property Jan. 1, 1907. By this purchase, the trackage of the United Railways Company has been increased 105.82 miles (41.21 in the city of St. Louis and 64.61 in the county of St. Louis), which makes its total trackage 456.64 miles, of which 350.59 miles is within the city limits and 106.05 miles outside of the city. It has attained an additional east and west trunk line running through the best part of the city, and through the business center; a line built on private right of way from the city limits half way to the business center, two additional cross-town lines and suburban lines, which extend to the western section of St. Louis County, and connect all of the important suburban towns and villages.

The United Railway Company of St. Louis has constructed extensive shops, adapted to the construction as well as the repair, of cars and their equipment, and has reconstructed, according to the highest standard, about 25 miles of track, and has otherwise improved its facilities. Extensions of the Milwaukee Suburban Railway system from Pewaukee Lake to Oconomowoc, a distance of 13 miles, and from Muskego Center to East Troy, a distance of 15 miles, will be open for service in the Spring. Reference is also made to the new light plants in St. Louis and Detroit.

REPORTED CLEVELAND & SOUTHWESTERN NEGOTIATIONS

Nothing official is available regarding the negotiations said to be under way by the Cleveland & Southwestern Traction Company for taking over the Webb line, now in operation between Columbus and Marion and the one under construction between Marion and Bucyrus. It has been stated that the offer of the Cleveland & Southwestern is to lease the Webb lines, for which 1 per cent dividends will be paid on the capital stock the first year and 1 per cent additional each year until the stock is paying 6 per cent. A conference was held with John G. Webb in Cleveland two or three weeks ago, when, it is said, he was made acquainted with the arrangement the Cleveland & Southwestern is willing to make. Previous to that time, President E. W. Moore had conferred with him in New York, and it was thought that some arrangement would be made by which this road would eventually connect with the Columbus, Delaware & Marion over the line now under construction between Marion and Bucyrus. This included the completing of the line from Sandusky to Fremont and Tiffin and an additional extension from Tiffin to Bucyrus. It is said that the Lake Shore now has under consideration the purchase of the Birchifield line between Norwalk and Plymouth. The completion of a short stretch of road now under construction will connect this line with the Mansfield Railway & Light Company's line at Shelby, and the distance across to Bucyrus is not great. With both the line from Fremont and Tiffin and that from Norwalk connecting with the Webb line at Bucyrus, Cleveland, Sandusky and Toledo would have direct connection with Columbus. The ultimate merger of the Lake Shore and the Webb lines with the shorter connecting lines mentioned would make a system which, in connection with the line from Toledo to Detroit and that from Cleveland to Ashtabula, would take in most of the southern shore of Lake Erie.

The owners of the Cleveland & Southwestern Company have been looking over a route from Mansfield to Columbus by way of Mount Vernon. A few days ago a party of Columbus men met President Pomeroy, A. E. Aikin and others at Mount Vernon to go over the matter. There is a possibility that a road from Mansfield by way of Homer and Gahanna may be built. At Gahanna it would connect with the Columbus, New Albany & Johnstown, now in operation between Columbus and that point, and it is thought that this road could be purchased at a fair price and an entrance to Columbus gained in that way.

STREET RAILWAY PATENTS

[This department is conducted by Rosenbaum & Stockbridge, patent attorneys, 140 Nassau Street, New York.]

UNITED STATES PATENTS ISSUED JAN. 22, 1907

841,694. Brake; Van Buren Lamb, New Haven, Conn. App. filed May 26, 1906. A laterally divided brake head, the two parts of which clamp an engaging shoulder of the brake-shoe when assembled.

841,695. Brake; Van Buren Lamb, New Haven, Conn. App. filed May 26, 1906. A transversely divided brake head in which the shoe is mounted by means of a tapering dovetail connection.

841,709. Electric Brake; Frank C. Newell, Wilkinsburg, Pa. App. filed May 3, 1900. The running controller has a single shaft with a switch and resistance controlling device thereon, and means whereby the switch and controlling device may be moved together, or the resistance device may be moved independently of the switch by rotation of the shaft.

841,71e. Electric Brake; Frank C. Newell, Wilkinsburg, and Edward H. Dewson, Edgewood Park, Pa. App. filed April 11, 1904 Relates to modifications of the above. The motors are adapted to be connected up as generators in the local brake circuit. Provides a braking controller and circuit connections whereby the current in the brake circuit may be controlled.

841,746. Rail Joint; John W. Webb, Columbus, Miss. App. filed April 14, 1906. An integral chair having vertical side flanges, one of which has a lateral flange bearing against the side of the rail head, and clamping means for the chair and rail sections.

841,750. Air Brake; Herman H. Westinghouse, New York, N. Y. App. filed April 16, 1904. Comprises means for reinforcing or supplying air to the auxiliary reservoir from an additional source, such as supplemental or storage reservoir, when the pressure in the auxiliary reservoir is reduced a predetermined amount.

841,751. Air Brake; Herman H. Westinghouse, New York, N. Y. App. filed Oct. 6, 1904. Provides means for controlling the release of the brakes upon the locomotive or head car independently of the other cars of the train, whereby the train brakes may be released while the brake on the locomotive or head car may be retained applied as long as desired.

841,767. Signal; Edward J. Condon, Dixon, Ill. App. filed Nov. 13, 1905. Air is compressed, to actuate a semaphore, by the engagement of the train with tappets alongside the track. The release of the semaphore is effected electrically through the actuation of the next succeeding semaphore.

841,778. Frogless Railway Switch; Thomas W. Harber, Springfield, Mo. App. filed May 3, 1906. Provides means whereby the movable portions of the rails at their crossings are actuated simultaneously with the throwing of the switch point.

841,855. Electric Signal; William F. Dreer, Coulters, Pa.

App. filed Oct. 27, 1906. A mechanical arm or bearer is depressed by the wheel flanges so as to move a switch arm into position to close a red light circuit.

841,897. Material for Deadening Sounds; August V. Ringstrom, Stockholm, Sweden. App. filed April 21, 1905. A material for deadening sound to be attached to wheels, brake-shoes, etc., comprising a thin strip of metal bent zig-zag and softer material interposed between the bends.

84 ,899. Metallic Tie; John C. Schafer, McKeesport, Pa. App. filed March 14, 1906. The tie consists of a channel bar, the flanges of which are cut or sheared and bent to form lugs which are adapted to engage the base-flanges of the rails.

841,973. Metallic Tie; Judd W. Hulbert, Hartford, Ohio. App. filed May 19, 1906. Details of construction.

842,004. Fender; Samuel D. O'Harra, West Washington, Pa. App. filed May 3, 1906. Relates to means for raising and lowering the fender.

842,045. Operating Mechanism for Fare Registers and Recorders; David B. Whistler, Dayton, Ohio. App. filed Sept. 19, 1906. Comprising a rotatable shaft adapted for connection with the setting mechanism of a register, winding wheels or drums driven from said shaft, and an indicator extending substantially parallel to the shaft and comprising flexible end portions wound on said wheels or drums, and an intermediate portion provided with an index or pointer, and an indicating scale co-operating with said index or pointer.

842,124. Railroad Rail; Mark W. Trimble, Idabel, I. T. App. filed May 8, 1905. To prevent cars from leaving the track the rail is provided with an upwardly and outwardly projecting guard flange.

PERSONAL MENTION

MR. LEWIS CASS LEDYARD has resigned from the New York Rapid Transit Commission.

MR. T. L. VANDERSLICE, formerly counsel for the Philadelphia Rapid Transit Company, is dead.

MRS. STELLA B. ARNOLD, wife of Mr. Bion J. Arnold, of Chicago, died at Colorado Springs Feb. 1. Mrs. Arnold's health had been failing for some time and she went to Colorado in the hope of prolonging her life.

MR. L. W. HARRINGTON has been appointed soliciting passenger and freight agent of the Columbus, Delaware & Marion Traction Company. Mr. Harrington is a railway man of ten years' experience with the Hocking Valley. He worked his way through the auditor's office and became chief clerk in the passenger department.

MR. T. W. RYLEY has been appointed superintendent of the Groton & Stonington Street Railway Company, of Mystic, Conn., to succeed Mr. J. B. Crawford who, as announced in the STREET RAILWAY JOURNAL of Feb. 2, has been appointed superintendent of the Fort Wayne & Wabash Valley Traction Company. Mr. Ryley formerly was assistant to Mr. Crawford at Mystic.

MR. J. T. HARMER, of Boston, has been elected to the newly created position of comptroller of the Worcester Railways & Investment Company, of Worcester, Mass., the holding company of the Worcester Consolidated Street Railway Company. A new treasurer of the company also has been elected in the person of Mr. Leverett Candee, of Boston, who succeeds Mr. E. E. Foye, of Boston. Mr. A. George Bullock, of Worcester, was elected president, and Mr. Francis H. Dewey, of Worcester, president of the Worcester Consolidated Street Railway Company, vice-president. Mr. B. W. Warren, of Boston, was elected secretary.

MR. LESLIE CARTER retired from the presidency of the South Side Elevated at the annual meeting of the company Jan. 31, and was elected chairman of the board of directors. He was succeeded as president by Mr. Marcellus Hopkins, formerly general manager. Mr. Hopkins was elected a director, also, in place of Mr. George E. Adams, resigned. Mr. C. E. Nichols was elected a vice-president. The other officers and directors were re-elected. The executive committee for the ensuing year will consist of Mr. T. J. Lefens, Mr. C. H. Wacker and Mr. Hopkins. Mr. Carter served as president of the company for ten years, or since its reorganization, and has directed the development of the property to its present position.

MR. C. L. WILCOXON has resigned as general superintendent of the Western Ohio Railway, of Lima, Ohio, to become general superintendent of the Pittsburg & Butler Street Railway Company, of Butler, Pa., a single-phase road now nearing completion. Mr. Wilcoxon has been engaged in street railway work since he was seventeen years old, his first service being with the Decatur (Ill.) Street Railway Company. After about five years' service with this company he became identified with the Western Ohio, then under construction. When the road was placed in operation Mr. Wilcoxon was appointed night train dispatcher. Subsequently he was appointed trainmaster and later succeeded his father as general superintendent.

MR. EDWARD J. DAVIS has tendered his resignation as general passenger and freight agent of the Columbus, Delaware & Marion Railway Company to Mr. George Whysall, general manager of the company. The resignation became effective Feb. 1, and with Mr. Davis' retirement the position of general passenger and freight agent has been abolished. To look after the traffic end of the company's business in Columbus, the position of soliciting passenger and freight agent has been created and Mr. L. W. Harrington has received the appointment. Mr. Harrington has been a resident of Columbus for thirty years and has been in the service of the Hocking Valley Railway Company for ten years. He was formerly associated in the Hocking Valley service with Mr. A. L. Neereamer, general superintendent of the Columbus, Delaware & Marion.

MR. H. A. CURRIE has been appointed assistant electrical engineer of the New York Central & Hudson River Railroad Company, to succeed Mr. J. D. Keiley, whose appointment as electrical engineer of the company was announced in the issue of this paper for Nov. 17, 1906. Mr. Currie has been associated with the electrical department of the New York Central Railroad since 1903, when the plans of the company for electrification were first undertaken. He has had a long electric railway experience, having been connected with the Brooklyn Rapid Transit Company for the nine years between 1894 and 1903. In Brooklyn he was engaged in power station work for six years, and later he was appointed as assistant to Mr. Keiley, who had charge of the engineering work in connection with the rolling stock of the surface and elevated divisions of the company.

MR. EDWARD PAYSON BRYAN, who was recently elected president of the Interborough Rapid Transit Company, is a native Ohioan. He was born at Windsor, in that State, on July 2, 1850, and was educated at Granville, Ohio, in the public schools, at the academy and Denison University preparatory department, leaving the latter institution before entering upon the regular course. After leaving his studies, he learned telegraphy at the age of sixteen, and took a position at Lebanon, Ky., on the Louisville & Nashville Railroad, remaining with that road until December, 1895. During the years he remained with this corporation he occupied the various positions from telegraph operator to superintendent. Upon severing his connections with the Louisville & Nashville road he accepted the position of vice-president and general manager of the Terminal Railroad Association, of St. Louis, on Dec. 1, 1895. This position he retained until May 1, 1902, when he resigned and accepted the position of vice-president of the Interborough Company. He was later placed in a similar position with the Subway Construction Company. Upon accepting the executive office of the Interborough he personally organized the present operating force, and at the same time organized and placed on a working basis the entire engineering force which equipped the Interborough lines, which includes power house, cars, interlocking block signal system, etc. Mr. Bryan is a member of the Lawyers' Club and the Society of The Kentuckians. He was married to Miss Arabella Welch at Frankfort, Ky., and has five sons, Mr. John Love Bryan, Mr. Edward P. Bryan, Mr. William Scott Bryan, Mr. Ashbel Welch Bryan and Mr. Sylvester Griswold Bryan.

MR. EDWARD PAYSON BRYAN

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NOTICE TO ADVERTISERS

Changes of advertising copy should reach this office by 10 a. m. Monday preceding the date of publication, except the first issue of the month, for which changes of copy should be received two weeks prior to publication date. New advertisements for any issue will be accepted up to noon of Tuesday for the paper dated the following Saturday.

During 1906 *the Street Railway Journal printed and circulated* 426,950 *copies, an average of* 8210 *copies per week. Of this issue* 8000 *copies are printed.*

Stimulating Traffic by Electric Signs

Considering the profits which are being reaped in so many lines of business by the judicious use of electric signs, it is a bit odd that street railway companies have not as yet generally realized what might be done with the electric sign in the way of traffic stimulation. The matter is certainly worth a few moments' thought, as the plans for the coming open season are being carried into effect. Electric signs have, of course, been used extensively to indicate routes on cars and to direct passengers at station platforms, but little has been done as yet to make the fixed electric sign on the busy street effective in advertising the attractions of various pleasure rides on the local trolley cars.

The so-called talking sign has been brought to a high state of efficiency within the last year or two, and the cost of operating even a pretty elaborate affair with two or three hundred, perhaps more, 8-cp incandescents upon it, is a small matter if the street railway company supplies the current. Illuminated electric signs giving the time each minute and pointing out the appropriateness of celebrating the passing hours with a certain highball are frequently seen in our large cities. If the passer-by can be induced in this way to act on suggestions, why should not he be similarly reminded that it is "7.46 P. M.—TIME TO TAKE THE TROLLEY TO FOREST LAKE PARK!" by a talking sign set up in some busy street?

Fixed signs can be made up in a company's own shops at small expense, they cost practically nothing to operate, and there ought to be a profitable field for their use in the coming spring and summer. They will usually be found a cheaper method of advertising than by circulars; in addition, they attract the attention of the man in the street at a time when a car is close at hand and can be taken easily.

Cleaning the Trucks

From the standpoint of appearance there is no more reason for neglecting to clean and paint trucks of cars at regular intervals than there is for neglecting the appearance of any other part of the car, yet many railway companies which pay a great deal of attention to the paint and varnish of the car body seem to have the impression that mud and grease on trucks cannot be seen. At any rate, so far as cleaning is concerned, trucks very often do not get the attention that they deserve. It is safe to say that some trucks which have been in service several years received their last coat of paint in the factory, notwithstanding the fact that the body above them has had its yearly trip through the paint shop and has been subjected to a thorough washing at weekly intervals. An idea of the effect of well-painted trucks on the general appearance of a car can be obtained by placing together two cars of the same type, one of which has recently painted trucks while the other is mounted on trucks which have been neglected so far as appearance is concerned. Such a test, it is safe to say, will convince almost any person that it would be well to give the trucks their share of attention. The argument may be raised that the cleaning of trucks would require a great deal of time. On the first attempt it might be quite an undertaking to get off all the cement-like mixture of dry oil and dirt that has accumulated, but afterwards a reasonable amount of time spent upon them would keep them in good condition. They need not be rubbed and polished like the

body. All that is necessary is to get off the greater part of the dirt with water and then go over the trucks at intervals with oily waste. Aside from the improved appearance of the car, there is another reason why trucks should not be allowed to remain covered with dirt. When they are dirty, fractures of the frames, loose bolts, or other injuries cannot always be seen, or at any rate often are not seen, and a defective truck should be guarded against by every means possible.

Small Blue Prints in Construction Work

There seems to be a prevailing idea that tracings and the blue prints which are made from them should be drawn to a very large scale. The result is that often, no matter what may be the nature of the drawing, the prints are of awkward and unwieldy size. Of course, where there is a great number of small details and dimensions that must be brought out clearly it is necessary to have the tracings and prints of large dimensions. But simple drawings are often made to cover sheets several feet in each dimension when nothing would be sacrificed if the tracing were made even as small as letter size, say 8½ ins. x 11 ins. When drawings are to be used in field work, it is particularly advantageous to have them on small blue prints. It is most difficult to refer to large drawings when the wind is blowing, and at any time, in fact, it is rather troublesome either to unfold a large print or to go to some point where it has been spread out and weighted down every time a person desires to refer to it. On the other hand small prints may be carried in book form in the pocket and may be referred to with some degree of convenience. Where the blue print is used to a considerable extent in outside work it is often possible to make two tracings, one in complete detail for office use, and the other, with many of the minor details omitted, for the field man.

When tracings must be large and in detail for the convenience of construction men and for office use, it will often prove of great advantage at times to photograph them on, say, 8-in. x 10-in. plates and make prints on thin paper from the negatives. All the details would of course be preserved in the photographs. One who has never given the subject thought would be surprised to find how small a photographic reproduction of a tracing can be made without causing the details to become unintelligible. Reference to such reproductions as have appeared in the STREET RAILWAY JOURNAL and other technical papers will give a practical example of this plan. With the free use of the camera office work could be greatly facilitated by photographing all of the standard blue prints and arranging the reproductions from them in book form for ready reference.

But it is the construction foreman who has the greatest difficulty in dealing with large prints, and whenever it is possible to do so small prints should be made for his convenience.

Supplying Power for Night Service

The problem of supplying power most economically to cars operating in an all-night service is one of increasing interest as the establishment of small-hour schedules becomes more extensive. The direct unprofitableness of owl car service depends chiefly upon the low density of traffic offered and the relatively high operating expenses per car-mile, taking into account the questions of wages and cost of running power plants at excessively poor load factors. On many roads there is no service of any kind over the tracks between 12:30 and 5:30 a. m.; power houses and sub-stations are shut down completely, and if inspection and light repairs are carried on at car houses, electricity for power and lighting is purchased from the local central station. This is the condition on a great majority of the electric roads in this country. As, however, the size of the system becomes greater, the more imperative becomes the need of providing for at least a limited night service, and the larger the importance of conducting this service economically.

Obviously, the main point to attain in operating a night service as inexpensively as possible is to eliminate the services of all but the most necessary employees. The force of street inspectors needed in the daytime can be practically cut out at night; conductors and motormen should be obliged to operate their own track switches, signal their own grade crossings, etc. As far as is feasible, sub-stations should be shut down and only such of the main power stations as are absolutely needed to provide proper voltage to move the cars on schedule should be kept alive. To facilitate the night service, switches should be closed around section insulators and the whole feeder system tied together. In this way a large area can be fed with the utmost ease from a power plant located perhaps three times as far away from the center of distribution on different routes as would be permissible for giving a decent voltage in the daytime. It is surprising how effective a few neighboring feeders on a city system become at night when they are temporarily tied together to supply a light traffic.

On purely suburban systems connecting with the ends of city lines night service is at present seldom given, and there is no doubt that in many cases there is practically no demand for owl cars. In other instances, however, the operation of a few night cars through the suburban territory would be regarded as a great boon by residents of the second 5-cent zone from the city, and as suburban populations grow the need of night cars running upon one or even two-hour intervals is sure to become more and more insistent. It is not realized by many managers of connecting companies how easily the power supply could be had from a single station, feeding 10 or 15 miles through temporarily connected feeders and trolley lines. Sectionalization of the overload circuits amounts to little or nothing in the face of a sparse night traffic, and if the power is to be metered at the junction points of connecting systems as a basis of monthly charges it is but a simple technical problem to accomplish.

Within the power station which operates all night the labor cost of each kilowatt-hour produced will naturally be high, but by using the lower capacity machines and running as few furnaces as possible, the fuel cost of the service need not be excessive. On all but the largest systems a single generator in a station will handle the night load of the plant with ease, and but one engineer and one fireman are needed to keep the equipment in motion. The load factor is bound to be poor, but if the fires are handled carefully and the feeders combined, the service can be given at reasonable cost, considering its value to the public.

Improvements in Electric Railway Motors

Nothing is more significant of the constant evolution of electrical equipment design than the progress evident in recent railway motor practice. Less than half a dozen years ago the idea was widely held that railway motors had reached a point in design and construction where little additional improvement could be expected, with the two exceptions of single-phase and heavy direct-current locomotive work. The vast majority of railway motors were thoroughly standardized, the capacity of each size and make was getting to be better understood every year, and the selection of motors for new and existing roads was largely a matter of placing an order untrammeled by detail specifications.

During the past three or four years, however, the problem of maintenance has been studied by progressive electric railways as perhaps never before, and every effort has been made by operating men to keep down the cost of repairs and to keep individual motors in regular and continuous service. The weak points of the older designs have become better appreciated as requirements have become more exacting, and it has been seen that there is still room for improvement in securing greater ease of repairs and increased reliability of service, though the actual commercial efficiency and the weight of motors for given outputs may not be susceptible of much improvement. Still, some gain in weight reduction has been made, notably in the new GE-90, which weighs but 2875 lbs, complete, in comparison with the familiar GE-57's weight of 2972 lbs. Both of these are so-called 50-hp motors, the GE-90 representing a design in advance of the 57. The armature weights are 677 and 704 lbs., respectively. These reductions are of course not much over 3 or 4 per cent of the weight of the earlier motor, and their actual decrease in the dead weight to be hauled is not a striking proportion of the total car weight, but when one considers that this dead weight excess is hauled about all day and month after month, up grades and around curves, it is clear enough that a saving in power is the result of adopting the newer equipment. Small though such a saving may be in the case of a single car, it becomes financially effective when multiplied by the equipment of even a single operating division. As for efficiency, it is evidently a very difficult matter to carry the ratio of output divided by input much above 75 or 80 per cent in the present direct-current railway motor, and it is this type which will doubtless handle the great bulk of trolley traffic in this country for not a few years to come.

For the conditions of heavy traffic and high speeds encountered in recent electric railway service the cast steel motor frame continues to meet the requirements, and the provision of hinges to enable the lower half of the motor to be swung down into the pit for inspection or repairs is as general among the later as with earlier motors. All later bearings are designed for oil and waste lubrication, and larger bearing surfaces are being provided to enable motors to make increased mileages without renewal of the linings. In some cases the armature shaft linings are finished bronze sleeves lined with a thin layer of babbitt metal, the babbitt being so thin that it will not allow the armature to rub on the poles in case it is melted out by overheating. In approved types of motors the oily waste used for lubrication is more or less completely packed in oil wells and arranged to bear upon the shaft through suitable holes in the low-pressure side of the bearings as in the lubrication of car journal boxes on steam roads. This reversion to established methods of oiling has already resulted in admirable records as to the life of bearings in heavy service under a wide variety of conditions. Great care is taken in all late motor designs to keep waste oil out of the interior of the motor.

The better mechanical protection of field and armature coils and the use of improved methods of insulation are objects constantly sought by the manufacturers of modern railway motors. Treatments vary with the different factories, but the increasing use of asbestos insulation is noteworthy. Form wound coils, either strap or wire, continue to be favored; commutators are largely built without necks, and are attached to the armature spiders more substantially than in the older types of motor, where vibration between the commutator and the armature core was not unknown, with resulting broken leads and short circuits. The reduction in the weight of brushes and the improvement of brush-holder designs to prevent irregular running and sparking on account of chattering; the deepening of commutator bars for increased capacity and the general use of laminated pole tips to reduce eddy current losses are characteristic features of later motor designs. In view of the fact that bad accidents have sometimes occurred from broken gear cases dropping upon the track at high speeds, special effort has been made to strengthen these parts by the use of malleable iron, three-point suspensions, strengthening ribs and divided supports with prevention of vibration between the upper and lower castings. Cast steel gears and forged steel pinions are now standard practice. In the matter of ventilation—and this is perhaps the most important point in the design of a motor of given efficiency and ability to withstand sudden overloads without sparking—special care is evident to secure a free circulation of air without sacrificing the mechanical protection of the windings. The tendency is to construct the armature so as to draw a large volume of air through the core when the motor is running, and to discharge the air through ducts opening along the exterior. The use of inner or commutating poles to prevent sparking and the further study of the cooling provided by air currents are both certain to be practiced in the near future with a view toward increasing the temporary and permanent overload capacity of the present machines. Of course, in the long run, no system of ventilation can take the place of plenty of iron and copper, and no magnetic means of preventing field distortion can entirely offset the use of faulty pole shapes and dimensions. The modern direct-current railway motor is a remarkably reliable and effective piece of machinery, and its ability to stand abuse is scarcely surpassed by even the induction motor. In these comments no special reference has been made to the recent progress in heavy motor designs for electric locomotive work, the object being to show that there has been no lack of advance in the equipment which bears the brunt of the load in urban and interurban service. There is no question that the future development of very high-powered railway motors depends not a little upon the results obtained in the electrified terminal service at New York, and until these results are made public little can be added to existing opinion as to the most enduring designs.

THE NEW SENECA STREET SUB-STATION OF THE INTERNATIONAL RAILWAY COMPANY, BUFFALO, N. Y.

The Seneca and Elk Streets sub-station of the International Railway Company, of Buffalo, N. Y., with an ultimate capacity of four 400-kw rotaries, became overloaded during the winter of 1905-1906. It could not conveniently be extended, and, as it was located in a section of the city which is flooded at least once each year by the overflowing of the Buffalo River, it was decided in building a new station to locate it outside the flooded district. The new Seneca and Imson Streets sub-station (just completed) is outside the area that is submerged at the times of highest water, and is as near the load-center of the southeastern section of the city as was the old station.

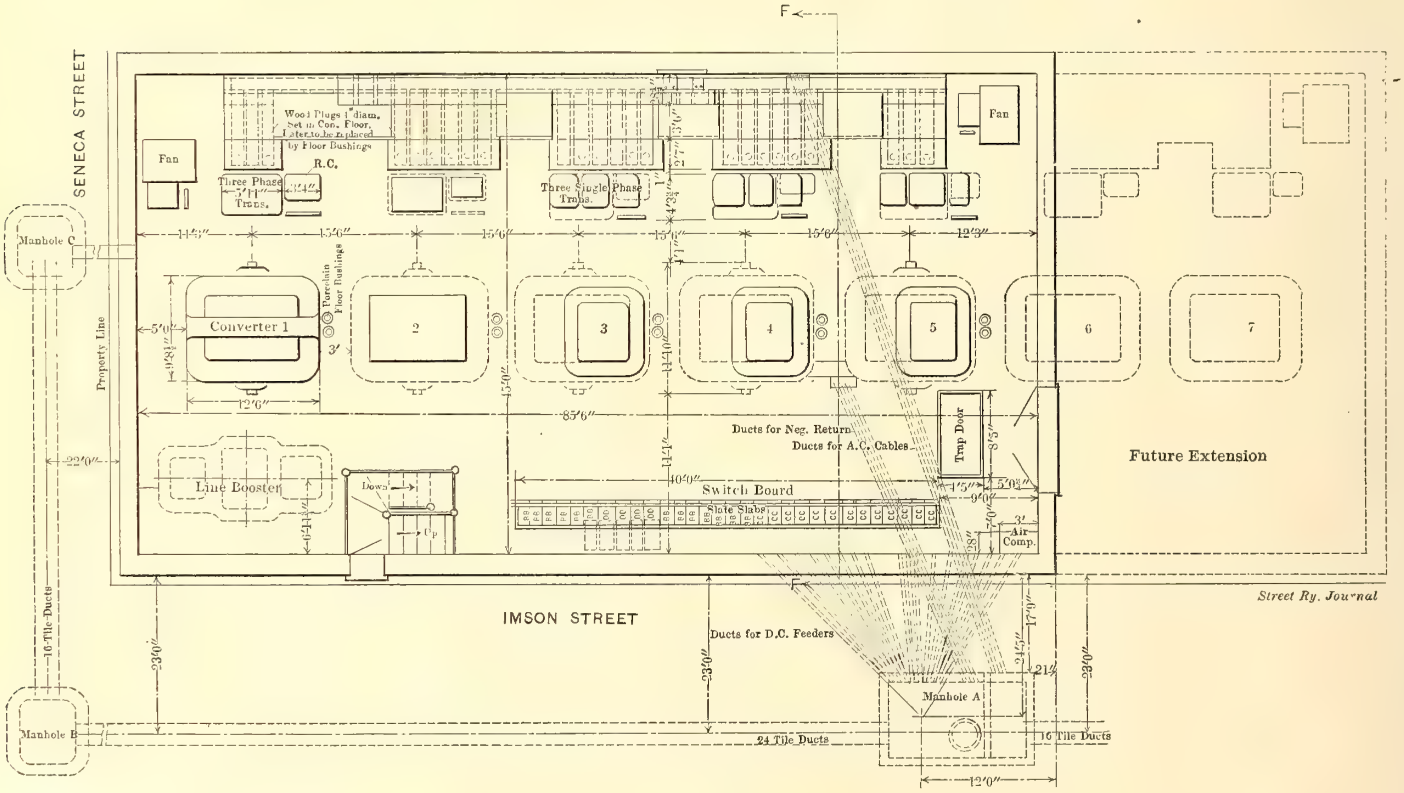
THE SENECA STREET EXCAVATION, WITH PORTION OF ROCK SWEPT CLEAN TO SHOW ITS SMOOTHNESS

THE BUILDING FEATURES

In excavating for the foundations, a solid, flat stratum of perfectly smooth rock was found within a few inches of the depth to which it had been planned to dig. The rock had a slight incline (less than 1 ft. in the length of the building) and it was only necessary to cut out a small channel in this to accommodate sewer pipes for drainage of the building. On this admirable foundation the walls were carried up to grade with concrete. The superstructure is of red shale brick with sandstone trimmings, and concrete floors and roof reinforced with expanded metal and ½-in. iron rods spaced 6 ins. apart.

On account of the proximity to the flooded district it was decided to place the high-tension bus-bar compartments, disconnecting switches, etc., on the main station floor, instead of in the basement as has been done in so many recent installations. This location also has the advantage of avoiding the dust that is always blown into the air chamber by the fans, and it brings the disconnecting switches where the operator does not have to leave the machinery to manipulate them.

In preparing the main floor the heavy I-beams were all arranged so that their tops are at the same level. The various floor openings were then framed in with 6-in. channels resting on top of the beams. The floor consists of 5½ ins. of concrete finished off with ½ in. of Monolith. The process of laying the floor was as follows: After placing the wood forms, the ½-in. round iron rods, spaced 6 ins.

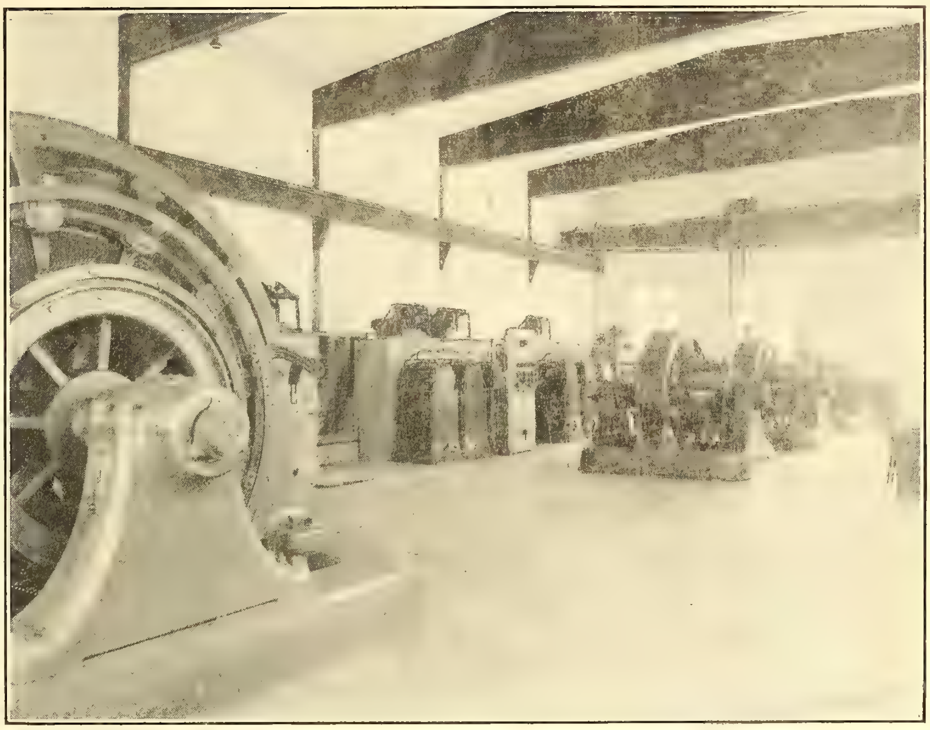


GENERAL PLAN OF THE SENECA STREET STATION, SHOWING THE LAYOUT OF ROTARY CONVERTERS, TRANSFORMERS AND SWITCHBOARD

apart, were laid and covered over with expanded metal, the two being wired firmly together. The control-wiring conduit (flexible steel tubing) was then put in place and wired to the expanded metal. When the concrete was poured, the rods, expanded metal and conduit were all lifted together so that no portion of the metal was within ½ in. of the false work.

The result is a strong and most satisfactory floor, smooth on both sides. The Monolith has the advantages of not staining with oil, not cracking, not giving off dust and not being as hard under the feet as concrete. It is also easy to keep clean and can be readily patched.

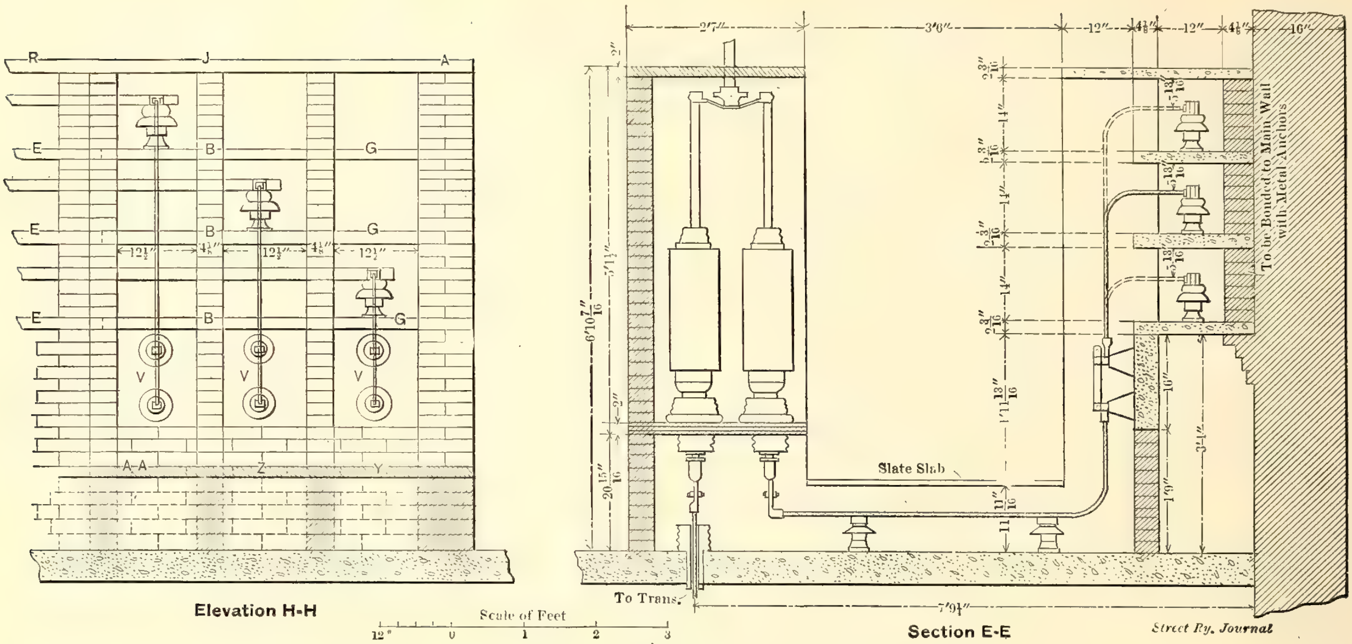
The use of flexible steel conduit has the advantages of cheapness in laying, perfect symmetry of short bends and no difficulty about keeping the ducts down close to the expanded metal at all points, thus obtaining the maximum possible depth of concrete above the ducts to prevent fractures in the concrete. The flexible conduit comes nearly enough to being water-tight for practical purposes. Where the conduits come horizontally out of the floor they were led through holes of suitable size drilled in the channels and the ends were capped with rigid outlet bushings secured snugly against the channels. Where the ducts pass vertically upward or downward out of the floor a solid steel elbow was attached to the flexible duct, enough of the elbow being embedded in the concrete to render an unyielding outlet fixture. The method of leading the wires from the floor ducts to the back of the switchboard panels is rather unusual and has many advantages over the individual junction boxes, bent tubing in wood sills, etc., that have often been employed. The switchboard panels stand on a wood sill, which in turn rests on two channel irons on edge, with ample space between them for handling and spacing the wires. The conduit projects just through the channels and is capped off snug. Vertical bushings in the wood sill lead the wires from the ducts to the back of the panels. The under side of this opening between the channels can easily be covered with steel plate to prevent injury to the wires from below.



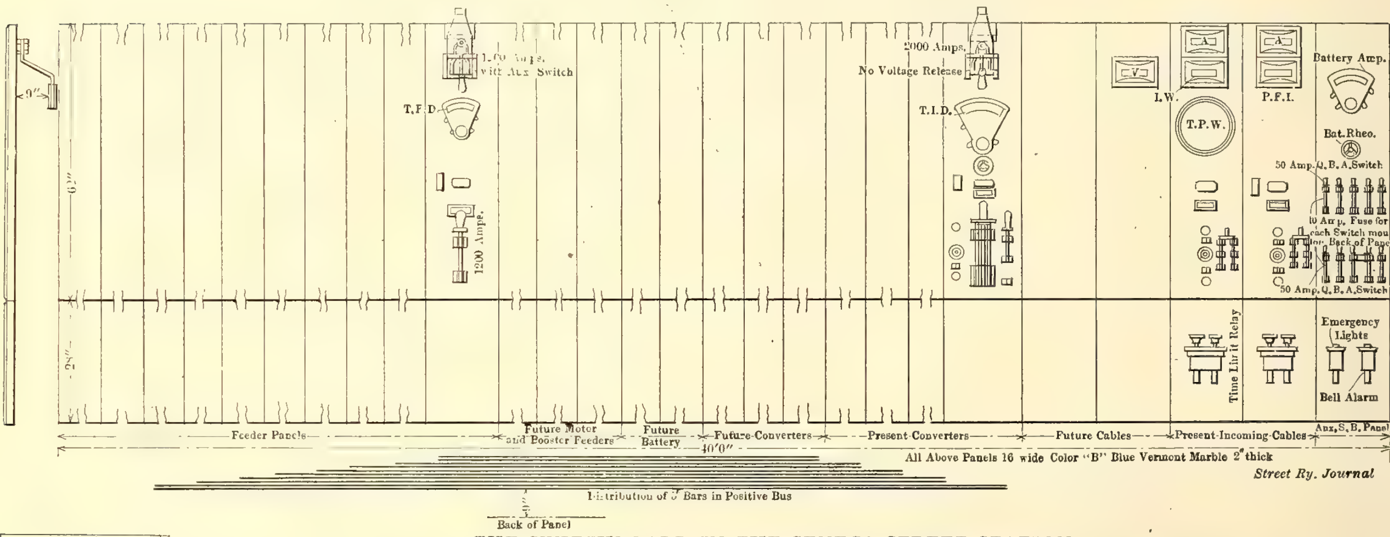
INTERIOR VIEW, SHOWING A 1000-KW ROTARY IN THE FOREGROUND AND THREE 400-KW ROTARIES AT THE RIGHT

EXTERIOR VIEW OF THE SENECA STREET SUB-STATION OF THE INTERNATIONAL RAILWAY COMPANY, BUFFALO, N. Y.

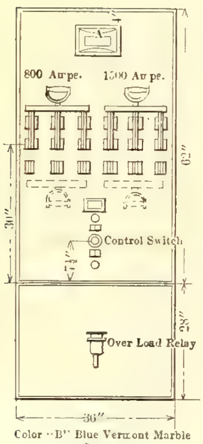
The sill of the large door is at the level of the main station floor and a little above the platform height of a heavy truck, so that apparatus can be conveniently unloaded. To facilitate unloading machinery and bringing it into the station an arrangement is provided by means of which the crane can be used to great advantage. Directly in front of the door and about 15 ft. from the sill, there is a heavy cast-iron plate secured to the floor framing. This plate has a thick portion which comes flush with the top of the finished floor, and through the thick part there is a vertical hole, or circular eye, 3 ins. in diameter, which passes all the way through the floor. Directly under this eye in the main floor is a ring-bolt anchored securely in the rock beneath the basement floor. By fastening a chain in the ring-bolt and



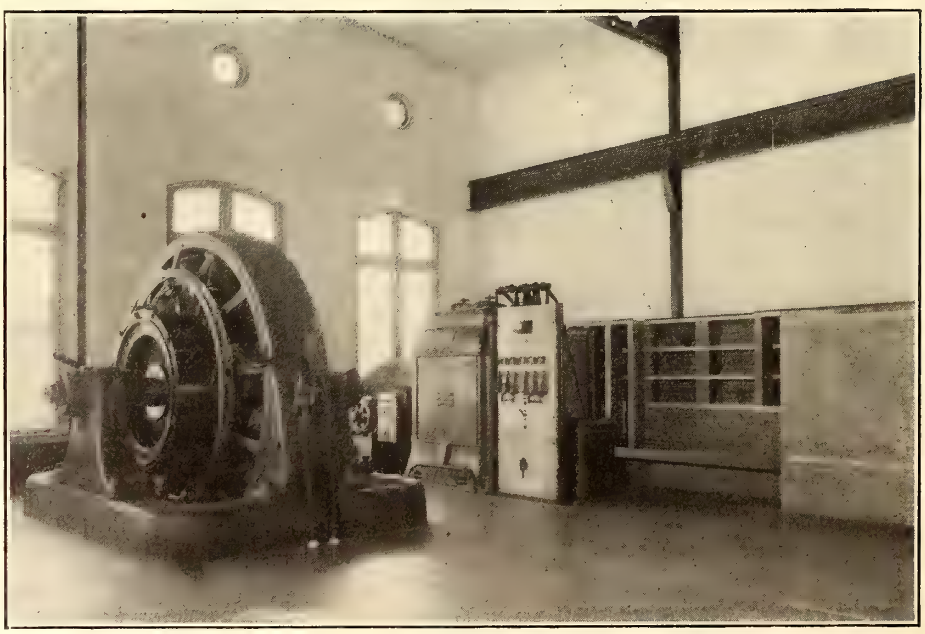
DETAIL OF BUS BAR AND OIL-SWITCH COMPARTMENT



THE SWITCHBOARD IN THE SENECA STREET STATION



A.C. PANEL FOR CONVERTER



1000-KW ROTARY AND BUS-BAR COMPARTMENTS WITH DOORS REMOVED

passing it up through the eye, a snatch-block can be secured at any desired height above the station floor. A cable around the snatch-block with one end attached to the load and the other to the crane hook can be used to haul the load off the truck and onto the station floor, where it can then be picked up by the crane in the usual way. The ring-bolt is set low enough in the basement floor so it can be covered with a checkered plate flush with the floor.

THE ELECTRICAL FEATURES OF THE SENECA STREET SUB-STATION

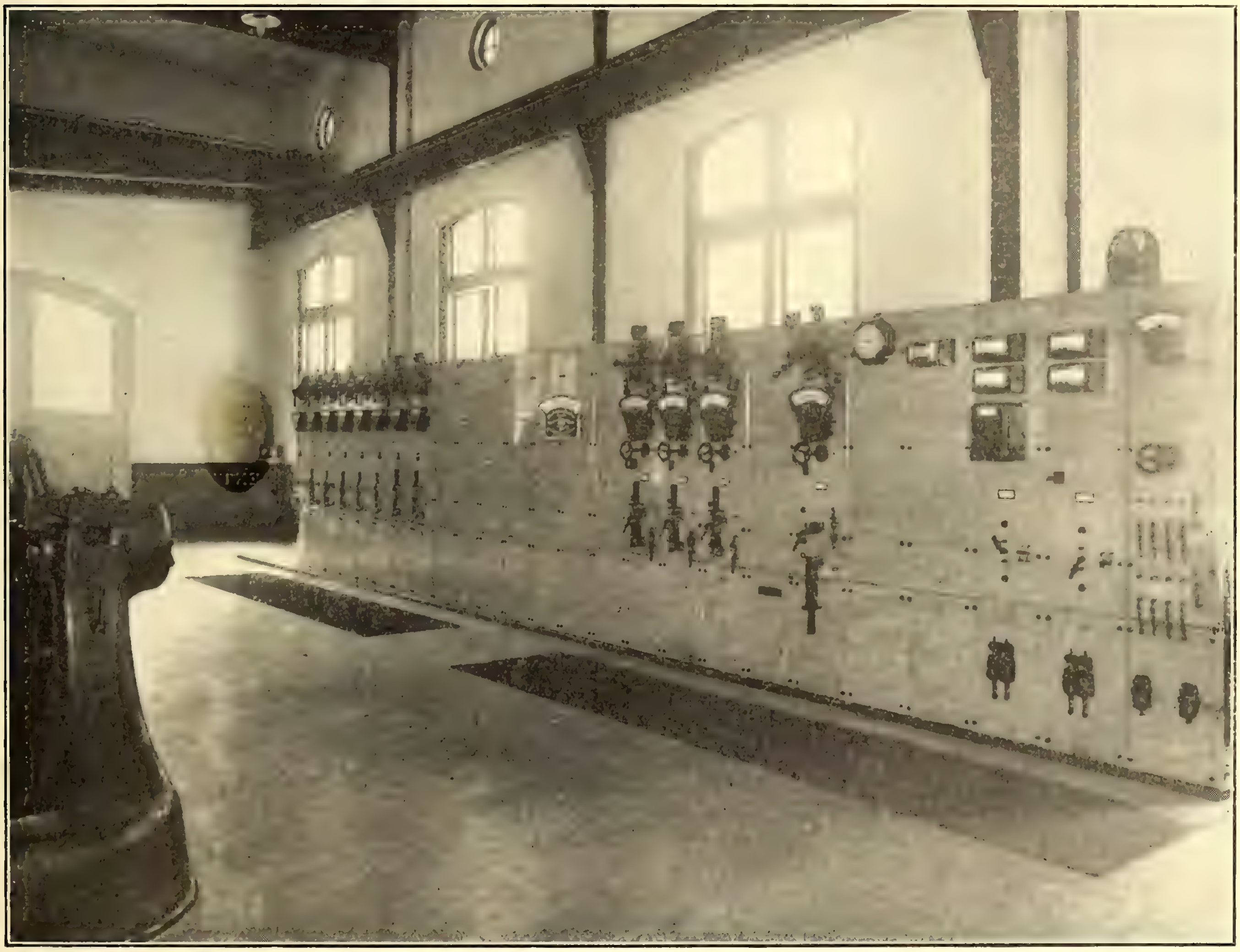
Power at 25 cycles, three-phase, 11,000 volts, enters the bus-bars at one side of the building and passes straight across through the successive switches and apparatus to the point where it leaves on the d. c. feeders at the opposite side of the house. All connections are thus simplified and minimum lengths of cable are required.

The incoming power is measured on a single meter regardless of the number of incoming cables in service. This is accomplished by paralleling the secondaries of the current transformers. Double-throw switches are provided for cutting out and short-circuiting the secondaries of the current transformers on the dead cables.

The d. c. feeders each leave the building through underground ducts directly in line with the centers of their respective panels. This separates the exposed lengths of cable and gets the feeders into the ducts by the shortest possible route. The ducts converge into one large vault under the street.

The placing of apparatus is so arranged that there is ample room around each element to perform usual operations, and the aisles are wide enough so that large, heavy pieces do not have to be raised high with the crane when installing or removing. This crane is of 15 tons capacity and runs the entire length of the building. It is also used in connection with the snatch-block device previously mentioned.

The fans for cooling transformers are located close to windows so that outdoor air may be had when necessary. The ventilation of the whole station has been well taken care of by providing on three sides large windows cut close to the floor and surmounted by transoms, smaller windows near the roof on all four sides, and six 36-in. ventilators in the roof.

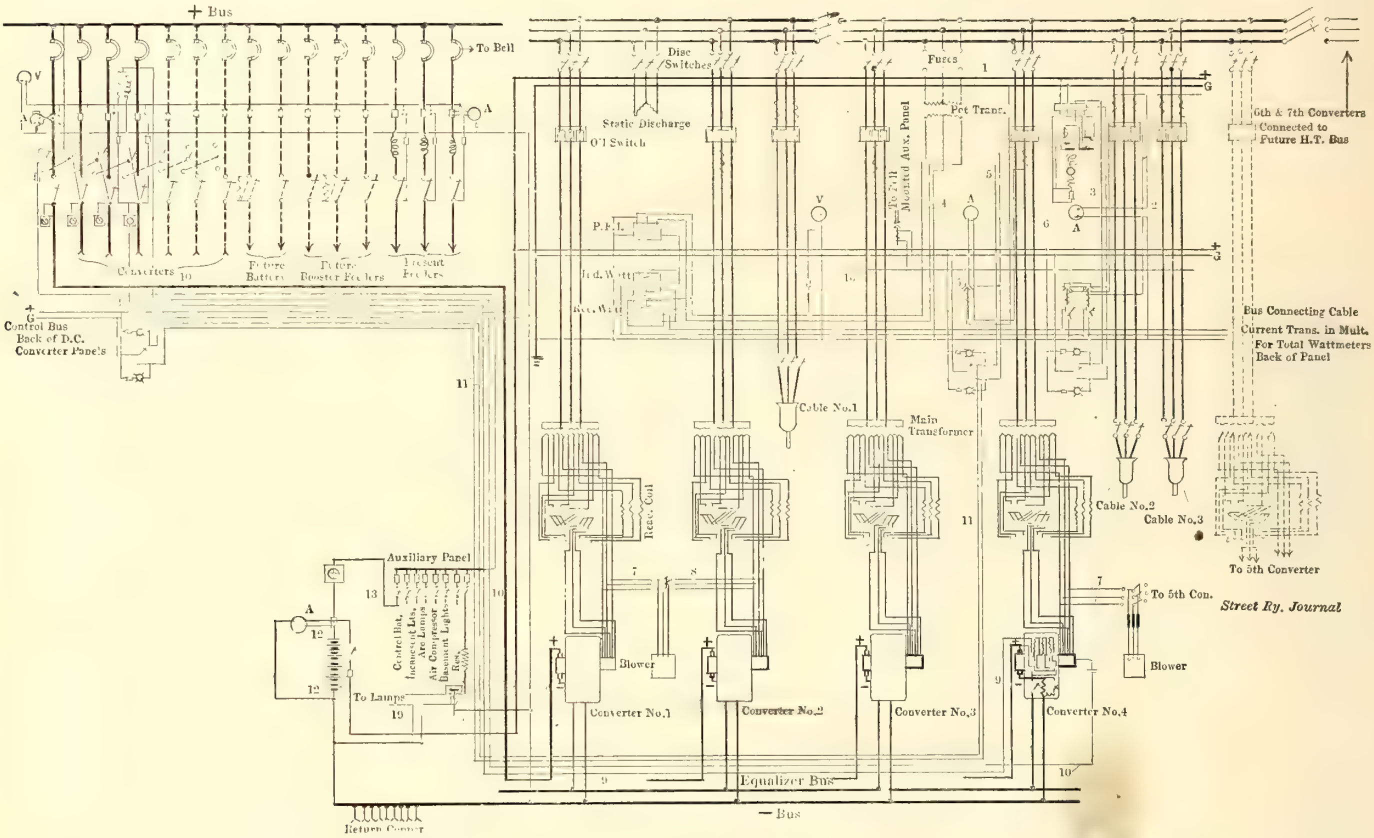


VIEW OF THE SWITCHBOARD IN THE SENECA STREET SUB-STATION OF THE INTERNATIONAL RAILWAY COMPANY, BUFFALO, N. Y. THE PRESENT BLANK PANELS ARE ALSO SHOWN

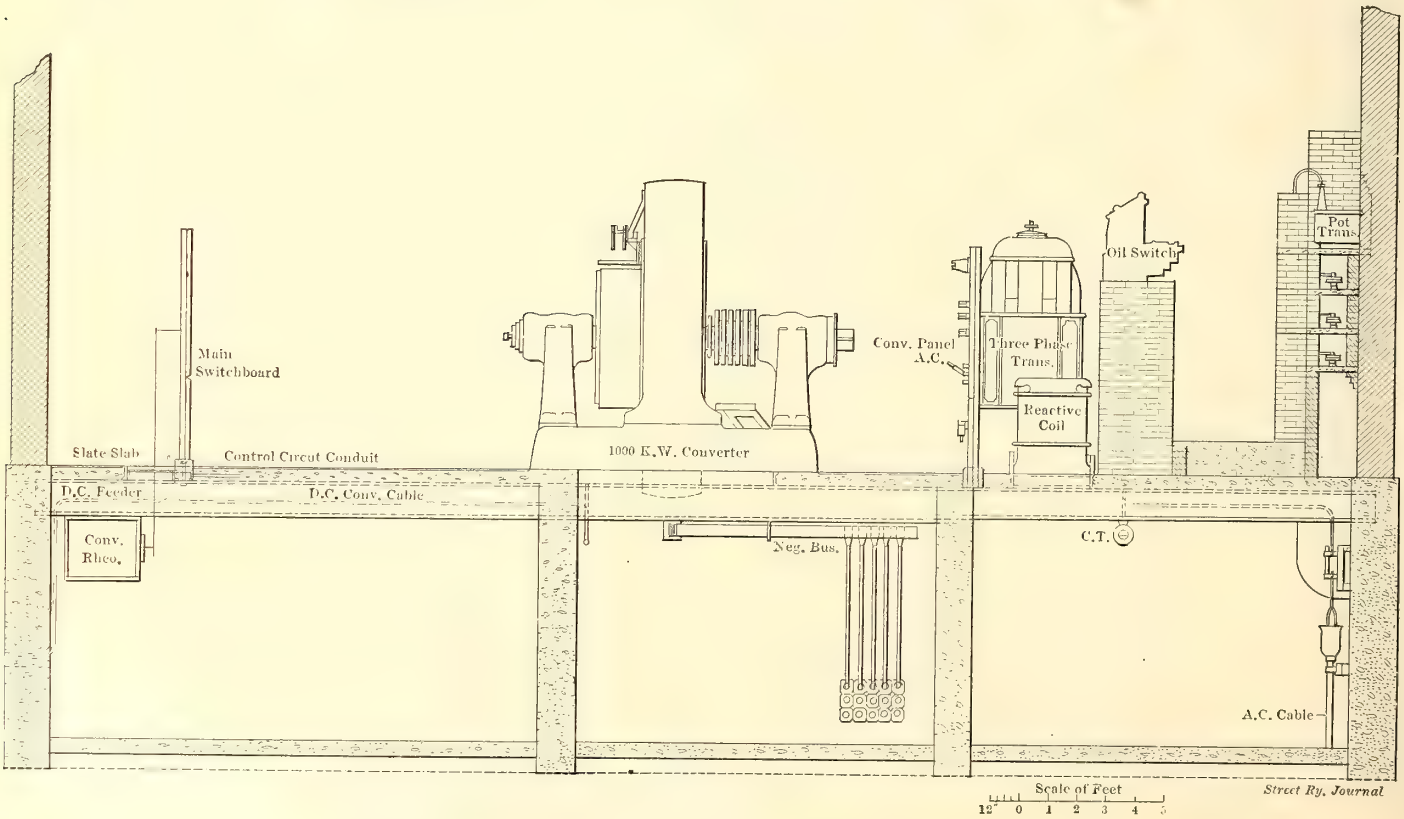
The a. c. rotary panels contain all the switches to be operated in starting a machine, except the field break-up switch. The overload relay and a. c. ammeter are also on this panel, thus simplifying the wiring. These panels are located close to the static transformers and rotaries instead of in the main switchboard. The advantages are that the attendant has fewer steps to take in starting a machine, cannot mistake the panel controlling any particular machine in case of trouble, and the main switchboard is re-

duced in length, thereby bringing the panels the attendant is constantly concerned with nearer together. There are control switches and indicating bull's eyes for the converter

A utility panel is provided in the main switchboard, containing the ammeter and rheostat controlling the storage battery for operating the oil switches; also switches and



GENERAL WIRING DIAGRAM OF THE SENECA STREET ELECTRICAL EQUIPMENT



CROSS-SECTION F-F, TAKEN THROUGH THE SENECA STREET STATION

oil switches on the d. c. rotary panels as well as on the a. c. panels. These switches on the d. c. panels are for use in emergency and are arranged so that they will only open the oil switches.

fuses for lighting circuits and motor-driven air compressor. On the lower section of this panel is a relay which sounds a gong in case any oil switch opens automatically, and another relay which causes six incandescent lamps on the

bottom of the middle roof truss to be instantly illuminated from the oil switch control battery in case of a general power interruption which puts out the regular station lights.

The d. c. feeder panels are equipped with potential receptacles connected to the station voltmeter, so that the attendant can determine, if he drops a feeder, whether or not it is alive from another station and what voltage it carries. The circuit-breakers are all wired to sound a gong when they open automatically.

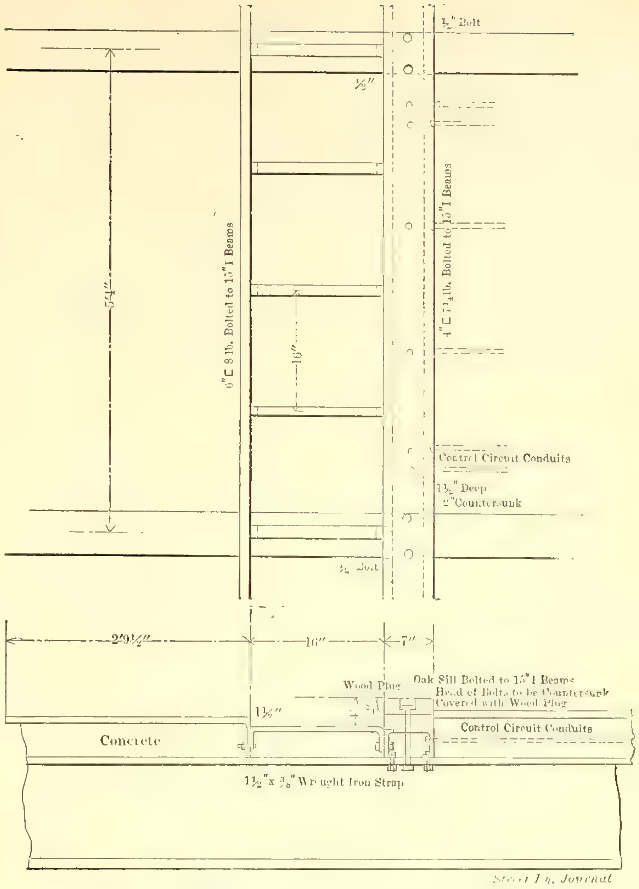
The 1000-kw rotary is started on low voltage taps in the secondary winding of the three-phase transformer, and the 400-kw rotaries are similarly started but are supplied with power through three single-phase transformers.

The oil switch control battery is placed in a separate room in the basement. This room is connected, by means of a pipe laid in the floor, with the air chamber under the transformers, and, as there are windows in the battery room, the air can be changed at any rate desired. Next to the battery room is the store room and station attendant's locker room, and opposite these is the toilet room. The whole basement is ventilated by windows protected by screens and bars.

The high-tension bus-bar structure is built up of Kittanning repressed buff brick, laid with ⅛-in. joints in cement tempered mortar. The disconnecting switch slabs and busbar barriers are of concrete. The bus-bars are supported on iron-capped, porcelain insulators of the pole-line type. The insulators are on iron pins set in the horizontal barriers. The hanging barriers for the cable disconnecting switches in the basement are built up of transite board glued to wood frames and painted. The bus-bar compartments and switch cells are completely covered with doors of transite board.

The electrical apparatus was furnished and installed by the General Electric Company, the station arrangement and design having been worked out by the engineers of the International Railway Company.

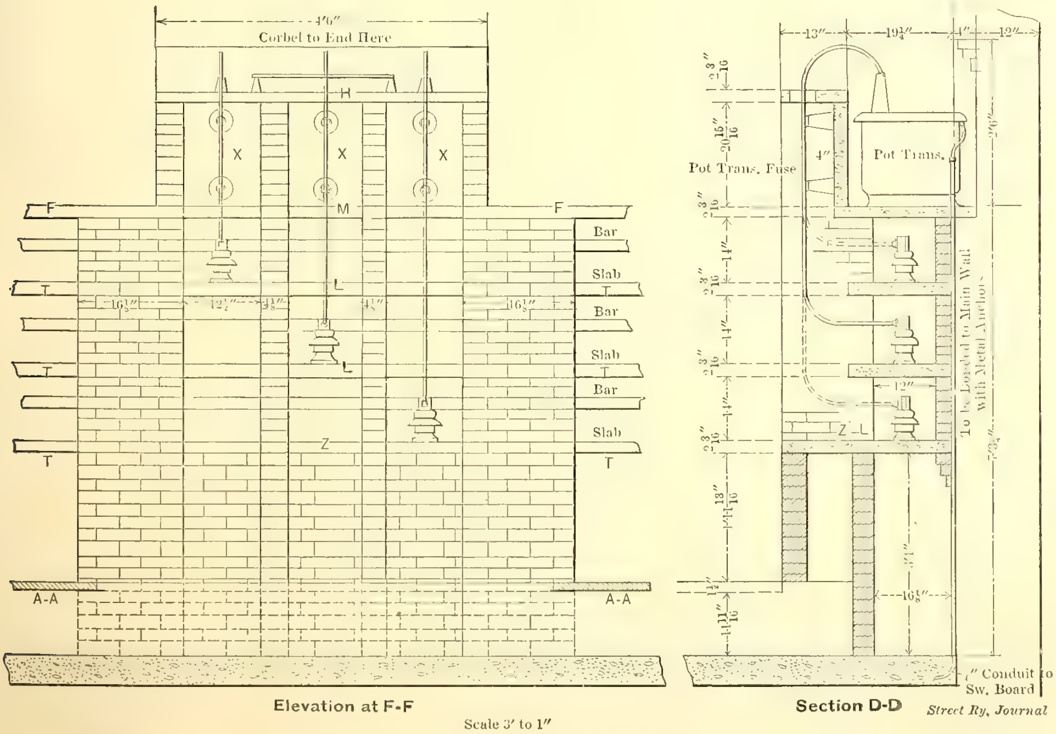
Sufficient land was purchased to accommodate an extension of the converter station, a storage battery house, and leave a driveway all around the property. The present station is complete with room for switchboards, bus compartments and switch cells for five 1000-kw rotaries and a double feeder booster. It now contains one 1000-kw and three 400-kw machines, which latter will be replaced by larger ones as the service requires. Blank panels are provided in the switchboard, and all conduit is in the floor for a station containing seven 1000-kw rotaries, a storage battery with its booster set, and a two-feeder booster set.



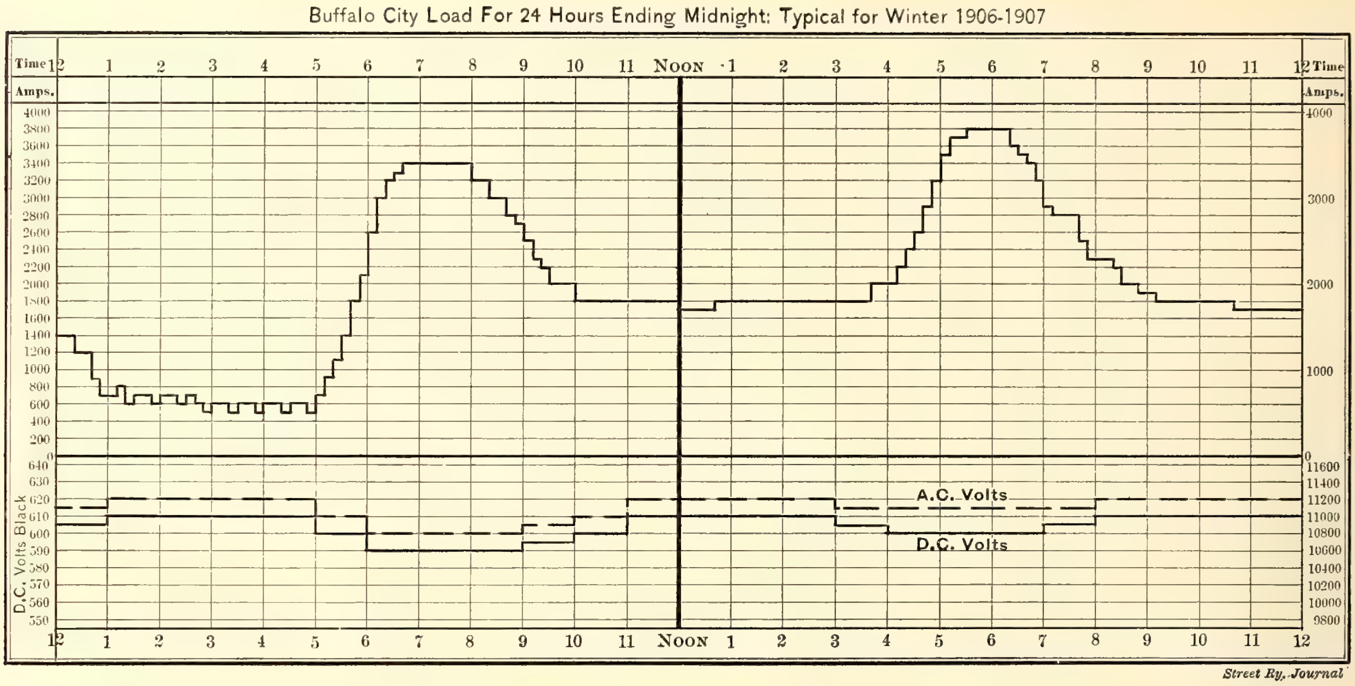
DETAIL OF SWITCHBOARD SLOT

BUFFALO POWER CONDITIONS AND SUPPLY

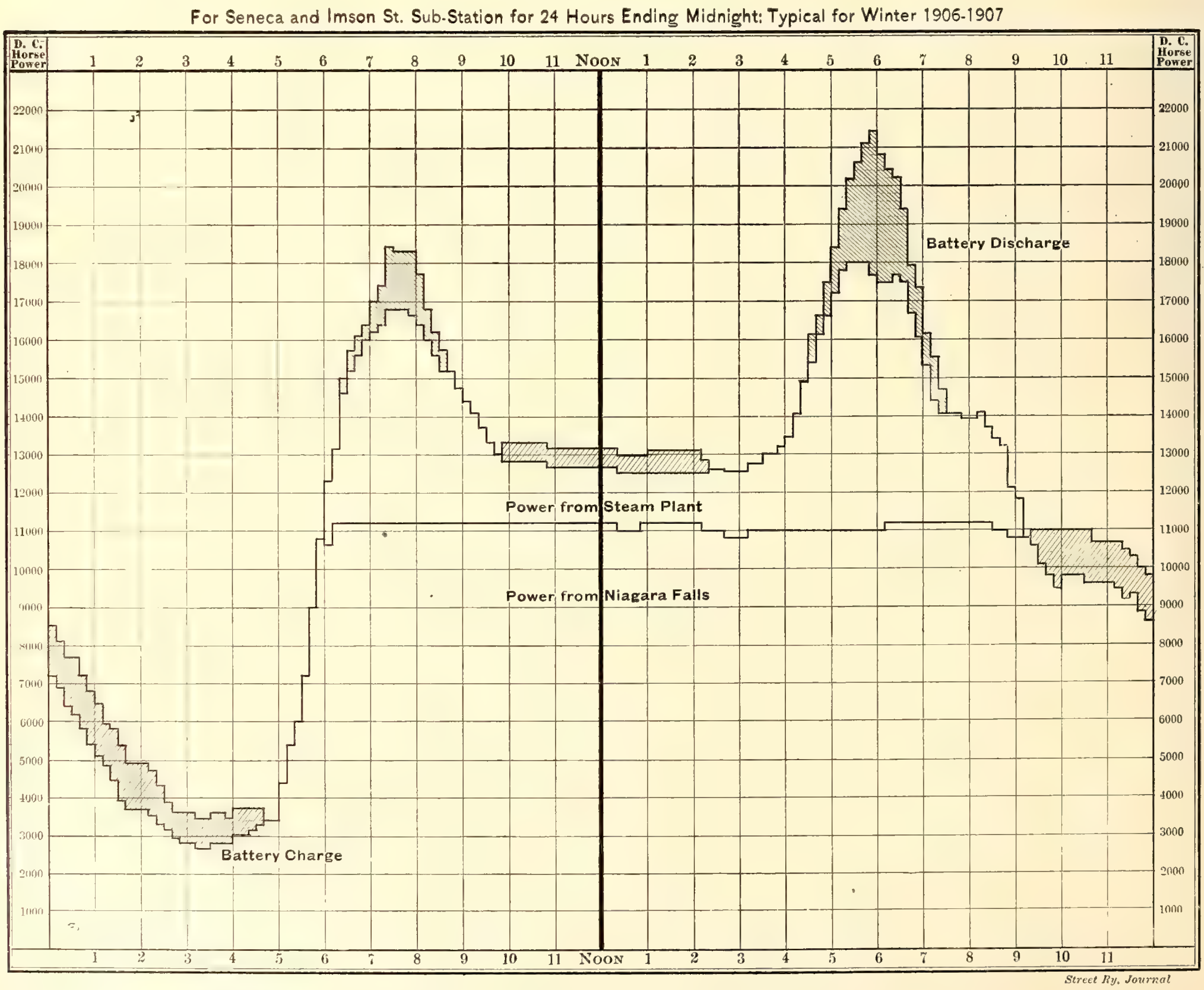
The southeast section of Buffalo is growing rapidly, and with the mustering into service of the heavy, electrically-heated "5000-type" cars it is expected that the new sub-station will soon carry a load that will show no too great margin of reserve capacity. It is not to be expected, however, that the section which can be economically fed from this station will ever produce a load beyond the capacity to which the station can conveniently be expanded.



DETAIL OF BUS-BAR COMPARTMENT, SHOWING THE LOCATION OF THE POTENTIAL TRANSFORMERS AND FUSES



TYPICAL DAILY WINTER LOAD DURING 1906-1907 COVERING THE BUFFALO CITY LINES OF THE INTERNATIONAL RAILWAY COMPANY



TYPICAL LOAD CURVES OF THE SENECA AND IMSON STREET STATION, STEAM-ELECTRIC AND HYDRO-ELECTRIC POWER WITH BATTERIES

The new Seneca and Imson Streets sub-station is supplied with power by means of underground cables of the Cataract Power & Conduit Company, Buffalo distributors of power from the Niagara Falls Power Company and Canadian Niagara Power Company. The International Railway Company has a steam plant in Buffalo which supplies a. c. power in parallel with the Niagara Falls power to some of its other sub-stations, but the cables to this particular sub-station are not connected with the steam plant. The largest Buffalo sub-station is that at Virginia and Washington Streets, containing six 1000-kw rotaries, a motor-generator lighting set and two 1500-hp (one hour rating) storage batteries and boosters. Other city sub-stations are at Walden Avenue and the Belt Line, and in the Niagara Street steam plant. The interior of the Virginia Street plant is shown in the accompanying cut.

GENERAL INTERIOR VIEW OF THE VIRGINIA STREET STATION, WHICH CONTAINS SIX 1000-KW ROTARIES

The interurban, and other divisions of the system outside of the city of Buffalo, are supplied with power from sub-stations located at North Tonawanda, Lockport, Olcott and in power house No. 1 of the Niagara Falls Power Company. All of these stations operate on power from the Niagara Falls Power Company, and the ones at North Tonawanda and Lockport have storage batteries. The International Railway Company supplies power to its Canadian division from its own hydro-electric plant situated at Table Rock, Niagara Falls, Ont.

UNIVERSAL SOLDERING FLUID

A soldering fluid which has proved very useful in the Willoughby shops of the Cleveland, Painesville & Eastern Railway is made by killing two quarts of muriatic acid with all the zinc it will take up. Then to the acid a quart of water is added, or it may have to be added before the zinc will fully dissolve. A quart of glycerine which has previously been mixed with a quart of alcohol is then added to the solution. This fluid is used for all kinds of soldering and has been found especially desirable with greasy or dirty connections as well as for soldering to iron. It is claimed that the glycerine prevents all rust, which plays havoc with many soldering fluids which contain muriatic acid.

FOLDING STEP FOR VESTIBULED CARS

W. R. W. Griffin, superintendent of the Rochester & Eastern Rapid Railway, has invented a combined folding door and car step which is now being tried on one of that company's cars. Three steps are used, of which two are permanent and one is a folding step which opens when the vestibule doors are opened outward. The door and step are controlled from the front platform.

SMITH SHOP FACE PLATE

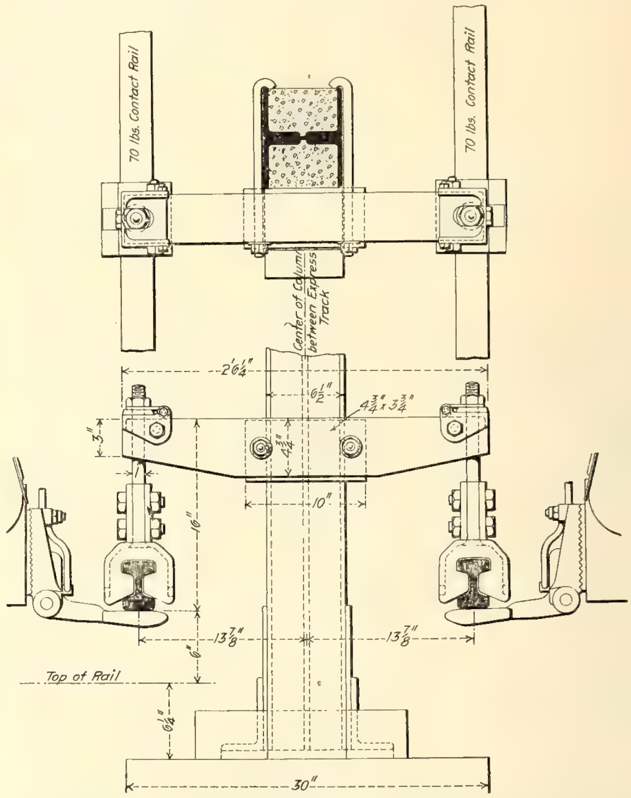
Among the tools used in the Willoughby smith shops of the Cleveland, Painesville & Eastern Railway is a portable face plate which has proved very convenient. It consists of an iron plate, about 30 ins. x 30 ins. x 3 ins., mounted on top of a heavy wooden frame of 6-in. x 6-in. stuff, and furnished with large casters that it might be easily moved from one forge to the other, as desired. This plate is fitted with a clamping device with which, on a recent visit of a representative of this paper, a smith was bending 6-in. x 1¼-in. iron into all manner of shapes for hanging up sets of 50-hp motors underneath the new cars received by the company. As a handy device the plate was certainly a success.

RECENT PROGRESS IN HEAVY ELECTRIC RAILWAY WORK AT PHILADELPHIA

The early opening of the regular subway and elevated service on the Market Street line of the Philadelphia Rapid Transit Company makes it appear desirable to publish a summary of the work to date. It will be recalled that the Sept. 23, 1905, souvenir issue of the STREET RAILWAY JOURNAL dealt very fully with this subject, but it was then in its early construction stages and several important points such as the class of rolling stock and the location and type of contact rail were still undecided.

By the end of 1905 the company had determined to adopt an all-steel car, and about the same time the third-rail question was also settled along the lines described and illustrated later in this article. The principal constructional features of this car were described in the Oct. 13, 1906, issue, but full details of the equipment are now available. In addition to this the Philadelphia Rapid Transit Company has permitted the publication of illustrated data covering the construction and track features of the proposed Frankford line of the elevated railway system.

SIDE VENTILATOR AT BROAD STREET STATION



METHOD OF SUPPORTING THE THIRD RAIL ON COLUMNS IN THE SUBWAY

LAYING THE BALLAST AND TRACK ON THE CONCRETE FLOOR

MARKET STREET ROUTE

The Market Street line primarily was built to relieve the surface congestion in the business district of Philadelphia.

Owing to the opposition manifested toward the erection of an elevated railway in crowded streets, the company built the first section as a subway, commencing at the west side of the City Hall, in front of the Broad Street Station of the Pennsylvania Railroad, at Sixteenth Street, then running west under Market Street to the Schuylkill River and Twenty-Third Street, over which it is continued on a bridge to run as an elevated structure to Market and Sixty-Third Streets. At the latter point the line descends to grade and terminates at Sixty-Ninth Street, where connections are made with several electric lines entering the city.

THE SUBWAY

The subway is about 4100 ft. long and contains four tracks, of which the two outer ones have been in use since Dec. 1, 1905, for standard surface cars running on the street after crossing the Schuylkill Bridge, where the elevated structure begins. The inner, or express tracks, will be used for the all-steel cars running over the entire route.

The subway has an inside width of 48 ft. 6 ins. and a height of 14 ft. 6 ins. The roof, which rests on three intermediate columns, is formed of concrete arches supported on I-beams, 5 ft. apart, placed across the subway. The side walls are of reinforced concrete, and the floor is built up of concrete alone. The use of a concrete floor adds to the cleanliness of the structure besides improving the drainage. The roof is waterproofed by a 1-in. coat of asphaltic mastic, and the walls, where necessary, by burlap layers soaked in the residium from petroleum after refining.

In view of subway experiences in other cities, the precautions taken for ventilation are of interest. In addition to the ventilation resulting from the stair passages to the street from stations, there are special chambers which connect to outside stacks to use either natural draft or artificial draft as conditions may require. One of the accompanying illustrations is a view of the ventilation tower at Twenty-Second Street, and is typical of the company's efforts to combine utility and art. Another illustration shows the side ventilator which has been installed at the Broad Street station.

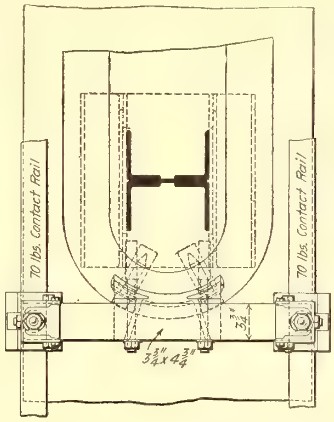
With regard to the illumination in the subway, it is hardly necessary to state that the lighting circuits are independent of the power circuits. The system is divided into sections about one-half mile in length. The lamps at each station and for a distance about half way to the next station are supplied on a 110-volt circuit from the station transformer. A throw-over switch permits the lamps to operate five in series on the railway circuit if necessary.

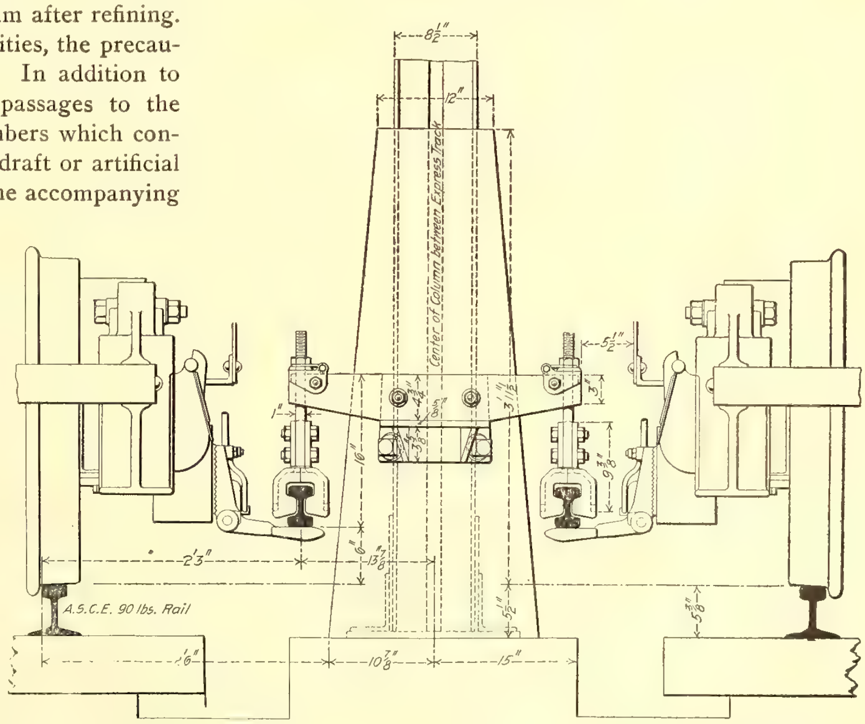
The track construction in the subway is of two types corresponding to the different kinds of service required. On the street car or local tracks, the rails are mounted on cast-iron chairs, which, with the rails, are completely embedded in concrete. The chairs or yokes are spaced 5 ft. apart and are provided at the top with adjusting screws. These rails are laid with the company's standard zinc joint. The cars over these tracks take power from an overhead wire flexibly supported from hangers placed in the roof as described in the Street Railway Journal for Dec. 23 and Dec. 30, 1905.

On express tracks the rails are mounted directly on yellow pine blocks, to which they are attached by clips and screw spikes. These blocks are bolted to 12-in. channels. The longitudinal channels are set in concrete. One rail of each express track is reserved for block signaling and the other has Mayer & Englund "Protected" bonds. Power for elevated and subway cars operating over these tracks will be transmitted through a 70-lb. under-running contact rail hung from brackets bolted to the inner columns. The cut on page 276 shows the standard clearance between the contact rail and column, and that on page 277 the minimum clearance as obtained at a double bulkhead.

THE MARKET STREET ELEVATED LINE

The bridge connecting the subway and elevated sections is 563 ft. long. It carries four tracks across the river at two different grades so as to unite the subway with the surface and elevated tracks. The 214½-ft. channel span and the 90-ft. and 98-ft. adjacent spans are riveted through truss structures and the two end spans and plate-girder structures about 78 ft. and 82 ft. in length, all of them of special construction to provide for the somewhat unusual arrangement of tracks. The two tracks in the center of the bridge for the elevated service ascend to the west on a grade of about 5 per cent, and continue beyond the river on the elevated railway. The two outside tracks are approximately on the level of Market Street, and connect west of

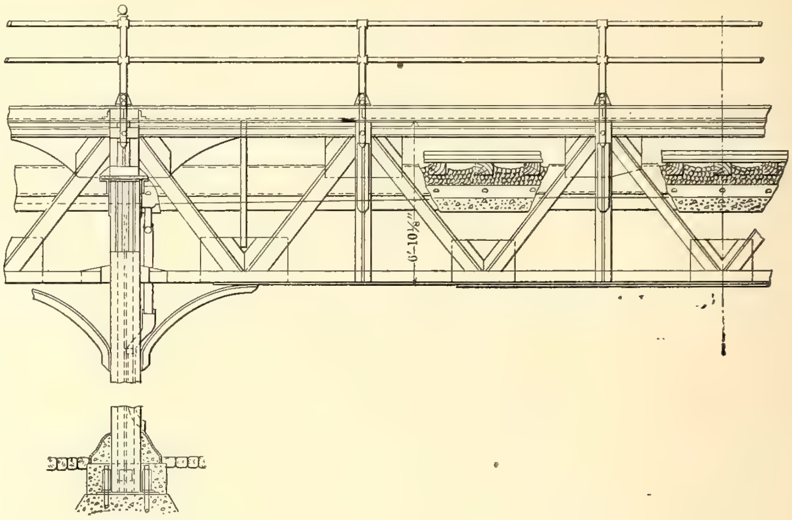




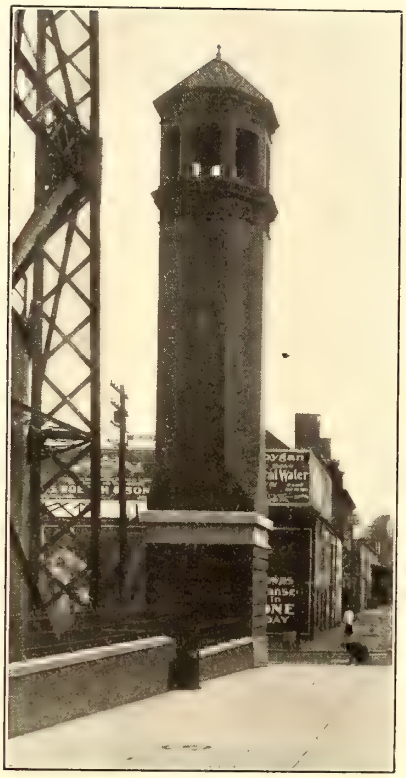
METHOD OF THIRD RAIL FOR A DOUBLE BULKHEAD IN SUBWAY

the bridge with the street railway tracks at the surface of the street.

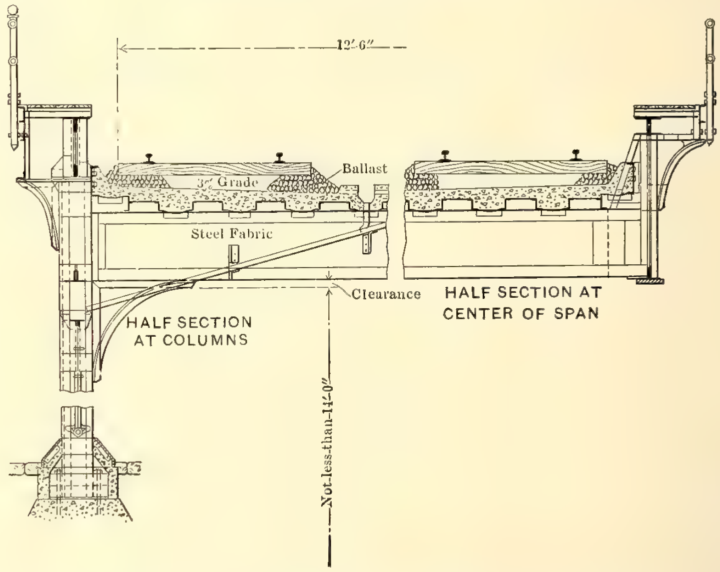
Nearly all of the elevated railroad structure is on a tangent. The maximum grade is 4.5 per cent; the minimum clearance above the street is 14 ft. 1½ ins., and the minimum height of rail above the street is 18 ft. 5 ins. In general the structure is made with 50-ft. longitudinal latticed girders directly connected to vertical columns 24 ft. apart transversely, with spans in special situations from 50 ft. to 80 ft. long, having the columns braced. At the stations, where



LONGITUDINAL ELEVATION OF REGULAR SPAN (MARKET STREET ELEVATED)



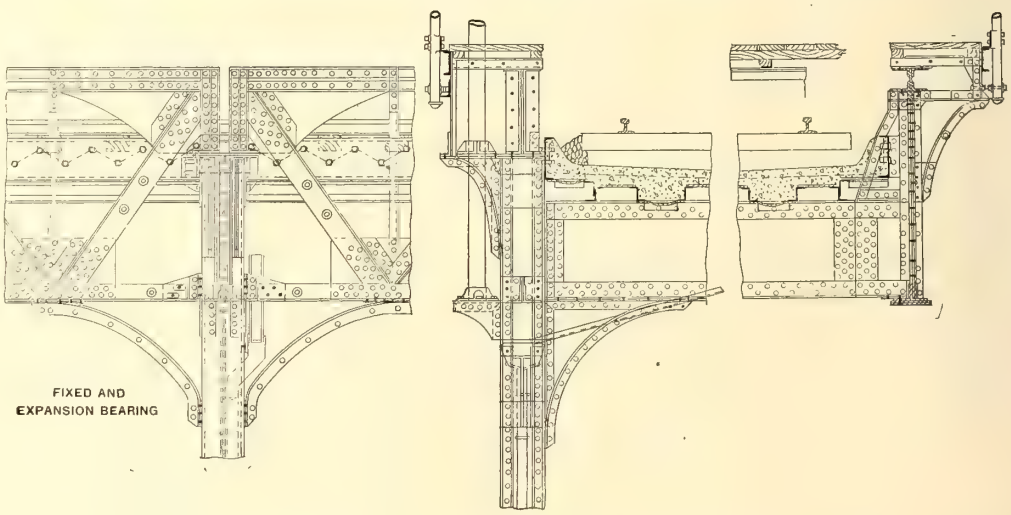
TYPICAL VENTILATION TOWER



TRANSVERSE ELEVATIONS OF REGULAR SPAN (MARKET STREET ELEVATED)

passages are provided over the street, under the tracks, with the consequent increased elevation of the structure, longitudinal bracing is afforded by the use of deep latticed trusses.

At the river end, where the tracks form a reversed curve to follow the offset of the alignment of the street, there are seven spans of plate girders from about 30 ft. to 60 ft. in length. The lengths of the spans and the arrangement of the columns is varied in a number of places on account of the clearance required for the cross streets and for the location of the stations. The latter are generally about four squares apart, and to minimize the transmission of train vibrations are supported on independent girders.

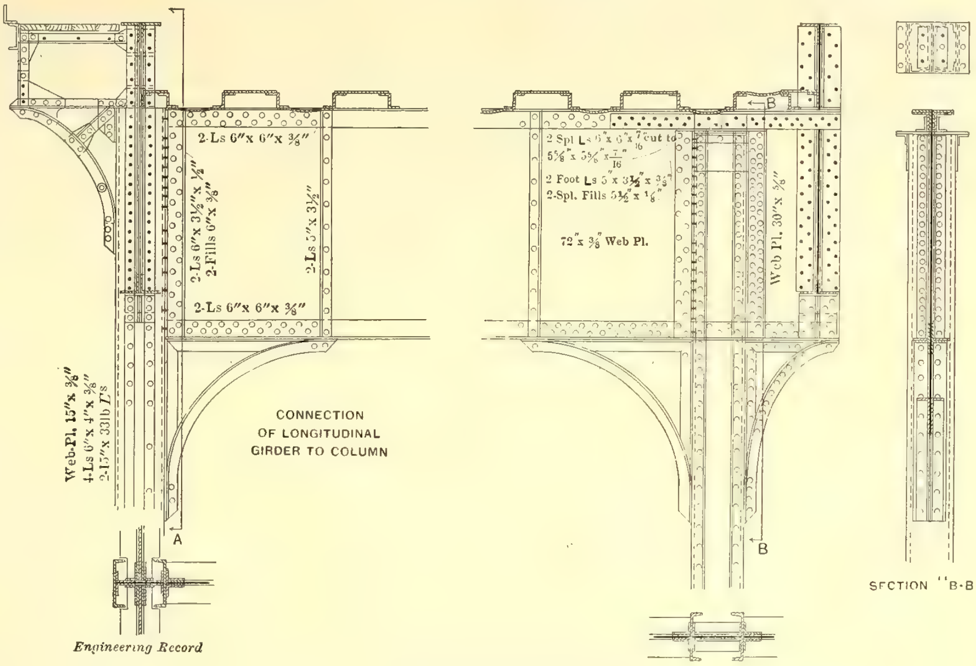


REGULAR COLUMN CONNECTIONS, FLOOR CONSTRUCTION AND TROLLEY-POLE SUPPORT

In general, there are three types of construction: the regular style with 50-ft. longitudinal girders about 7 ft. deep over all, which is used for about 17,900 ft.; about 517 ft. of deep span construction near the stations made with 50-ft. longitudinal girders about 15 ft. deep; the third, about 325 ft. of plate girders. Up to the Delaware County line, a distance of 18,750 ft., the city ordinance required a solid

floor which would intercept all leakage and drip. The rest of the structure is of the ordinary open floor construction with cross-ties laid on the top of the flanges of the longitudinal girders.

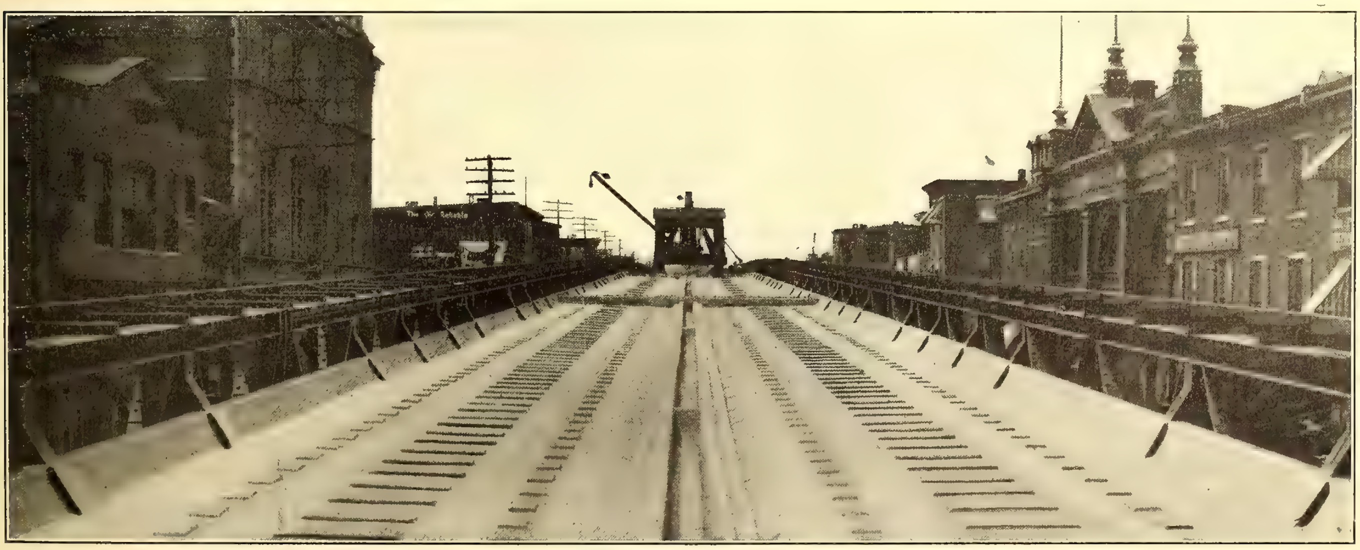
In the typical construction the columns have an H-shaped cross-section made with a web plate connecting four angles, and two 15-in. channels, the flanges of the latter being turned inward with round corners. The feet of the columns have extended bases reinforced by horizontal flange angles and are seated on concrete pedestals about 20 ins. below the pavement surface. The columns continue nearly to the base of the rail and receive both the longitudinal and transverse girders. The top chords of the longitudinal trusses are about 2 ft. higher than the base of the rail, and support the inner ends of wooden sidewalk beams.



DETAILS OF COLUMN AND GIRDER CONNECTIONS ON MARKET STREET

The solid floor as shown in the cuts is made with longitudinal troughs. The troughs were shop-riveted complete in sections about 7 ft. wide and 20 ft. long, the dished bottom plates being cut to clear the flanges of the transverse girders. The top plates of the troughs are spliced with short horizontal cover plates, and at the ends of the bottom plates short angles are riveted to the edges of the transverse girder flange angles to prevent any drip from following the surface of the girder. The troughs are filled with 1:3:6 concrete made with Vulcanite Portland cement filled in to a minimum height of 4 ins. above the top plates. To prevent shrinkage cracks, the concrete is reinforced with ⅜-in. Johnson bars, 12 ins. apart transversely and 18 ins. apart longitudinally. To secure the concrete and key it thoroughly to the vertical face of the fascia web and at the expansion joints where the concrete is retained by a similar cross-curb, horizontal bolts are made to project a few inches from the webs of the curbs or fascia and are united by ziz-zag lines of wire bedded in the concrete.

The concrete is finished with 1 in. of granolithic, pitched to the gutter on the center line of the structure, the latter having a minimum grade of 1 per cent to drainage holes at both ends of every span. Stone ballast is filled in on the concrete surface and receives the cross-ties as indicated. The rain water, drip, etc., drains to the open gutter and thence through short vertical pipes to inclined steel troughs with their lower ends discharging into cast-iron catch basins placed inside the main vertical columns. These catch basins waste through vertical pipes carried down inside the columns to the street level, where they discharge to underground drains connected to the sewer.



APPEARANCE OF CONCRETE FLOOR BEFORE BALLAST AND TRACK WERE LAID

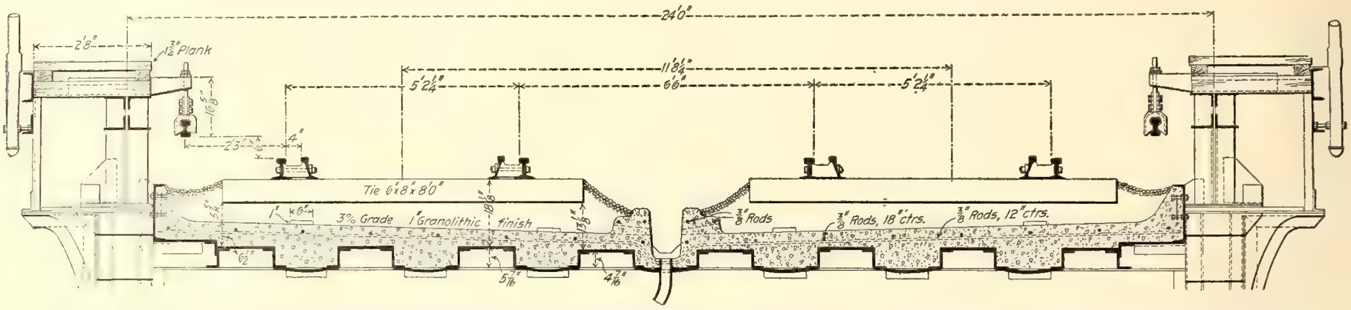
In the deep span construction the longitudinal girders are made with lighter chords than those of the regular construction and the knee-braces are omitted. The transverse girders

at the column bents in the deep construction are of the same depth as the longitudinal girders, and like them are light lattice girders supporting the floor troughs on their top flanges. The intermediate floor beams in the deep construction consist of latticed cross-frames.

In the spans adjacent to the Schuylkill River, where the plate-girder construction is adopted, there is considerable variation on account of the deflection of the alignment, and in a number of spans the longitudinal girders are supported by transverse girders projecting a considerable distance beyond them to provide for the location of the vertical columns at suitable points in the street, and to clear the street railway track connections. The longest transverse girder is about 53 ft. 4 ins. long.

The structure was proportioned for a live load of electric cars 46 ft. long over all, with 25,000-lb. loads on each of the four axles, with provision for impact. The total weight of the main steel superstructure is about 41,000,000 lbs., and that of the solid floor type is about 2000 lbs. per linear foot. The work was designed and supervised by the Philadelphia Rapid Transit Company, Wm. S. Twining, chief engineer, and Charles H. Mills, principal assistant engineer. The steel work was furnished by the American Bridge Company.

The track construction adopted for the Market Street elevated structure covers the use of a 90-lb. T-rail laid on 6-in. x 8-in. x 8-ft. ties in rock ballast on the concrete floor or on the ties alone on the open span beyond the county line. Up to Sixty-Third Street the same type and style of outside suspension or underrunning third rail employed in the subway is used. Beyond that point, which

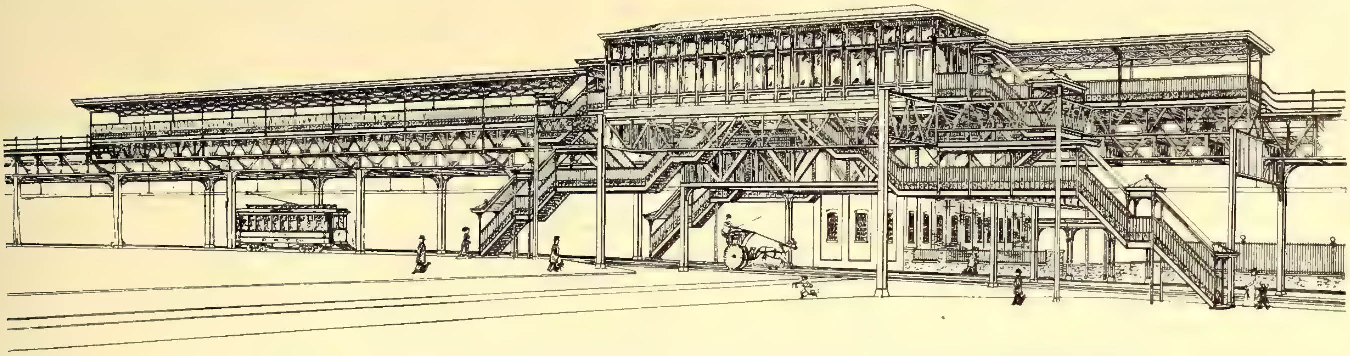


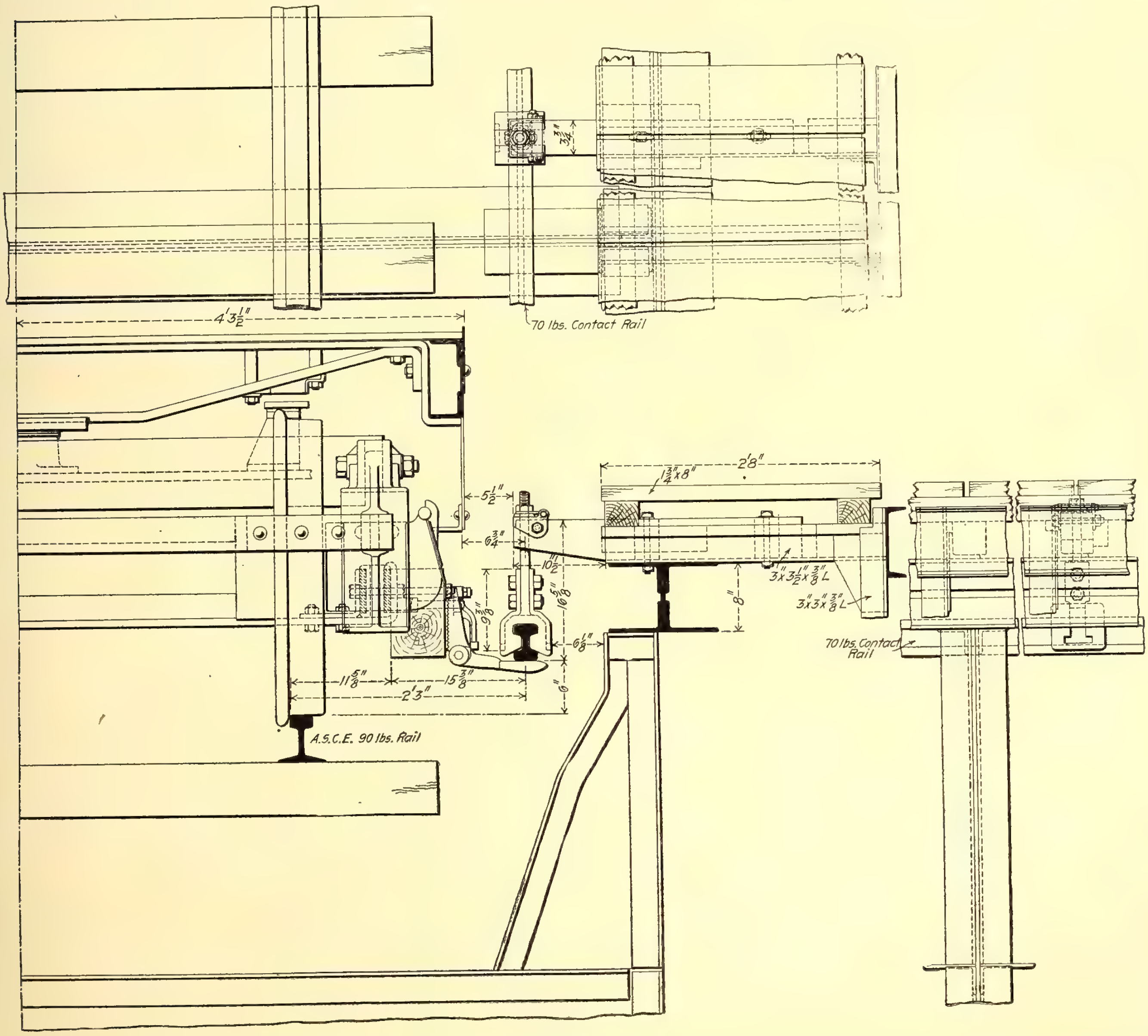
CROSS-SECTION OF THE MARKET STREET ELEVATED STRUCTURE, SHOWING FLOOR AND TRACK CONSTRUCTION

VIEW SHOWING METHOD OF THIRD-RAIL SUSPENSION ADOPTED ON THE MARKET STREET ELEVATED LINE TO SIXTY-THIRD STREET

AT MARKET AND SIXTY-THIRD STREETS, WHERE THE THIRD RAIL IS PLACED BETWEEN THE TRACKS

marks the descent to grade terminating at Sixty-Ninth Street, the company has placed the contact rails between the tracks and used the supporting bracket under-running type adopted by the New York Central Railroad. One of the accompanying illustrations was made from a photograph taken at the place where this change-over is made.


TYPICAL STATION ON THE MARKET STREET ELEVATED LINE, PHILADELPHIA



DETAIL OF THIRD-RAIL APPLICATION ON MARKET STREET ELEVATED, BETWEEN TWENTY-NINTH AND SIXTY-THIRD STREETS

Among the views of the constructional and electrical features of the elevated railway will be noted several which show the substantial construction of the passenger stations. Another illustration shows a typical passenger station as it will appear when completed.

THE FRANKFORD ELEVATED RAILWAY

The next portion of the elevated railway system to be built by the Philadelphia Rapid Transit Company will run on Delaware Avenue, forming the Frankford division. The columns and longitudinal lattice girders on this structure will be similar to the Market Street line except that the spans will be longer, namely, 85 ft. The transverse girders,

however, will be entirely different. No track ballast will be used. For drainage purposes there will be a 3-in. reinforced concrete floor placed as shown on the accompanying cross section. The same illustration also shows that the third rail is of the New York Central underrunning type and placed on the outside of the tracks. The Frankford section is to start at Arch Street and terminate at South Street. It will have siding and cross-over tracks in addition to the two running tracks. The minimum headroom will be 20 ft. 6 ins.

THE COMBINATION TERMINAL

The Philadelphia souvenir issue of the STREET RAILWAY JOURNAL referred to the building which was to be erected at Sixty-Ninth and Market Streets to serve as a common terminal for the Philadelphia Rapid Transit Company, the Philadelphia & West Chester Traction Company, and the Philadelphia & Western Railroad. The location of the terminal at this point led to an interesting study in track location without grade crossings, as the Philadelphia & Western's right of way passed through the center of the property which the Philadelphia Rapid Transit Company has laid out for repair shops, car houses and a steam plant. The solution of the problem will be noted from the accompanying plan in addition to the references given later to the different track layouts.

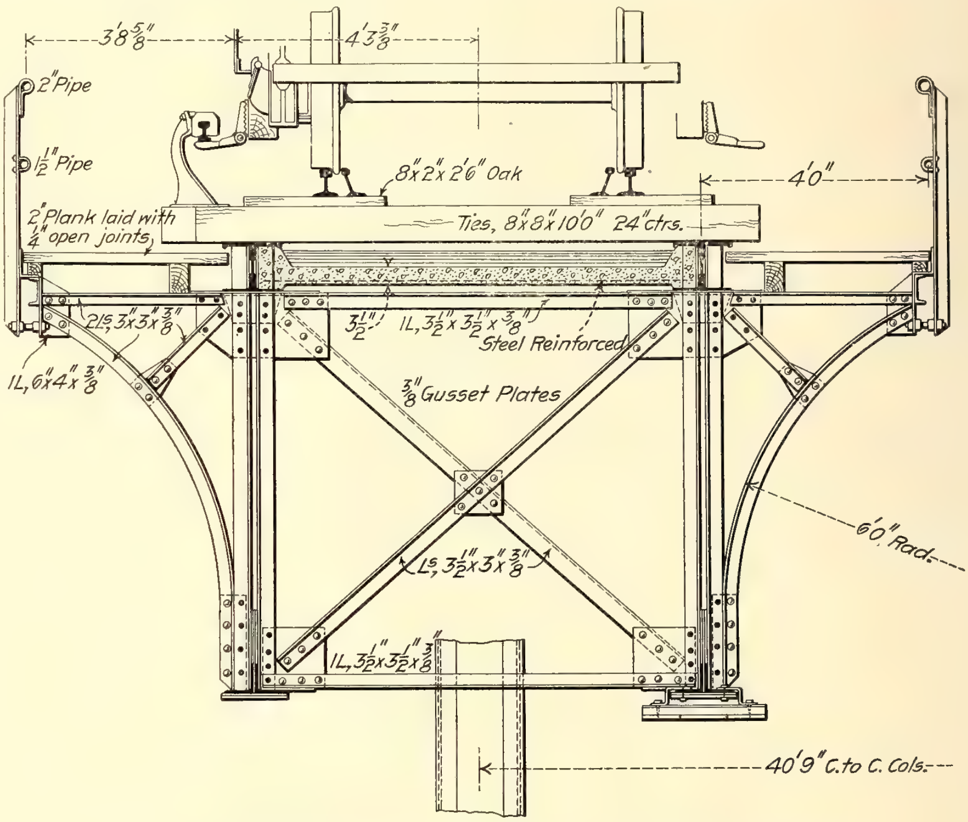
The terminal building will consist eventually of three parts, each built by one of the three companies. However, the portion intended for the Philadelphia & Western Railroad has not yet been put up. This will be added to the northern end, connecting with the present waiting room.

The Philadelphia Rapid Transit Company's section is at the southeast corner, which contains the common waiting room and ticket offices. Its frontage is 97 ft. and its depth 117 ft., with a rear portion 75 ft. wide and 79 ft. long extending over one emergency and two regular passenger tracks and two 350-ft. reinforced concrete platforms. The second floor is to be used for offices, trainmen's quarters and other purposes.

The discharging platform is 15 ft. wide and the loading platform 33 ft. The Market Street elevated cars will enter the eastern end of the station, discharging passengers at the north platform, which communicates with the waiting room and the loading platform by a bridge and stairways. The latter platform, as noted, is considerably wider, as it also serves the emergency track. The western exits from the waiting room lead directly to the Philadelphia & West Chester tracks and the southern exit to the street. Passengers on the north platform may also transfer to the platforms of the Philadelphia & Western Railroad.

If the unloaded elevated cars are to go to the shops they turn north, crossing the Philadelphia & Western tracks under grade; otherwise they describe a rising loop of 150-ft. radius over the depressed shop tracks, returning to take east-bound passengers from the south platform. The emergency track previously mentioned starts from the storage tracks and encircles part of the loop. It extends under the station, being used for extra trains and for unloading freight at the basement level, from which it is continued as a switch track connection to the Philadelphia & West Chester Company's tracks. Cars from the Philadelphia Rapid Transit Company's surface lines connecting with the Philadelphia & West Chester at Sixty-Third and Market Streets can therefore be hauled to the shops if necessary.

The Philadelphia & West Chester Company's section has a southern frontage of 172 ft. and is 117 ft. deep. Part of the east end is two stories high, the upper floor serving the same uses as that of the Philadelphia Rapid Transit Company's office floor. The tracks of this company coming from the west climb a walled embankment leading to a five-track stub terminal level with the waiting rooms. The northernmost track is furnished with an inspection pit. The loading tracks are 155 ft. long except the one on the south, which is 17 ft. less. The platforms in this section are also of reinforced concrete. The middle platforms, which are four in number, are 15 ft. 5¼ ins. wide and have a fence down the center for the entire length of the shed to prevent confusion between arriving and departing passengers. A similar fence will extend from wall to wall along the west side of the lobby used by the Philadelphia & West Chester passengers. This fence will have double sliding gates at the end of each platform, so that passengers can only reach the platform sections intended for them.

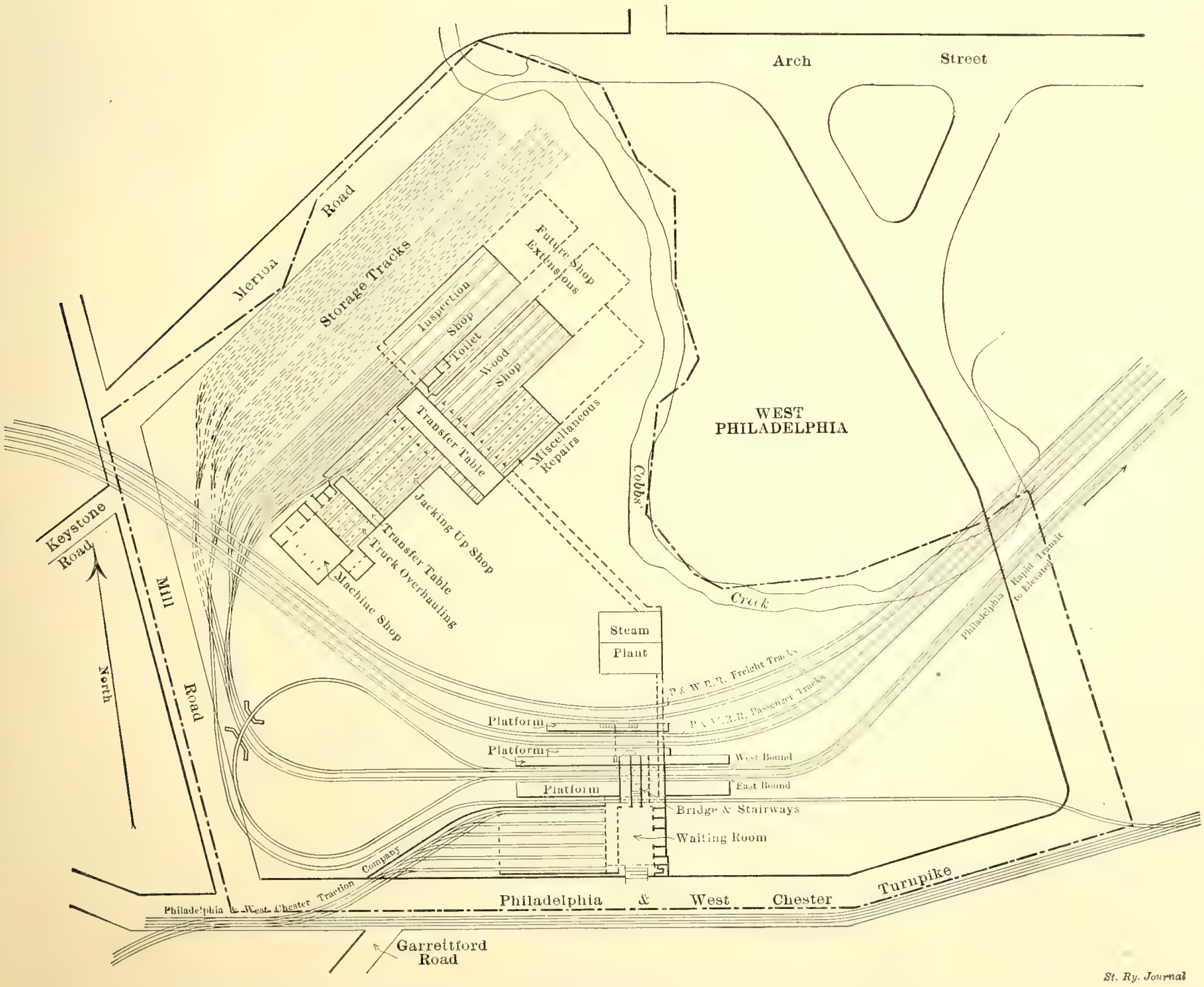


SECTION SHOWING STEEL AND TRACK CONSTRUCTION PROPOSED FOR THE FRANKFORD ELEVATED RAILWAY, PHILADELPHIA

THE REPAIR SHOP

The inspection and repair shops of the Philadelphia Rapid Transit Company for the elevated-subway division are located on the company's property about 700 ft. northwest from the terminal at Sixty-Ninth Street. The layout of these build-

THE MARKET STREET TERMINAL OF THE PHILADELPHIA RAPID TRANSIT COMPANY AND CONNECTING RAILWAYS



GENERAL PLAN OF COMBINATION TRACK LAYOUT AT THE MARKET STREET TERMINAL

ings was published in the Sept. 23, 1905, issue, but the accompaning illustration is given to give some idea of their general appearance at present. These buildings comprise an inspection shop, a jacking-up and truck repair shop, a machine shop, miscellaneous repair shop, a store room, offices, employees' quarters, etc. Thus far the only work done at these shops has been to fit up the new rolling stock, but machine tools are already installed for carrying on the activities of an up-to-date railway maintenance shop.

THE ROLLING STOCK

One of the forty steel cars which the Pressed Steel Car Company has furnished to the Philadelphia Rapid Transit Company for the Market Street elevated and subway service was illustrated in the Oct. 13, 1906, issue of the Street Railway Journal. In that issue the construction details were given, together with a statement of some of the fittings adopted. Since then the cars have been equipped ready for regular service, making it possible to give more extended details.

The cars are built of steel throughout with non-combustible floor. The outside sheathing is of cold rolled steel and the underframe consists of deep fish-belly side sills, with cross-bearers and connections in girder form. In consequence of this construction it was necessary to place the contactors of the multiple-unit system further back from the side of the car than is usual, as otherwise it would not have been possible to look after them as easily as where the ordinary sill is used. The girder adopted, however, was needed in view of the installation of center doors.

The underframe is covered with corrugated steel sheets and Monolithic flooring composition. The interior finish is of straight-grained mahogany. The roof is constructed of tongue and groove poplar ½ in. thick and covered with 8-oz. cotton duck. There are two safety chains on each end, equipped with 4-in. diameter springs. Pantagraph safety gates are applied on platform corners opposite the motorman's cabs. Mason safety treads are applied at each end door. Each car is fitted with twelve pairs automatic ventilators and Keystone hand fire extinguishers. There are twenty-four side windows per car, eighteen of which have upper sash movable and lower sash stationary. These windows are furnished with Pantasote curtains and Forsythe ring fixtures. The cars are painted Tuscan red with gold stripes.

The seating arrangement, as published in the Oct. 13, 1906, issue, shows that, despite the center door, eight cross seats are in place. These transverse seats, however, can easily be taken out as soon as the growth of traffic requires the use of the center door. Both the vestibule side and center doors are arranged for pneumatic opening and closing. Each brakeman actuates the closing handle on his car, and when all the doors on the train are closed a buzzer sounds in the motorman's cab as the signal for starting.

The car bodies are mounted on Curtis trucks fitted with Symington journal boxes. The draft rigging is of the Van Dorn type and the air brakes were furnished by the Westinghouse Traction Brake Company. In addition to the air brakes there are bevel-gear vertical hand brakes on each side of the car, A novelty for this type of service is embraced in the installation of pneumatically-operated Kalamazoo track scrapers.

The electrical equipment per car consists of two GE-66 125-hp motors using type-MC-36 control. The electric lighting consists of twenty-five single fixtures, one headlight and two markers on each end controlled by one main fuse and six individual fuses. The heating equipment is made up of eighteen Consolidated heaters. A double train line is used, one for the air-brake connections and buzzer circuit to the motorman and the other for the train control, lighting and heating circuits. All of the operating switches are placed in a cabinet built in a corner of the car opposite the motorman's cab. They are all properly stenciled and are mounted on a slate panel enclosed by a steel door covered with insulating material on the inside and finished on the outside in harmony with the all-steel construction of the car. This cabinet is very compact, not projecting more than 3 inches from the car body.

The seating capacity of this car, as made up of four longitudinal seats for nine passengers each and eight cross seats for two passengers each, totals 52. The approximate weight of an empty car is 32 to 33 tons, and of a loaded one about 40 tons. The principal dimensions are as follows: Length over platform (over all), 49 ft. 7¼ ins.; length over door posts, 40 ft. 6¼ ins.; length inside of car (end lining), 39 ft. 6¼ ins.; width of car outside of side sheets, 8 ft. 7 ins.; width of car inside, 7 ft. 7¾ ins.; height from rail to top of floor, 3 ft. 10 ins.; height from floor to ceiling center, 8 ft. 6½ ins.; height from rail to top of car, 12 ft. 7 ins.; opening for vestibule side door (between door posts), 2 ft. 9 ins.; width of end door opening, 3 ft. 2½ ins.; width of center

INSPECTION AND SHOP BUILDINGS OF THE PHILADELPHIA RAPID TRANSIT COMPANY, NEAR THE MARKET STREET TERMINAL

door opening (side), 3 ft. 4 ins.; distance from center to center of trucks, 34 ft. 6 ins.; width over eaves—upper deck, 5 ft. 6¾ ins.; width over eaves—lower deck, 8 ft. 8⅝ ins.; width of vestibule end door opening, 2 ft.

CORRESPONDENCE

SUBSTITUTION OF THE ELECTRIC MOTOR FOR THE STEAM LOCOMOTIVE

Feb. 13, 1907.

Editors STREET RAILWAY JOURNAL:

The letters of Messrs. Sprague, Armstrong and Henderson, published in your issue of Feb. 9, constitute an interesting addition to the discussion of the paper which Mr. Putnam and I had the honor to present at the meeting of the American Institute of Electrical Engineers, on Jan. 25.

It appears from Mr. Sprague's letter that his position in respect to the 1200-volt d. c. motor has been misunderstood. It is particularly gratifying to learn from his letter that "he believes that there are many opportunities and possibilities for alternating-current equipment," and that as regards 15 cycles he feels that "it may be advisable in the end to adopt for a. c. operation about this periodicity."

As regards the opinion expressed in our paper, to the effect that for the equipment of trunk-line divisions a. c. systems only are worthy of consideration, this view is founded not only upon a general view of the possibilities and limitations of the contrasted systems available, but also upon the results of painstaking investigation and calculation in important specific instances.

The effort to stretch the direct-current system to meet the requirements of general railroad equipment is in some respects analogous to the similar effort which has been made in certain quarters to force the direct-current lighting system by increasing voltage to cover the broad field of electric illumination. In some cities here and abroad the 440-volt, three-wire d. c. system is used for lighting purposes and it is, of course, used successfully, but it falls far short of proving itself in general a satisfactory substitute for the alternating-current system of distribution for lighting purposes. Undoubtedly the 1200-volt motor will work, and it will work successfully, but the essential limitations of the system as compared with the single-phase a. c. system are so obvious that it is difficult to imagine a case in which its adoption for the operation of a trunk line division could be justified.

The position which Mr. Putnam and I take in this matter may be stated as follows:

(a) A general view of the railway field, including freight as well as passenger traffic, obviously shows that for anything approximating a general solution the single-phase a. c. system is decidedly superior to the 1200 or 1500-volt d. c. system. This conclusion is corroborated by calculations easily made and based only upon established facts.

(b) The admitted advantages of electricity in respect to increased earning power and decreased cost of operation are such as in the near future assure rapid increase in the use of electricity by railway systems now operated by steam.

(c) The necessity of standardizing frequency rests practically upon the same arguments as have induced railways to standardize track gage, height of drawbar, location and couplings of air-brake train line and steam line.

In other words, the significance of our estimates of comparative operating costs is that the results, viewed in connection with admitted facts, in respect to increased earnings indicate that a general electrification of important railway divisions and even trunk lines is coming much more rapidly than has been realized, even by electrical engineers, and the lesson to be drawn from this conclusion is that we must standardize as promptly as possible everything essential to convenient interchange of rolling stock.

Specifically and especially the only thing which should be agreed upon now is frequency, and this, we take it, has been practically settled by the remarkable unanimity of competent engineering opinion which was evidenced during the discussion of our paper.

I infer from Mr. Sprague's letter that if he should ever be induced to use a single-phase alternating-current motor for railway work he would prefer 15 cycles to a higher frequency.

It is surprising to find Mr. Armstrong and a few other engineers opposing the idea of standardizing ordinary railway practice. The explanation of their attitude must be found either in the fact that they have inferred more than was intended by our use of the word "Standardization" or that they have failed to realize an adequate general view of the railway problem which confronts us.

Our paper proposed that standards of practice be agreed upon in respect to (a) location of third rail; (b) location of overhead conductor used with single-phase alternating systems; (c) frequency of alternating traction systems. We remarked also that it is clearly desirable but probably less easy to agree upon a standard system of multiple-unit control for train operation.

In his interesting letter Mr. Armstrong expresses the opinion that "it is hard to see the advantage of forcing the adoption of any electrical standards at the present time. At best the standardization of apparatus or methods is attended by the constant danger of Chinese stagnation, and, too, no piece of apparatus or method is ready to be standardized until its continued use has shown it to be a survival of the fittest."

In 1890 the engineers of the Westinghouse Company selected for lighting purposes a standard frequency of 60 cycles per second. This choice was based upon knowledge certainly not more complete in respect to the requirements, limitations and possibilities of the field of use in which it was expected to employ this frequency than is now available to enable us to make a wise choice of frequency for railway purposes. In 1890, 60 cycles was not a case of a survival of the fittest. As a matter of fact, when it was chosen as the standard frequency to supersede much higher frequency previously in use it had never been embodied in a commercial plant in actual operation. Nevertheless it appears to have withstood successfully the test of time.

Similarly in 1890 the Westinghouse Company selected as the standard frequency for work in which rotary converters were to be employed extensively a frequency of 30 cycles per second. About two years later, and before any important plants using 30 cycles had been installed this was changed to 25 cycles, owing primarily to the fact that the Niagara Falls Power Company had arranged to install turbines operating at 200 r. p. m.—a speed which did not permit the development of 30-cycle current by alternators directly connected to the turbine shafts.

The frequency 25 cycles per second, when adopted for the Niagara installation was not selected as the survival of the fittest among a number of alternative frequencies preferred by various engineers and experimented with in commercial service at the expense of the purchaser. At the time it was

chosen knowledge of the facts essential to a wise choice was far less exact and comprehensive than to-day is our knowledge of the considerations which should enable us to predetermine and select that frequency which is best fitted to survive.

The letter of Mr. G. R. Henderson deals with certain important features of our estimate of operating expenses. Discussion of this kind is decidedly apropos and useful. Mr. Henderson's arguments, however, in large part, are based upon misconception of facts, due perhaps to lack of perspicuity in our exposition of our premises and reasoning. We shall avail ourselves of an early opportunity to point out some of the errors into which he has fallen and shall endeavor to set forth, in somewhat greater detail than was practicable in our paper, certain assumptions and methods embodied in our calculations. L. B. STILLWELL.

RECORDING AND CHECKING TRAIN ORDERS

Cuyahoga Falls, Ohio, Jan. 31, 1907.

Editors STREET RAILWAY JOURNAL:

I notice in your issue of Jan. 5 an editorial on "Keeping Records of and Checking Train Orders," recommending that all copies of orders should be compared and some one obliged to explain the discrepancies, thus avoiding the natural tendency to become careless. I enclose a draft of a form of train sheet, which seems to cover all the points mentioned. The sheet, I think, is self-explanatory. The conductors receive the order over the telephone and write same on a blank order. This is given to the motorman and later turned over to the division superintendent, who can then easily compare them with the dispatcher's train sheets. All transfers of cars and reasons for same should be noted on margin of sheet, thus making a permanent record of the sheet for future reference. A. S. KIDD.

JAMAICA, BATH & NEW UTRECHT TRACTION CO.
TRAIN SHEET, A.B.& C. DIVISION

DESPATCHER'S CODE
Meeting Points
Call order........C.
Carry Signals........S.
Flag........F.
Changed order........C.O.
Signals off........S.O.

WEATHER REPORT A.M. / P.M.

NORTHBOUND / SOUTHBOUND

Car No.	Leave Terminal	"A"	Southern Div. Crew	Northern Div. Crew	"A"	"B"	"C"	"D"	"E"	"F"	"G"	"H"	"I"	"J"	Car No.	Northern Div. Crew	"J"	"J"	"I"	"H"	"G"	"F"	"E"	"D"	"C"	"B"	"A"	Southern Div. Crew	"A"	Arrive Terminal	Despatchers will Note any Causes of Delays, Accidents or Special Note.
27	5.40	6.03	Adams Johnson	Adams Johnson	6.03		✓		✓	✓		✓		7.10	30	Ross Starr	5.40			✓			✓		✓	✓	6.40	Ross Starr	6.40	7.00	
7				Murphy Smith	6.33	✓			✓					7.40	26	Foster Mason	6.40			✓		✓			✓	✓	7.40	Foster Mason	7.40	8.00	
2	6.30	6.48	Martin Jones	Martin Jones	6.50		S ✓					C		8.16	23	Wagner Lamy	7.40			✓			✓		✓	✓	8.40	Wagner Lamy	8.40	9.00	
11	6.40	7.02	Graham Dean	Graham Dean	7.03		✓					C ✓		8.16	18	Noble Plant	7.55			✓		✓			✓	✓	8.44	Noble Plant	8.44	9.00	Limited
12				Butler Amos	7.33	✓			C	✓		✓	✓	8.50	31	Green Dale	8.25			✓		✓			✓	✓	9.14	Green Dale	9.14	9.30	"
30	7.40	8.02	Ross Starr	Ross Starr	8.03		✓		C	✓		✓		9.12	27	Adams Johnson	8.40		✓	✓			✓		✓	✓	9.40	Adams Johnson	9.40	10.00	
Limited 28	8.30	8.47	Goff Harris	Goff Harris	8.47									9.40																	

Street Ry. Journal

DESPATCHER'S TRAIN SHEET

The tax paid by the United Railways & Electric Company, of Baltimore, in 1906 to the city for the maintenance of parks amounted to $410,208, the largest on record. The company is required to pay the city 9 per cent of its gross receipts in the city as a park tax. The gross earnings of the United for 1906 amounted to $6,589,847. The tax returns indicate that the gross receipts from the city lines totaled $4,558,985, so that the earnings of the suburban lines were $2,002,862.

CAR EARNINGS OF THE PHILADELPHIA RAPID TRANSIT COMPANY

From the number of car licenses purchased by the Philadelphia Rapid Transit Company, as recorded in the Bureau of Highways, it is possible to figure some interesting results respecting the operations of the company, says the Philadelphia News Bureau. The number of cars regularly licensed, not including the additional bridge licenses for cars crossing the Schuylkill, was 2,070 in the year ended Dec. 31, 1906. The company reported 448,576,785 passengers carried in the year ended June 30, 1906. This would give the average number of passengers carried per car during the year as about 216,703. In 1902, when the company began operations, 1725 cars were regularly licensed and the number of passengers in the company's fiscal year was 325,801.963. So the number of passengers carried during the year, per car, was then about 188,869, or 27,834 per car per annum less than at present. In observing this increased efficiency per car it is to be remembered that not only has there been concentration in the car service, but there has also been very material increase in the size of the cars which have been built and put on the lines in the last few years. The results may be somewhat affected by the number of summer or open cars, which may not be altogether included in the figures for licensed cars, but as the summer cars when in operation are substituted for other cars in many cases, the general results indicated by the following figures may probably be fairly taken as a criterion.:

	Number Cars Reg. Licensed	Number Passengers	Av. No. Pass. Carried per Car During Year
1906	2,070	448,576,785	216,703
1905	2,000	402,893,245	201,446
1904	1,895	390,532,689	206,085
1903	1,844	365,908,051	198,431
1902	1,725	325,801,963	188,869

Similarly, taking the company's earnings figures for the respective fiscal years, the gross net earnings per car show:

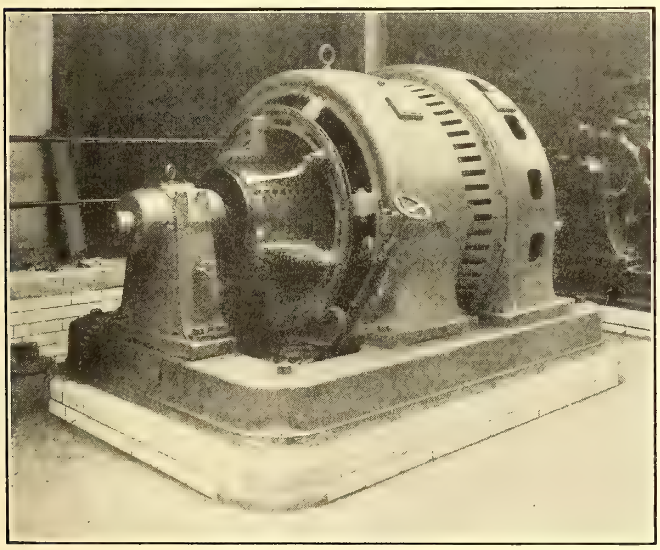
	Gross Earnings	Gross Earnings Per Car	Net Earnings	Net Earnings Per Car
1906	$17,483,144	$8,619	$8,329,541	$4,024
1905	16,188,645	8,094	8,005,208	4,202
1904	15,923,507	8,404	7,930,193	4,184
1903	15,277,806	8,285	8,042,913	4,386
1902	13,969,232	8,098	7,566,894	4,386

The gross receipts per car show a decided gain, but the net receipts per car, on account of the increasing ratio of expenses to gross earnings reflect a decrease in the net receipts per car.

MOTOR CONVERTERS

The methods employed abroad and in this country for rectifying alternating currents for railway and general power purposes are quite different. In Europe the rotary converter has never reached the same popularity as here, and the motor generator is used in its stead, partly, perhaps, because of the higher commercial frequencies generally used. In this country the rotary converter is considered both less expensive and more efficient, and is almost the only device considered. For the reasons outlined above, little attention has been given in this country to substitutes for the rotary converter or motor generator. On the other hand, European inventors have been giving a great deal of attention to this subject, and within the past year or so have developed at least three entirely different kinds of machines, all of which are practically unknown so far as use is concerned.

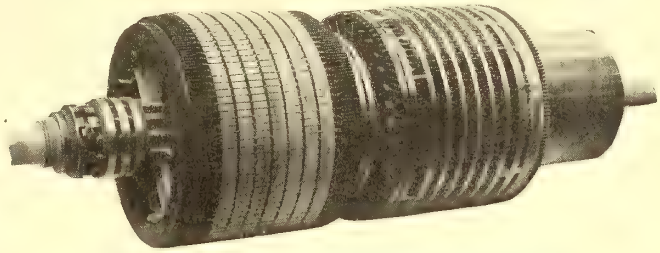
Two of these have been described in recent issues of this paper, and for a better understanding of their design a short resumé will be given of their salient features and differences. The first is the permutator described in the issue of Dec. 23, 1906. This machine is very similar to the converter except that the armature is stationary and the brushes revolve synchronously. The revolving magnetism is produced by stationary polyphase windings that are inductively related to the stationary armature winding of the permutator. This machine, as developed in the Rougé-Faget design, exhibits the desirable characteristics of possessing a small mass of rotating material, and therefore can be rapidly synchronized. Moreover, the machine would neither experience nor produce any injurious effect if it were to fall out of step; its synchronizing power is enormous, so that the possibility of such occurrence is very remote.



MOTOR CONVERTER

A second substitute for the converter and motor generator can properly be designated as an alternating-current rectifier, and was described in the Street Railway Journal for Jan. 12, 1907. As noted at that time, the rectifier operates to best advantage when used on electric locomotives for supplying to the motors pulsating direct current at variable voltage, and is being applied for this purpose.

A third type of converter, and one for which many claims are made in connection with its advantageous characteristics when used to deliver constant potential direct-current when the supply is high-frequency, high-voltage alternating current, is being built by Bruce Peebles & Co., of London and Edinburgh. This machine has been introduced on a large scale for electric railway work in Great Britain, where it is stated that there are now more than four times as great capacity in use for 50-cycle current as there are rotary converters, although the latter have been available for at least four times as long. The cascade converter, or the "motor converter," as this rectifier is called in England, consists of two machine structures whose revolving parts are mounted on the same shaft. The input machine resembles in every respect an induction motor with a coil-wound (rotor) secondary; the output machine is exactly similar to a rotary converter, and it receives its current from the secondary winding of the input induction motor at a frequency much reduced from that impressed upon the primary winding.



ROTOR WINDINGS OF MOTOR CONVERTER

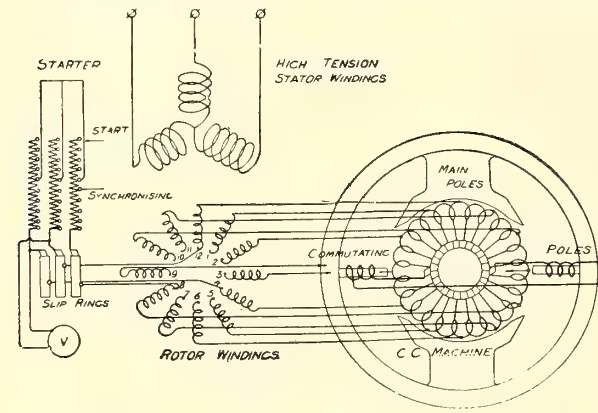
For simplicity in explanation it may be assumed that the motor and the converter have the same number of poles. The induction motor rotates at a speed corresponding to half frequency; half of the electrical power supplied to the induction motor will be converted into mechanical power and transmitted by means of the shaft to the converter, while the other half is transferred to the secondary (rotor) windings and thereby to the converter armature in the form of electrical power. Thus the induction motor operates half as motor and half as transformer, while the converter operates half as direct-current generator and half as rotary converter.

The rating of the induction motor is theoretically half as large as it would be if it were to convert the whole of the electrical power into mechanical power, because its rating depends on the speed of the rotating field and not on that of the rotor. The converter runs at a speed corresponding to half the primary frequency, which is more advantageous with regard to commutation. Consequently its design offers less difficulty than would a rotary converter for the same output and primary frequency.

The secondary winding of the induction motor is generally arranged for twelve phases, as is also the alternating-current end of the rotor to which it is directly connected. In starting up the motor converter from the high-tension side, the primary winding is connected directly to the high potential leads. Three taps on the secondary winding, corresponding to three phases, are brought out to slip rings by means of which an external resistance is inserted in this circuit during the starting period. The external resistance is gradually decreased as the speed of the machine increases. The machine thus starts up as an ordinary polyphase induction motor. Since the secondary windings of the induction motor are connected to points on the converter armature winding, the field of the converter is built up as though it were a direct-current generator. A voltmeter is used to indicate when a machine is running synchronously. It is stated that the synchronizing of this machine is so simple

that no special skill whatever is required for its performance, the converter dropping into synchronism automatically a few seconds after the synchronizing notch of the rheostat has been reached. The current taken at starting varies from one-quarter to one-third of the normal current and depends upon the magnetizing current of the induction motor.

The advantages of the "motor-converter" for single-phase



CIRCUIT DIAGRAM OF MOTOR CONVERTER

service are particularly marked because the synchronizing force of a single-phase set is practically as powerful as it is in a polyphase converter, this being due to the fact that the rotor of a single-phase converter is also wound with twelve phases. Furthermore, the difference between the efficiency of a single-phase and a poly-phase motor converter is less than the corresponding difference in the case of rotaries or motor generators. It is claimed that in comparison with a motor generator the motor converter is more economical in first cost and 2½ per cent more efficient in operation. In comparison with a rotary converter and the necessary bank of transformers, the motor converter is about equally as expensive in first cost and has an efficiency 1 per cent less than the rotary equipment. It is claimed to be better than the rotary converter for frequencies above 40 cycles on account of the improved commutation at the low frequency used in the direct-current portion of the machine. For lower frequencies, such as from 20 to 30 cycles, the rotary converter is evidently preferable, although for all frequencies the motor converter is said to afford much better control of the voltage of the current delivered and requires less skilled attention.

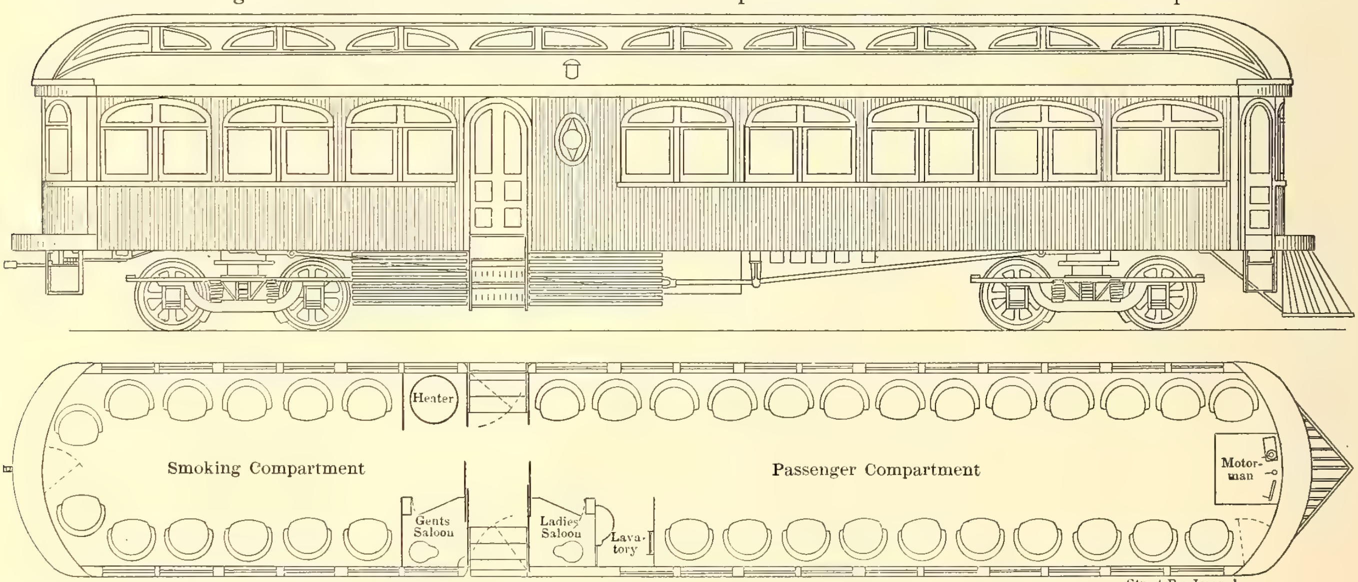
A CENTRAL ENTRANCE INTERURBAN CAR

A central-entrance car has been designed by H. A. Nicholl, general manager of the Indiana Union Traction Company, which it is believed avoids the greater number of objections which are present when the usual end-entrance car is placed in limited service. The car is intended for operation in one direction only. In addition to the central entrances, end doors are provided for the convenience of the motorman and conductor.

The car contains two compartments, one on either side of the central entrance. There being no vestibules or platforms, all of the passengers are able to see the track either forward or behind, and the car is therefore strictly an observation car. The forward compartment, instead of being given over to smokers, who constitute the minority of passengers, is reserved for the ladies, children and non-smokers. The central-entrance feature avoids the necessity of smokers passing through the ladies' compartment or vice versa. The one entrance, it is believed, also gives greater freedom from accidents, as it can be watched closely by the trainmen.

Saloons are provided in both compartments and a lavatory is located in the larger one. The heater, instead of being enclosed in a cabinet as is sometimes the practice on interurban cars, is merely surrounded by an iron rail.

In some features the car resembles the private car "Martha" which has been in service on the company's lines for several years. This private car has the central entrances and the smaller door at each end. The motorman, instead of being isolated in a cab, occupies space in the large front compartment of the car. The successful operation of this private car in a service which approximates that of limited service has no doubt influenced Mr. Nicholl in working out the new car design in question.

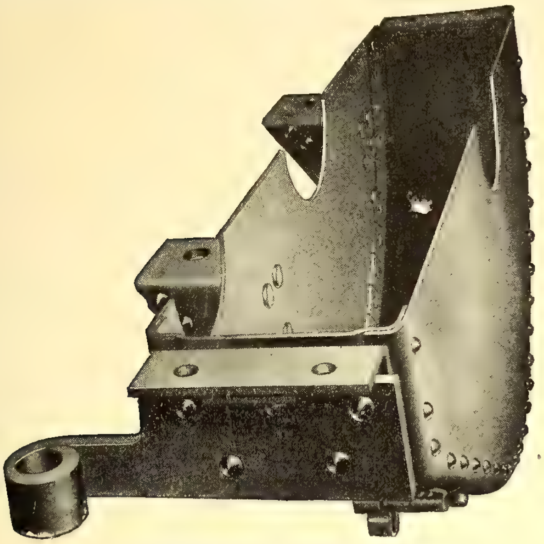


SIDE ELEVATION AND SEATING PLAN OF INTERURBAN CAR, DESIGNED BY H. A. NICHOLL

As operating managers of the Manila Electric Railway & Light Company, J. G. White & Company, Inc., have been working steadily for the attainment of the highest operating efficiency. Probably the most important move in this policy has been the replacing of the service of the old plant of La Electricista Company by up-to-date service from the new steam turbo-electric plant which supplies power for general commercial purposes as well as for the street railway.

SHEET STEEL GEAR CASE

The Electric Service Supplies Company announces that it is now ready to take care of orders for Lyon sheet steel gear cases. These cases are manufactured by the Lyon Metallic Manufacturing Company, and their sale controlled by the Electric Service Supplies Company. For some time



SHEET-STEEL GEAR CASE

the demand for these cases has been so great that the company was not able to take care of its orders, but its factory has recently been quadrupled in size, so that orders can now be given prompt attention.

The Lyon sheet steel gear case is said to weigh from 75 to 100 lbs. less than a cast-iron case, hence will reduce the weight on each car from 150 to 300 lbs. This saves the amount of power necessary to propel the car, and it also facilitates the handling of gear cases in car pits. Some operators not familiar with this gear case have raised the objection that the case is too light. By examining the engraving of the top section of the case shown herewith, it will be seen that the case is strongly reinforced and amply riveted throughout, and is made extra strong at the brackets, where all strains come.

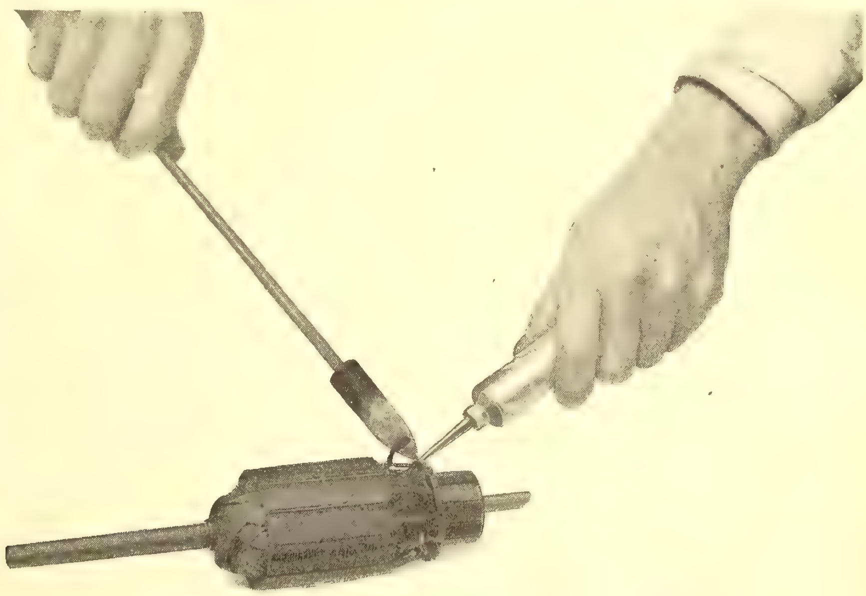
WELLS-FARGO EXPRESS COMPANY ESTABLISHES FREIGHT LINE BETWEEN COLUMBUS AND MARION

The Wells-Fargo Express Company, which recently entered into a contract with the Columbus, Delaware & Marion Railway Company for the handling of its express matter over that line between Columbus and Marion, put a special Wells-Fargo express car on the line Feb. 11, which is now making two trips daily between Columbus and Marion. The express matter has been handled heretofore in the regular freight and combination cars of the railway company. This is the service that gives the Wells-Fargo an entrance into and an outlet from Columbus, Ohio, and a connection at Marion with the Erie Railroad, which handles its express matter East and West.

SOLDERING FLUX IN COLLAPSIBLE TUBES

The convenience of the metallic collapsible tube for general use has led manufacturers wherever possible to make their liquid and paste products available in this form. In the case of soldering flux so put up, perfection is approached in convenience, usefulness and economy, provided the all-important consideration has been taken into account of the possible closing up of the vent through which the flux issues, and such occurrence provided against. Blake Tube Flux is a product which the manufacturer, the Blake Signal & Manufacturing Company, of Boston, says permits the paste to be applied not only directly to the joint at the same time with the heat without soldering the vent, but makes it possible to stick the aluminum spout into the solder without danger of clogging it up. In the workshop this tube keeps the soldering flue free from dust and dirt, so that there is no waste from foreign matter. Besides, just the required quantity can be put on the spot desired, thus reducing waste and making a better job. Because both hands do not have to be used in order to get the soldering flux on a splint and do the work, the use of the tube flux saves time. Moreover the protection which the tube affords to the flux makes the last squeezed out as good as the first.

As far as convenience in transportation is concerned, the tube can be carried in the tool kit without smearing over the tools, and by the outside wireman the tube can be carried in the pocket like a screwdriver. For the general repair man the danger is entirely removed of his dropping the flux where not wanted. The same advantages as regards convenience of application apply in all classes of service, more especially in overhead work and in intricate switchboard work, where foreign matter might seriously damage the



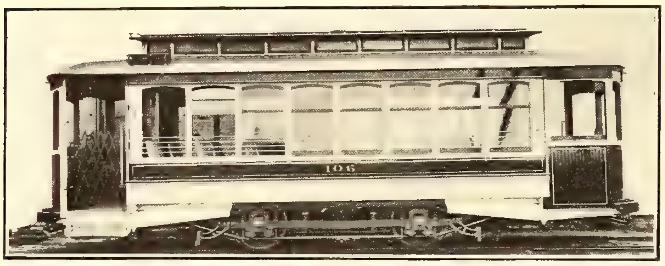
SOLDERING FLUX AS USED IN ARMATURE WORK

switchboard connections. For the armature room tube flux is almost indispensible, as it allows the workmen to get the flux just where it is needed for soldering armature leads to the commutator bar. Its advantages for this work and for electric light work in connection with repair shops and stations are made readily apparent in the accompanying illustration.

The Indiana Union Traction Company is planning to operate through service between Indianapolis and Ft. Wayne.

IMPROVEMENTS IN JACKSON, TENN.—NEW ROLLING STOCK

Since the Jackson Railway & Light Company came, about a year ago, under the control of a Louisville syndicate which also owns properties at Scranton, Miss., and Rome, Ga., the system has developed considerably. At present, a new power plant and a new car house and shop are in the course of construction. The lines are being extended to Hicksville and Bemis, two nearby towns, which will add about 8 miles to the system. Jackson is a city of about 22,500 inhabitants and is not dependent on the surrounding farming country for its support as are most Southern cities of its size. It is a railroad center of some importance and possesses large cotton and machine factories, and its central location makes it a favorite place to hold conventions. Any enterprise engineered by the street railway company is capable of being well supported, and the populace has taken very kindly to the improvements now in progress at Highland Park, or "Happyland," as it is now called, owned by the railway company. New buildings are going up, artificial lakes formed and other attractions to create a first-class place of amusement.



EXTERIOR OF THE JACKSON CAR

The American Car Company furnished the new rolling stock, which consists of six cars containing the Brill grooveless-post semi-convertible window system. Both ends of cars are enclosed with stationary round end vestibules; opposite diagonal corners of the vestibule are paneled around to body of car, permitting entrance on one side of car only. At the other entrances the Brill folding gate is utilized. The truck is of the No. 21-E pattern with a wheel base of 8 ins. The interiors of quartered oak are well lighted, lights being arranged down the center of the ceiling as well as along the upper section of the headlining on each side; the globes are frosted. The seats are of Brill make. Following are the chief dimensions: Length over end panels, 20 ft. 8 ins.; over crown pieces, 30 ft. 1 in.; width over sills, including sheathing, 7 ft. 9½ ins.; framing consists of side sills 5 ins. x 3⅜ ins.; sub-sills, 4¼ ins. x 5 ins., and center sills, 3¼ ins. x 4¾ ins.

The West India Electric Company, which operates in Kingston, Jamaica, reports that earnings from the electric lines are about $100 a day less than before the earthquake.

FREIGHT TRAILERS FOR OHIO-INDIANA SERVICES

The Indiana, Columbus & Eastern Traction Company put on a limited passenger service between Columbus and Zanesville, Ohio, Jan. 1. Two limited cars are run daily each way, with intermediate stops only at Hebron and Newark, and about an hour is cut from the regular running time between the two points. The distance to Zanesville, 50 miles, is made in two hours, and from Zanesville to Columbus in one hour and fifty-five minutes.

ELECTRIC LOCOMOTIVE FOR THE KANSAS CITY & WESTPORT BELT RAILWAY

The American Locomotive Company, in conjunction with the General Electric Company, has recently completed for the Kansas City & Westport Belt Railway a 50-ton electric locomotive designed for freight service. The body is carried on two four-wheel motor trucks of the equalized type, with a total wheel base of 22 ft. and a rigid wheel base of 6 ft. 6 ins. Each truck is equipped with two G. E. type 55-H direct-current motors, inside-hung, half the weight being carried on the axle and half by nose suspension from the truck frame. The rated maximum tractive effort is 16,400 lbs. When exerting the rated draw-bar pull, the motors take a current of 160 amps. per motor and operate a train of 320 tons on a 2 per cent grade at approximately 8 m. p. h. At a current of 215 amps. per motor the locomotive exerts a maximum instantaneous effort for starting purposes of 25,000 lbs., and will haul the same weight of train on the level at a speed of 13 m. p. h. The locomotive is provided with type-M single-unit control, with five steps in series and five in parallel. It is equipped with General Electric Company's combined automatic and straight air brakes, operated by one centrifugal pump and a No. 23 air compressor, with a piston displacement of 50 cu. ft. per minute when delivering at a pressure of 90 lbs. Only one U. S. trolley is used. The frame is of 10-in. channels with cast-iron bumpers and floor plates of ⅜-in. steel. The cab is of the steeple type with one main motorman's cab and two auxiliary cabs. Some of the principal dimensions are as follows: Length over all, 31 ft. 1 in.; height over cab, 11 ft. 9 ins.; width over all, 9 ft. 6½ ins.; total wheel base, 22 ft.; rigid wheel base, 6 ft. 6 ins.; driving wheels, 36 ins. in diameter.

50-TON ELECTRIC LOCOMOTIVE FOR FREIGHT SERVICE ON KANSAS CITY & WESTPORT RAILWAY

LEGAL DEPARTMENT*

ASSISTING PASSENGERS

It is remarked by a standard legal author that "the obligation of a carrier to assist passengers in getting on and off depends largely upon the nature of his vehicle, the facility with which access may be had without assistance, and similar circumstances. Thus, where a ship lies considerably above the level of the pier, and no plank is run ashore, or where she lies at a distance from the shore, the master, if he has undertaken to carry passengers, is bound to hoist them aboard. So a railway company, stopping its train for passengers at a place so steep or inconvenient that they could not easily get on or off the train, would be bound to assist them to do so. But when access is easy, without such aid, as where a guarded plankway is laid from a ship to a pier, or the platform of a railway car is attainable by steps of ordinary length, and otherwise convenient, assistance cannot be required as a right."

The doctrine so laid down is applicable to street railways unless statutes, ordinances, or rules of companies provide otherwise. A street car company is not bound to help persons on or off, unless there be something peculiar about the place of landing or alighting. If, however, passengers be called upon to enter or leave cars at unusual or dangerous places, the carrier will be required to provide such assistance as the necessities of the case demand, and whether or not proper assistance has been rendered will be a question for a jury to decide if any person is injured and brings suit.

Attention may profitably be directed to two qualifications of the general rule. First. If a carrier, although not required to assist passengers, through its conductor or other servant, volunteers such aid, it will be liable for any negligence of the employee in the course thereof through which the passenger is injured. The matter has very recently been passed upon by the New York Court of Appeals in a steam railway case, and its principle would seem equally applicable to cases of street railway passengers. (Hanlon v. Central Railroad of New Jersey, N. Y. Law Journal, Jan. 23, 1907.) The principle was reiterated that a steam railway company was not bound to assist passengers off its cars at a station, but it was held that if a conductor assumes to help a woman down from a platform and does it in a negligent manner by suddenly withdrawing his support and causing her to fall, the company is answerable in damages.

It was argued that where an employee of a carrier volunteers to do an act of mere kindness or courtesy his master cannot be held responsible for the manner in which it is performed. The Court of Appeals on this point, however, said:

"A conductor is placed in a position of responsible control by the company and he is bound to exercise the greatest care in seeing to the safety of the passengers. He is invested with such apparent authority over them as reasonably to induce their confidence in and compliance with his directions, and, as well, their reliance upon his acts. The situation in this case, it is true, was not such as to suggest any serious danger to the plaintiff in leaving the car; but when the conductor assumed to extend his aid in doing so, she had the right to accept it and to rely upon his act being a careful one."

Second. A carrier is not bound to accept as a passenger without an attendant, one who, because of physical or mental disability, is unable to take care of himself; but if it does voluntarily take such a passenger without an attendant, the disability being obvious or having been made known at the time to its servants, the company is guilty of negligence and liable therefor, if proper assistance under the circumstances be not afforded.

An interesting comparatively recent decision on this point was by the Supreme Court of Minnesota, in Croom v. Chicago, Milwaukee, etc., Ry. Co. (52 Minn. 296). The Court remarks: "Of course, a railroad company is not bound to turn its cars into nurseries or hospitals or its employees into nurses." The opinion then lays down the doctrine of obligation to extraordinary care by reason of acceptance as a passenger of an infirm person, and concludes: "In such case it must exercise the degree of care commensurate with the responsibility which it has thus voluntarily assumed, and that care must be such as is reasonably necessary to insure the safety of the passenger, in view of his mental and physical condition. This is a duty required by law as well as the dictates of humanity."

Here again the question whether reasonable care was exercised will be a jury question. The case last cited was a steam railway case, but its doctrine is applicable to street railways in the absence of special provision either by law or by a company's rule.

CHARTERS, ORDINANCES, FRANCHISES, ETC.

CONNECTICUT.—Error to State Court—Scope of Review—Question not Involved in the Record—Constitutional Law—Impairing Contract Obligations—Reserved Power to Amend or Repeal Street Railway Charter.

1. A Federal question respecting the validity of a paving assessment against a street railway company is not open on writ of error from the Supreme Court of the United States to a State court, where the latter court based its ruling that the question had no standing in the case upon its view as to the scope of the application of the railway company for relief from the assessment, and of the pleadings, and it is not contended that such view is erroneous.

2. The imposition upon street railway companies by Connecticut act of July 1, 1895, of the cost of paving and repaving that part of the streets occupied by their tracks, is a valid exercise of the power reserved by the State to alter or amend the charter of a street railway company, which required such company to keep the street between its tracks and 2 feet on each side in good and sufficient repair.—(Fair Haven & Westville Railroad Company, Plff. in Err., vs. City of New Haven, 27 Sup. Court Rep., 74.)

CONNECTICUT.—Trial—Non-Suit—Failure of Proof—Street Railways — Streets — Duty to Repair — Judgment — Conclusiveness—Denial—Discretion of Court—Continuance—Surprise—Trial—Reception of Evidence—Qualifications—Witnesses—Redirect Examination—Refreshing Memory—Request to Charge—Weight of Evidence—Opinion of Court.

1. Where, in an action against a city and a street railway company for injuries caused by a defect in a street, there was no cause of action alleged against the railway company except one based on its failure to perform its statutory duty of repairing the highway within certain prescribed limits, and plaintiff failed to produce any evidence of the existence of a defect within such limits, he failed to make a prima facie case, entitling the railroad company to a non-suit as provided by Gen. St. 1902, Sec. 761.

2. Where a street railway company was required by statute to keep in repair a part of the street on which its tracks were laid to a distance of 2 feet on each side thereof, the railroad company owed no duty to travelers in respect to the repair of the street except the specific duty imposed by the statute.

3. Where, in a statutory action against a street railway company and a city for injuries from a defect in the street, plaintiff suffered an involuntary non-suit against the street railway company and then elected to pursue his action against the city, which he was not bound to do, and was defeated in a trial on the merits, he was bound by the judgment.

4. The denial of a non-suit in favor of one of two defendants is wholly within the discretion of the court.

5. Where, in a statutory action against a street railway company and a city for injuries on a defective street, the court granted an involuntary non-suit in favor of the street railway

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company, but denied a non-suit in favor of the city, it was within the court's discretion to grant the city a continuance on the ground that it had prepared to try the case as an action primarily against the street railway company and only incidentally against the city, as authorized by Gen. St. 1902, Sec. 3838, and that it was not then prepared to try the action as one against the city for a defect in the portion of the highway under its care.

6. Where, in an action for injuries on a defective street, plaintiff sought to introduce defendant's map as a part of plaintiff's case merely as "illustrative" and not as "accurate," the court properly held that, if plaintiff put in a map as an exhibit, it must go in without qualification with such explanations as plaintiff might wish to make by his witnesses.

7. Where plaintiff, on redirect examination of his own witness, sought to examine him as to his testimony on a former trial, the court properly ruled that the examination should be conducted in a manner appropriate to the purpose of refreshing the witness' memory.

8. Where the court properly stated the law to the jury, it was not bound to change the language of written requests, though such requests were quoted from opinions in reported cases.

9. Where, in an action for injuries by a defect in a highway, the court charged that, if plaintiff, in the exercise of his best judgment, believed the sidewalk to be dangerous, and that the roadway was a safer place for him to travel, the fact that he was in the roadway could not bar his right to recover, it was not error to refuse a request that it was not negligence for plaintiff to walk in the roadway and that the bare fact that he was walking there when he received his injuries could not prevent a recovery.

10. Where the court submitted the questions of fact to the jury, without any direction as to how they should find the facts, the fact that the court either directly or inferentially expressed its opinion on the facts was not error in the absence of abuse of discretion.—(Crotty vs. City of Danbury et al., 65 Atl. Rep., 147.))

NEW YORK.—Master and Servant—Injuries to Third Person—Punitive Damages—False Imprisonment—Evidence—Malicious Prosecution—Pleading—Issues—General Denial—Acts Constituting—Misdemeanor Justifying Arrest.

1. In an action against a master for a tort of his servant, punitive damages cannot be given for the malice of the servant.

2. In an action against a railroad company for an arrest by its servant, evidence that he believed that the act of plaintiff in getting on a moving train was a misdemeanor was inadmissible on a cause of action for false imprisonment.

3. In an action against a railroad company for illegal arrest by its servant, evidence that the servant believed that the act of plaintiff in getting on a moving train was a misdemeanor was admissible on a cause of action for malicious prosecution, malice being an essential ingredient of the cause of action itself.

4. On a charge against a railroad company for false imprisonment by its servant, a general denial was sufficient to authorize the admission of evidence that plaintiff got on the steps of a moving train on the wrong side and climbed over the platform gate into the car.

5. Pen. Code, Sec. 426, subd. 2, prohibiting persons from getting on any car while in motion for the purpose of obtaining transportation as a passenger, though under the caption "Riding on Freight Trains," makes the attempt to get on a moving passenger train a misdemeanor, so that a railroad company whose servant arrested a person getting on a moving train was not guilty of false imprisonment or malicious prosecution.—(East vs. Brooklyn Heights Ry. Co., 101 N. Y. Sup., 364.)

NEW YORK.—Carriers—Misconduct of Servant—Excessive Damages.

A passenger on boarding a car paid a cash fare, instead of tendering his transfer. Before the conductor had rung up the fare, the passenger requested the return of the money, whereupon the conductor abused him and undertook to forcibly remove him from the car. The passenger remained on the car. He suffered no serious injury. Held, that a verdict of $500 was excessive and should be reduced to $100.—(Burfeindt vs. New York City Ry. Co., 101 N. Y. Sup., 589.)

VERMONT. — Contracts — Part Performance — Quantum Meruit Recovery — Action — Evidence — Admissibility — Asumpsit, Action of —Pleading Declaration—Damages—Breach of Contract—Loss of Profits—Evidence—Appeal Harmless Error—Curative Instructions.

1. Where one who had contracted to furnish electric power to an electric railroad failed to furnish the amount of power which he was required to furnish, though the railroad availed itself of the power furnished, he was entitled to a quantum meruit recovery for the power furnished, less any sum in which defendant was damaged by the breach.

2. In an action for a quantum meruit recovery, it was proper to admit evidence tending to show that plaintiff's failure was the result of an extraordinary drouth affecting his water power; that after the shortage occurred or became imminent, steam power could not have been established in time to relieve the situation, and that plaintiff gave defendant a preference over other patrons.

3. A technical quantum meruit count is not necessary to a recovery quantum meruit, but such recovery may be had under the common counts in indebitatus assumpsit.

4. Where one who had contracted to furnish electric power to an electric railroad failed to furnish all the power required, but that furnished was used, and thereafter recovery quantum meruit was sought, it was error to exclude evidence tending to show that, in consequence of plaintiff's failure to furnish the power according to the contract, defendant suffered a loss of patronage and earnings.

5. Plaintiff contracted to furnish electric power to an electric railroad, but failed to furnish the amount of power required, though that furnished was accepted, and subsequently he sought a recovery on quantum meruit for that accepted. Evidence was introduced by plaintiff to show that at the time plaintiff failed to perform his contract, defendant was under contract with a certain lighting company not to take power from plaintiff while plaintiff furnished light in certain cities, and that a suit had been commenced against defendant to compel the performance of such contract, and that defendant was enjoined from taking power from plaintiff, though the injunction was dissolved on the giving of a bond, for the purpose of showing that defendant derived a benefit from the termination of the contract between plaintiff and defendant, but plaintiff failed to show wherein defendant was benefited, and did not furnish a basis for computing such benefit, if any. Held that in the absence of such explanatory evidence, that admitted was erroneously in the case, and ground for reversal, notwithstanding an instruction by the court to the effect that the evidence was withdrawn from the consideration of the jury in an instruction in which the court stated the purpose of the evidence and the reason why it was not open to the consideration of the jury.—(Viles vs. Barre & M. Traction & Power Co., 65 Atl. Rep., 104.)

LIABILITY FOR NEGLIGENCE

INDIANA.—Trial—Preponderance of Evidence—Evidence—Opinion Evidence—Medical Experts—Damages—Personal Injuries—Nurse Hire—Witnesses—Examination—Leading Questions.

1. An instruction enumerating certain facts and circumstances which the jury might consider, but not undertaking to tell the jury that if such facts were shown to exist by a preponderance of the evidence they should return a certain verdict, and closing with a statement that from all such facts, together with all the evidence and circumstances given in evidence, the jury should determine whether defendant was negligent as charged in the complaint, did not invade the providence of the jury.

2. An instruction that where witnesses of equal candor, fairness, and intelligence testify, with equal knowledge, opportunity of knowledge, and memory, and their testimony is in all respects of equal weight and credibility, and there is, nevertheless, a conflict which cannot be reconciled, a verdict should be rendered in harmony with the testimony of the greater number of witnesses, was erroneous, as taking from the consideration of the jury all corroborating circumstances.

3. In an action for personal injuries, a physician competent to testify as a medical expert, and who attended and treated plaintiff immediately after the injuries and for some time after that, was competent to testify as to what in his opinion was the producing cause of sleeplessness and nervousness with which plaintiff was afflicted.

4. In an action for personal injuries, there was no error in admitting evidence as to the value of nurse hire where plaintiff lived, though the evidence showed that he was nursed by his wife.

5. In an action for injuries sustained by a passenger on a street car, a question to a witness, on redirect examination, as to whether he noticed "the motorman have hold of the brass handle and operate it in any way just previous to the accident," was erroneous, as leading.—(Indianapolis & E. Ry. Co. vs. Bennett, 79 N. E. Rep., 389.)

INDIANA.—Appeal—Complaint—Attack—Street Railways—Rights in Streets—Pedestrians—Use of Street—Care Required—Street Car Drivers—Degree of Care—Trial—General Verdict—Special Findings—Injuries to Pedestrians—Contributory Negligence—Proximate Cause—Last Clear Chance—Evidence—Opinions—Appeal—Harmless Error—Record—Briefs—Instructions—Estoppel to Allege Error—Husband and Wife—Injury to Wife—Medical Bills—Recovery—Verdict—Review.

1. A complaint will be upheld when first attacked on appeal if the facts alleged are sufficient to bar another suit for the same cause of action.

2. A street railroad company has no superior and predominant right to the use of the streets of a city on which its tracks are laid over the rights of other users, except the right of way when required.

3. Where a street on which defendant's street car tracks were located was covered with melting snow and ice to a depth of from 6 to 14 inches, except the space between the rails, which was paved with brick and practically free from obstructions, the pedestrian was entitled to use such space for passage, using ordinary care for her own safety, and was not bound to assume that she would be run into by a car approaching her from the rear at an excessive rate of speed, at broad daylight, on a straight track without warning.

4. Where a street car was being propelled along a city street at a speed of from 20 to 25 miles per hour, at a point where persons on foot or in vehicles were constantly passing and repassing, the ordinary care required of the driver was a high degree of watchfulness and vigilance to prevent accidents.

5. Special finding will override the general verdict only when both cannot stand and the antagonism is apparent on the face of the record, beyond the possibility of being removed by any evidence legitimately admissible under the issues.

6. Plaintiff was struck and injured while walking along defendant's street car track, by a car which approached her from the rear without warning at a high rate of speed. The track was straight and the motorman could have seen plaintiff for a distance of from a quarter to a half a mile. When plaintiff entered on the track, she looked in the direction from which the car approached, and again when she had proceeded half a square on her journey, but no car was then in sight. She listened continuously as she advanced, but failed to discover the approach of the car, the noise of which was deadened by the passing of a car in the opposite direction on the adjoining track. Held, that plaintiff's negligence, if any, in not keeping a constant watch for the approach of a car was the remote and not the proximate cause of her injury, and was, therefore, no bar to her right to recover therefor.

7. The motorman in charge of the street car had the "last clear chance" of avoiding the injury, and his negligence in failing to do so was the proximate cause thereof.

8. In an action for injuries to a pedestrian by being struck by a street car, questions "that would not prevent it, would it?" and "she could step off, could she not, and prevent the collision?" relating to the condition of the street adjacent to the track on which plaintff was walking at the time of the accident, were objectionable in form as calling for an opinion of the witness.

9. Where, in an action for injuries, the jury expressly found that, within 100 feet of the place of the accident, there was nothing to prevent plaintiff from stepping far enough from defendant's street car track to have avoided the passing car, by which she was struck, had she known it was coming, defendant was not prejudiced by the exclusion of evidence offered to prove such fact.

10. Where instructions given at appellant's request were not set out either in full or in substance in appellant's brief, the Supreme Court would not search the record in order to make a comparison between such instructions and those given for appellee, in order to determine whether they were conflicting as alleged.

11. Where instructions given by the court independent of appellant's requests were correct, appellant could not procure the giving of an inconsistent or erroneous instruction and then complain on appeal of the error.

12. Where a married woman, after being injured in a street car accident through defendant's negligence, incurred expenses for medical treatment on her own behalf, she was entitled to recover therefor as a part of her damages, though her husband was ordinarily chargeable with the payment of her medical bills.

13. Where a verdict is sustained by evidence and is not contrary to law, it will not be disturbed on appeal as against the weight of the evidence.—(Indianapolis Traction & Terminal Co. vs. Kidd, 79 N. E. Rep., 347.)

KENTUCKY.—Street Railways—Collision—Damages—Trial—Instructions—Damages for Personal Injuries—Negligence—Ordinary Care—Damages—Exemplary Damages—Gross Negligence—Instructions.

1. In an action against a street railway company for damages to person and property caused by collision with a street car, a verdict for $400 rendered under proper instructions is not excessive where plaintiff was badly bruised, was thrown some 20 feet into the street, causing a shock that confined him to the house several days and requiring treatment from a physician, and the buggy in which he was riding at the time was virtually destroyed.

2. In an action for damages resulting from a collision with a street car, an instruction that the jury might compensate plaintiff for permanent injuries or for reduction of power to earn money is unwarranted where there was no evidence that plaintiff sustained injuries of that nature.

3. In an action for damages from a collision with a street car, an instruction that "ordinary care is such care as an ordinary person would usually observe under the same or similar circumstances as those under investigation" is erroneous; ordinary care being such care as an ordinarily prudent person would usually exercise under circumstances similar to those proven in the case.

4. Exemplary damages can never be recovered for anything short of gross negligence, and where the negligence of a motorman, resulting in a collision with plaintiff, was simply failure to use ordinary care, an instruction authorizing recovery of exemplary damages is erroneous.—(Henderson City Ry Co. vs. Lockett, 98 S. W. Rep., 303.)

KENTUCKY.—Carriers—Injuries to Passenger—Injuries to Passenger Alighting from Car—Contributory Negligence.

1. When a street car has been stopped at the usual place for discharging passengers, it is the duty of the operatives of an approaching car on a parallel track to have it under such control that it may be stopped at a moment's notice so that persons who have alighted may cross the track in safety.

2. Though one who alighted from a street car and walked around behind the same to cross a parallel track failed to exercise ordinary care to avoid a car approaching on the other track from behind the car from which she alighted, whereby she was injured, the company was liable if the operatives of the approaching car could, by ordinary care, have discovered her peril and prevented injury to her.—(Louisville City Ry Co. vs. Hudgins, 98 S. W. Rep., 275.)

MASSACHUSETTS.—Carriers—Carriage of Passengers—Degree of Care—Injury to Passengers—Negligence—Contributory Negligence—Assumption of Risk—Questions for Jury—Evidence.

1. A carrier must use the highest degree of care, consistent with the nature of its business, not only to provide suitable vehicles for the carriage of its passengers, but to maintain such reasonable regulations as will protect its passengers against injuries caused by the misconduct of other passengers, which may be anticipated and be guarded against, and to employ a sufficient number of competent employees to meet any contingency, which, in the exercise of a proper degree of care it has reason to anticipate.

2. Where, in an action against a carrier for injuries to a passenger by reason of the pushing of a crowd while attempting to enter a car at a station, there was evidence that there was usually a large crowd in the station at that time of day, and that there had been on many previous occasions the same struggle to get on the car as occurred at the time of the accident, and that the carrier ought to have anticipated the happening of the accident, and ought to have taken reasonable precautions to guard against such injuries, the refusal to charge that there was no evidence of negligence of the carrier was proper.

3. Where the crowding of the platforms and cars of a carrier

at certain hours of the day was unavoidable in carrying on its business, the questions whether the carrier was bound to employ an increased number of men to prevent such crowding as involved danger to passengers, and whether it was reasonable to require such precaution, were for the jury.

4. Whether a passenger, injured while attempting to board a car at a station by reason of the jostling of a crowd, was guilty of contributory negligence or assumed the risk, in view of the fact that she had been in similar crowds before and had seen the same struggling and the same failure on the part of the carrier to control the crowd, was for the jury.

5. Where a carrier held out a station as a proper place for its passengers to go for the purpose of taking its cars, and the passengers had the right to regard themselves as having come to the station by its invitation, the carrier, though not controlling the station, but using it for his own benefit under an agreement with a lessee thereof, was liable to the passengers for injuries caused by defects in the rules regulating the use of the station, rendering the details of the agreement with the lessee inadmissible.—(Kuhlen vs. Boston & N. St. Ry Co., 79 N. E. Rep., 815.)

MASSACHUSETTS. — Carriers — Personal Injuries — Question for Jury—Contributory Negligence.

1. In an action against a street railway for injuries to a passenger, owing to his being struck by a trolley pole while standing on the running board of the car, held, under the evidence, that the question of negligence was one for the jury.

2. In an action against a street railway for injuries to a passenger, owing to his being struck by a trolley pole while standing on the running board of the car, held, under the evidence, that the questions of contributory negligence and assumed risk were for the jury.—(Pomeroy vs. Boston & N. St. Ry. Co., 79 N. E. Rep., 764.)

MASSACHUSETTS.—Street Railroads—Injuries to Pedestrians—Contributory Negligence—Position of Peril.

1. Decedent, who was familiar with the locality, undertook to cross a street on which double street car tracks were located, and, having passed over the north-bound track, between two street cars which were standing, proceeded over the space between the two tracks and to the middle of the south-bound track, when he first saw a south-bound car close upon him. From the time he left the sidewalk, until he was struck, he neither looked nor listened for a car on the south-bound track, though he "hesitated" before he crossed the north-bound track. Held, that decedent was guilty of contributory negligence as a matter of law.

2. The fact that the gong of one of two standing street cars was struck as decedent was passing between them was not a negligent act on the part of the railroad company, indicating that decedent was in a place of peril, so as to justify him in stepping onto the adjoining track, without looking or listening, directly in front of a rapidly approaching car.—(Blackwell vs. Old Colony St. Ry. Co., 79 N. E. Rep., 335.)

MASSACHUSETTS.—Carriers—Injuries to Passengers—Negligence.

A passenger was injured while alighting from a car. Her dress was caught while she was alighting from the front platform so firmly that some one pulled her towards the car to loosen her dress. There were five persons on the platform at the time she alighted. Held insufficient as a matter of law, notwithstanding the doctrine of "res ipsa loquitur," to show negligence on the theory that the platform was defective.—(Thomas vs. Boston Elevated Ry., 79 N. E. Rep., 747.)

MASSACHUSETTS.—Carriers—Injury to Employee Riding on Pass—Contract Exempting from Liability—Question for Jury—Appeal—Right of Review.

1. Though a condition of a pass, issued to a railway employee as a gratuity, that he assumes all risk of accident is binding, it is not binding where the pass is issued as one of the terms of his employment.

2. Whether or not a pass held by a street railway employee was a gratuity or was issued as one of the terms of his employment, thereby making him a passenger for hire, held, in an action for injuries received by him while riding on a car, to be a question for the jury.

3. Where defendant asked the trial judge to rule on a question of fact as if it were a question of law, he could not complain of the court's ruling thereon.—(Dugan vs. Blue Hill St. Ry. Co., 79 N. E. Rep., 748.)

MASSACHUSETTS.—Street Railroads—Injuries to Person on Track — Contributory Negligence — Appeal — Harmless Error—Exclusion of Evidence.

1. A boy of eleven started to "trot" across a street in which there were double electric railway tracks, immediately behind a car on the track nearest to him, and was injured by being struck by a car coming in the opposite direction on the further track. He was familiar with the street, and testified that he looked both ways before he started to cross, but that his view of the car that struck him was obstructed by the other car. Held, that he did not exercise the care required of one of his years.

2. Where, in an action against a street railway for injuries to one struck by a car while attempting to cross a track, plaintiff offered evidence tending to show that the fender on the car was a dangerous appliance, and that the brakes were insufficient, the exclusion of the evidence was harmless; it appearing that plaintiff himself was not in the exercise of proper care.—(Stackpole vs. Boston Elevated Ry. Co., 79 N. E. Rep., 740.)

MASSACHUSETTS.—Master and Servant—Injuries to Servant—Question for Jury—Persons Engaged in Superintendence—Acts of Superintendence.

1. In an action for injuries to a servant owing to the fall of a ladder, held a question for the jury whether defendant's superintendent was negligent in the manner in which he secured the ladder.

2. On an issue as to whether a certain person was defendant's superintendent in the work of unloading coal from a schooner, it appeared that he did manual work only when he felt like it; that it was his duty to report how many men he wanted, and to report them if they did not work properly; that it was his duty to tell the men where to shovel the coal, and to tell the engineer when to hoist and lower the coal scoop, and also to tell the men when to stop work; and that there was no other person in the immediate charge of the work. Held that the facts warranted a finding that he was a superintendent, within the employers' liability act.

3. The act of one in charge of the work of unloading a schooner in selecting an improper piece of rope, for the purpose of lashing a ladder by which access was had to the hold, was an act of superintendence, notwithstanding that he himself did the lashing.—(Hourigan vs. Boston Elevated Ry. Co., 79 N. E. Rep., 738.)

MASSACHUSETTS.—Carriers—Injuries to Passengers—Contributory Negligence—Evidence—Negligence of Carrier—Question of Law or Fact.

1. Evidence that a woman with a child in her care boarded a street car, and while she was still standing, facing partly forward and partly sideways, and helping the child to move over from the end of the seat, the car, which was standing at the beginning of the curve, started with a sudden jerk, causing her to fall, was sufficient to warrant a finding that she was in the exercise of due care.

2. Such evidence did not show as a matter of law that there was no negligence on the part of the conductor in starting the car when he did.—(Hamilton vs. Boston & N. St. Ry. Co., 79 N. E. Rep., 734.)

MICHIGAN.—Damages—Impairment of Earning Capacity—Evidence—Sufficiency to Justify Instruction.

Two physicians who had examined plaintiff, suing for personal injuries, detailed his condition, and plaintiff and his wife testified to his diminishing earning capacity. Plaintiff testified as to the amount of his annual earnings in handling horses, his regular occupation, and as to his inability to longer do such work. Held sufficient evidence of what his diminished earning capacity was to justify an instruction authorizing damages therefor.—(Lewless vs. Detroit United Ry., 109 N. W. Rep. 1051.)

MISSOURI.—Street Railroads—Injuries to Pedestrian—Contributory Negligence—Questions for Jury—Evidence—Instructions—Municipal Regulations—Validity—Action—Instructions — Appeal — Review — Theory of Case — Trial — Questions for Jury—Instructions—Assumption of Facts—Negligence—Personal Injuries—Proximate Cause—Correction of Error—Appeal—Grant of New Trial—Review—Reason for Decision—Street Railroads—Injuries to Pedestrian—Negligence—Actions—Pleading.

1. Whether a boy 11½ years of age, who, on approaching a street railroad crossing, looked, and seeing a car approaching, waited till it had passed, was guilty of negligence in attempting to cross the track in front of a car following without again

looking in the direction from which the car had come, is, under the evidence, a question for the jury.

2. Where, in an action against a street railroad for injuries to a boy at a crossing, there was no evidence that the car injuring him was not stopped in the shortest time and space possible, it was not error for the court to nullify, by instruction, the effect of an ordinance which had been introduced in evidence, providing that "on the first appearance of danger the car shall be stopped in the shortest time and space possible," as there could be no recovery on that theory.

3. An ordinance declaring that the motorman, or any other person in charge of a street car, shall keep a vigilant watch for all persons on foot, especially children, either on the track or moving toward it, and on the first appearance of danger to such persons the car shall be stopped in the shortest time and space possible, is valid, being simply declarative of the common law.

4. In an action against a street railroad for injuries to a boy at a crossing, caused by being struck by a car, it was error not to give an instruction embodying the duty of the motorman to keep vigilant watch, especially for children approaching the track.

5. Where, in an action against a railroad for injuries to a boy at a crossing, caused by being struck by a car, the instructions on both sides proceed on the theory that it was the duty of the motorman to see the boy and warn him, and the case was tried on that theory, it will be heard on appeal on the same theory.

6. Where the facts are undisputed, an issue may be dealt with as a question of law.

7. Where, in an action against a street railroad for injuries to a boy at a crossing, caused by being struck by a car, the question of warning was a disputed fact, and the evidence was substantially one way that there was time and space in which to warn the boy by a gong after he had started to the track, an instruction assuming that it was defendant's duty to warn the boy and that it had time and space to perform that duty by the use of the gong was not erroneous.

8. Mere proof of negligence is not sufficient to support a verdict in an action for personal injuries. Such negligence must be the proximate cause of the injury.

9. In an action against a street railroad for injuries to a boy at a crossing, caused by being struck by a car, the court instructed that if the jury found that the boy used ordinary care in stepping on the track in front of the car without first looking to see if a car was coming, and if they further found that the motorman did not sound his gong so as to give timely warning, and that, if he had done so, the boy would have been warned in time to have kept out of danger, then plaintiff was entitled to a verdict. The court further charged that before the plaintiff could recover the law required him to prove negligence of defendant, and that such negligence was a proximate cause of the accident; and that, if plaintiff had not so proved negligence, and that such negligence was a proximate cause of the accident, then defendant was entitled to a verdict. Held that failure of the court to submit the issue of proximate cause in the first instruction was cured by the latter instruction.

10. Where the court rightfully granted a new trial, the fact that a wrong reason was assigned therefor is not ground for disturbing the ruling on appeal.

11. In an action against a street railroad for injuries to a boy at a crossing, caused by being struck by a car, the petition alleged several pretermitted duties and averred several acts of negligence, and followed these allegations with the averment, "all of which directly contributed to cause the injuries hereinafter complained of." Held that the allegation quoted meant that the pleaded acts of negligence contributed with one another to cause the injury, and plaintiff did not by the use of the word "contributed" plead his own contributory negligence, and hence state himself out of court.—(Deschner et al. vs. St. Louis & M. R. R. Co., 98 S. W. Rep., 737.)

MISSOURI.—Street Railroads—Pedestrians—Use of Street—Collision—Death of Pedestrian—Presumptions—Burden of Proof—Contributory Negligence—Question for Jury—Discovered Peril—Persons on Track—Evidence—Trial—Instructions—Refusal.

1. The fact that a railroad track was laid in a public highway did not make a pedestrian walking thereon a trespasser, he being entitled to use the street for all ordinary purposes in the exercise of due care and caution.

2. Where intestate was killed by being struck by a street car, the law presumes that he was exercising ordinary care at the time, and the burden of rebutting such presumption is on the defendant.

3. A pedestrian is not guilty of contributory negligence as a matter of law in walking at night on a street railway track.

4. In an action for death of plaintiff's intestate by being struck by a street car while he was on the track at night, evidence held to require submission of the question of defendant's negligence and plaintiffs contributory negligence to the jury.

5. A street car company is liable even to a trespasser if it fails to use ordinary care to prevent injuring him after discovering his peril.

6. Intestate, while lying on defendant's street car track at night, was struck and killed by an approaching car, and defendant's servants testified that intestate could have been readily seen on the track for from 40 to 75 ft. ahead of the car, and that the car was actually stopped in 32 ft. after intestate was discovered on the track. Held to justify an inference that defendant's motorman if he had been exercising ordinary care could have discovered intestate on the track in time to have avoided injuring him.

7. Where the instructions given fully covered the case there was no error in the court's refusal of additional instructions requested.—(Goff vs. St. Louis Transit Co., 98 S. W. Rep., 49.)

MISSOURI.—Carriers—Street Railroads—Premature Start—Duty of Conductor—Diligence in Alighting—Evidence—Instructions—Misleading Instructions—Modification.

1. It is the duty of a street car conductor, after the car has stopped to permit passengers to alight, to know before giving the signal to start that no one is in the act of getting on or off the car, and it is no excuse for his failure so to do that he is busy with other matters within the car.

2. A passenger on a street car is entitled to assume that the conductor will not start the car while the passenger is in the act of alighting, though he sees the conductor's arm raised toward the bell cord.

3. Plaintiff had been riding in the vestibule of defendant's street car, which was full of people and tool boxes. The car came to a full stop at the point where plaintiff desired to alight, and as soon as the car stopped he endeavored to get to the steps as fast as he could. There were others ahead of him, whom he followed in his endeavor to alight as soon as possible, and as soon as the man ahead of him got off he stepped down, and while in the act of doing so was suddenly thrown to the street by the starting of the car. Held, that plaintiff exercised reasonable dispatch in endeavoring to alight.

4. In an action for injuries to plaintiff while alighting from a street car, the court charged that if plaintiff was a passenger, and when the car stopped plaintiff undertook to alight, and while in the act of stepping from the platform, and before he had time to alight by using reasonable diligence and exercising ordinary care, the car was suddenly started by defendant's servants, whereby plaintiff was thrown to the pavement and injured, and defendant's servants failed to use the utmost skill and care which prudent men would use under similar circumstances to see that plaintiff had safely alighted from the car or was in a perilous position, plaintiff was entitled to recover. Held, that such instruction was not objectionable as eliminating the question of plaintiff's contributory negligence.

5. In an action for injuries to a passenger while alighting from a street car, defendant requested an instruction that plaintiff had no right to alight or attempt to alight from the car after it had started, or while it was in motion, and, if he did so, he assumed the risk of injury; that if, after the car had started or while it was in motion, plaintiff attempted to get off and was thrown down by the motion of the car, then his injuries, if any, were caused by his own fault, and the verdict should be for defendant. Held, that the instruction as requested was misleading, and was properly modified by requiring that plaintiff must have been thrown down only by the motion of the car, "and without any negligence on the part of defendant's servants in charge thereof."—(Hurley vs. Metropolitan St. Ry. Co., 96 S. W. Rep., 714.)

MISSOURI.—Street Railways—Interurban Railways—Failure to Fence—Double Damages for Stock Killed—Occupancy of Public Roads.

1. An interurban electric railway company, incorporated under Rev. St. 1899, c. 12, art. 3, Sec. 1187, and authorized to operate a street railway for public conveyance of passengers, mail and express, is a railroad corporation within article 2, Sec. 1105, requiring every railroad corporation incorporated in the State under such article, or any railroad

corporation running or operating any railroad in the State, to erect and maintain lawful fences on the sides of its road passing through cultivated fields, and, until such fences are constructed, making it liable for double damages for stock killed on its road.

2. An interurban electric railroad company, incorporated under Rev. St. 1899, c. 12, art. 3, Sec. 1187, is not relieved of its duty to fence its road, as required by article 2, Sec. 1105, making railroad companies liable for double damages for stock killed on roads, not fenced, running through and adjoining inclosed fields and uninclosed lands, because it was constructed on the right of way of a public road by permission of the county court.—(Riggs vs. St. Francois County Ry. Co., 96 S. W. Rep., 707.)

MISSOURI.—Carriers—Injury to Street Railway Passenger—Cause of Injury—Evidence—Negligence—Prima Facie Case—Burden of Proof—Appeal—Harmless Error—Instructions—Trial—Request for Instructions—More Specific Instructions.

1. Evidence, in an action for injury to a passenger on a street car, held sufficient to authorize a finding that the accident was caused by the passenger's heel catching on a piece of metal projecting from the step of the car.

2. Proof of injury to a passenger, by the heel of her shoe catching on a piece of metal projecting from the step of the street car, makes a prima facie case of negligence, putting on the carrier the burden of disproving it.

3. Error, if any, in giving instructions as to negligence, without defining it, is harmless; the instructions having fully defined the degree of care resting on defendant, the absence of which was negligence.

4. One desiring a more specific definition of what constitutes ordinary care than is contained in the charge must request it.—Rattan vs. Central Electric Ry. Co., 96 S. W. Rep., 735.)

MISSOURI. — Street Railroads — Operation — Personal Injuries—Question for Jury—Injury Avoidable Notwithstanding Contributory Negligence—Damages—Excessive Damages.

1. In an action for personal injuries caused by a collision of a street car with a wagon in which plaintiff was riding, evidence held to present a question for the jury whether the gripman operating the car was negligent.

2. Where one riding on a wagon along a street car track relied on hearing the gripman's bell, and did not look for an approaching car, it was a question for the jury whether he was negligent.

3. A person riding on a wagon along a street railway track, and injured by a collision with the street car, is entitled to recover therefor if the gripman on the car saw his danger in time to have averted a collision, or could have seen it had he looked, and failed to exercise ordinary care to avoid injuring him.

4. An award of $2,000 damages for a permanent injury to plaintiff's knee, such that he cannot properly extend his leg, and that it pains him and will continue to do so in the future and is likely to grow worse, is not excessive.—(Winn vs. Metropolitan St. Ry. Co., 97 S. W. Rep., 547.)

MISSOURI.—Carriers—Street Railways—Injuries to Passengers—Negligent Construction—Contributory Negligence—Questions for Jury.

1. Where the elbow of a street car passenger was struck and injured by a passing car, it appearing that the space between defendant's double tracks at the point in question was so narrow that the cars would rub or bump together in passing, and plaintiff's evidence showed that they did so, it would be presumed that the tracks were negligently constructed and maintained, authorizing the jury to find defendant guilty of negligence in operating cars over such tracks.

2. Where plaintiff, a passenger on a street car, sustained a fractured elbow by its being struck by a passing car on an opposite track, plaintiff was not guilty of contributory negligence, as a matter of law, in exposing his elbow to a slight degree from the window of the car on which he was riding, or in resting the same on the window sill within the car.—(Smith vs. St. Louis Transit Co., 97 S. W. Rep., 218.)

MISSOURI.—Street Railways—Injuries to Travelers—Contributory Negligence—Humanitarian Doctrine.

1. Plaintiff, shortly after dark, was driving his two horses and wagon along defendant's street car track, going in the direction the cars ran, with his cap pulled down over his ears, though he knew that a car might overtake him from the rear at any time. There was no necessity for his being on the track, there being ample room in the street proper, and he was struck and injured by a car approaching him from the rear. Held, that plaintiff was guilty of contributory negligence.

2. Plaintiff was struck and injured by a street car approaching him from the rear as he was driving on defendant's street car track at night. He testified that it was dark, and that when he looked back, several times, he did not see a car, until finally, when he heard a noise, he again looked and saw the car only 30 ft. away, which he could then distinguish only as some dark object, which struck his wagon within the time he could hit his horses. Held, that the motorman was not guilty of negligence in failing to see plaintiff's wagon in a position of peril in time to have avoided strikng the same.—(Abbott vs. Kansas City Elevated Ry. Co., 97 S. W. Rep., 197.)

MISSOURI.—Street Railroads—Injuries to Pedestrian—Action—Pleading—Repugnant Allegations—Petition—Review—Allegations—Remedies—Death—Negligence of Employees—Statutes—Application—Municipal Ordinances—Death of Pedestrian—Vigilant Watch—Contributory Negligence—Construction.

1. In an action against a street railway company for injuries to a pedestrian at a crossing, a petition alleging in one count that the motorman failed to keep a vigilant watch, etc., and also that he failed to stop the car in the shortest time and space possible, was not objectionable as alleging repugnant grounds of negligence.

2. Where a petition is defective as alleging repugnant grounds of negligence in the same count the defect can only be reached by demurrer or motion to elect, and not by a demurrer to the evidence.

3. Rev. St. 1899, Sec. 2864, providing that whenever any person shall die from an injury resulting from, or occasioned by, the negligence of any servant or employee while running any car, the corporation in whose employ such servant or employee shall be at the time the injury is committed shall forfeit and pay for every person so dying the sum of $5,000, is applicable to street railways.

4. Rev. St. 1899, Sec. 2864, creates an action for death resulting from, or occasioned by, the negligence of any servant or employee while running any car, etc. Held that the right of action so given included death from negligence generally, whether consisting of negligence as refined by the common law, or arising from a failure to discharge a duty imposed by statute or municipal ordinance.

5. Where, in an action for death of a pedestrian at a street railroad crossing, there was evidence that, by the exercise of ordinary care, the motorman could have seen deceased on the track in time to have saved his life by the exercise of ordinary care thereafter, plaintiff was entitled to recover, though there was no evidence that, after the motorman in fact saw the deceased, he could have prevented a collision.

6. Where, a petition, for death of a pedestrian in a collision with a street car, charged certain acts of negligence, and then alleged violations of a city ordinance, "which violations of such ordinance directly contributed to cause the death and injury of plaintiff's husband," the petition should be construed to mean that the violation of the ordinance contributed with the other precedent acts of negligence charged in the petition to cause such injury and death, and not that they contributed with deceased's negligence to cause such injury.—(McQuade vs. St. Louis & Suburban Ry. Co. et al., 98 S. W. Rep., 552.)

NEW JERSEY.—Master and Servant—Injury to Servant—Contributory Negligence.

Plaintiff, an employee of a water company, was engaged with others in connecting a main at night, the plaintiff's duty being to hold a lantern to show a light to others who were working in a trench, the nearest edge of which was 18 ins. from defendant's tracks. The gang had been working on this job during the latter part of that day, during which the motorman had sounded the gong on approaching the point. At quitting time, about 5 p. m., the men quit, and then resumed work at 10 o'clock at night, of which the trolley employees had no notice. The plaintiff held his lantern 18 ins. from the ground, kneeling for this purpose on the narrow strip between the trench and the tracks, knowing that he would be struck by a passing car if he did not get out of its way. There was nothing in his occupation that prevented the free use of his senses, and no obstruction to his vision up or down a straight track in each direction. These circumstances having appeared in the plaintiff's case, the de-

fendant's motion that he be non-suited for contributory negligence should be granted.—(Bushay vs. Ocean City Electric Railway.)

NEW JERSEY.—Carriers—Injuries to Passengers—Negligence.

1. The plaintiff, a passenger on a street car, alighted for the purpose of taking another car, and in passing to the rear of the first car came in contact with the chain running down from the rear dash to the end of the fender, and was injured. The fender, contrary to the usual custom as to rear fenders, was down. Held, that the facts did not justify an inference of negligence on the part of the street railway company.

2. The street railway company is bound to the exercise of a reasonable judgment and due care and skill, but it is not to be condemned as negligent merely because the event that happened would have been avoided if its judgment had been different.—(Whilt vs. Public Service Corporation of New Jersey, 64 Atl. Rep., 972.)

NEW JERSEY.—Master and Servant—Injuries to Servant—Defective Appliances.

Where it appears, on the plaintiff's proofs, that the grab iron upon the top of a trolley car, which the line or repair man was required to use, was faultily constructed, in that the screws which held it were too small; and that it was also defective, in that wood into which it was fastened was rotten, the court could not non-suit the plaintiff.—(McIsaac vs. South Jersey Gas, Electric & Traction Co., 64 Atl. Rep., 976.)

NEW JERSEY.—Infants—Personal Injuries—Right of Action.

In an action brought by a little girl, two years and seven months old, who had lost a leg by the negligence of a trolley company, it was error for the trial justice to refuse to notice a request by defendants to charge that the jury could not allow any compensation for the loss of the earning capacity of the child until she reaches her majority.—(Gallagher vs. Public Service Corporation of New Jersey, 64 Atl. Rep., 978.)

NEW JERSEY.—Street Railroads—Frightening Horses—Evidence—Non-suit—Instructions.

1. Plaintiff alleged in his declaration that the defendant propelled one of its cars on a public highway in a negligent manner, and with such speed and noise as to cause plaintiff's horse to become unmanageable, whereby plaintiff was injured. At the close of the plaintiff's case there was proof that the plaintiff's horse took fright at the noise made by defendant's car. There was also proof that, after the frightened condition of the horse had become apparent by his behavior, the trolley car followed up the frightened horse at a high rate of speed for several city blocks until the horse became unmanageable and wrecked the wagon. Held that, assuming that plaintiff's testimony failed to show that the noise at which his horse took fright was due to any negligence on the part of the defendant, the further circumstances were such as to render the allegation as to speed a pertinent inquiry for the jury on the question of the defendant's negligence, and that the motion to non-suit was properly denied.

2. In response to a request of the defendant to the trial court to charge the jury that "there must be positive proof that the car made an unusual noise," the court charged as requested with the addition of the words, "or some other misconduct on the part of the defendant making them negligent." Held that the jury will be deemed to have applied this instruction to the case in hand, and that, thus limited, it was not injurious to the defendant.".—(Applegate vs. West Jersey & S. R. Co., 65 Atl. Rep., 127.)

NEW YORK.—Negligence—Imputed Negligence.

The negligence of the driver of a team, with which a street car collided through negligence of the motorman, will not be imputed to an occupant of the team injured by the collision, though he and the driver were engaged in a common employment; he not having done or attempted to do anything to influence the driver.—(Scheib vs. New York City Ry. Co., 100 N. Y. Sup., 986.)

NEW YORK.—Appeal—Judgment of Non-suit—Review—Carriers—Injury to Passenger—Negligence—Questions for Jury.

1. The court, in reviewing a judgment of non-suit, must place on the evidence a construction most favorable to plaintiff and consider the reasonable inferences that may be drawn therefrom.

2. Railroad Law, Laws 1890, p. 1126, C. 565, Sec. 138, provides that trains on elevated railroads shall not be permitted to start until every passenger desiring to alight shall have left the train, provided the passenger has manifested his intention to alight by moving toward the platform of the car. A passenger, on the train stopping, got up, ready to walk out, and he reached the exit door, when the train started with a sudden jerk, injuring him. Held that the question of the negligence of the railroad in starting the train was for the jury; the movement of the passenger being a manifestation of his intention to alight, and it being the duty of the railroad not to start until the passenger had been given a reasonable opportunity to do so.—(Fruhauf vs. Interborough Rapid Transit Co., 101 N. Y. Sup., 781.)

NEW YORK.—Appeal—Non-suit—Inferences from Evidence—Street Railroads—Negligence of Motorman—Question for Jury—Contributory Negligence.

1. Upon an appeal from a non-suit, appellant is entitled to the most favorable inferences deducable from the evidence.

2. Whether a motorman on a clear track, with his car under control, could have brought it to a stop or sufficiently reduced its speed to avoid an injury within the distance of 125 ft., was a question of fact.

3. As a matter of law a person who attempts to cross a street at a crossing but 15 ft. to pass over to reach a place of safety at a time when a car is approaching from a distance of 125 ft. is not guilty of contributory negligence.—(Duffy vs. Interurban St. Ry. Co., 101 N. Y. Sup., 767.)

NEW YORK.—Street Railways—Injuries—Action—Instructions.

Where, in an action against a street railway for the death of a child three years and nine months old, run over by a car, the court left to the jury the question whether the child was sui juris, defendant was entitled to an instruction that if the child was sui juris, he was bound to exercise such care and caution as was to be expected of a child of his age under the circumstances.—(Hirtenstein vs. Interurban St. Ry. Co., 100 N. Y. Sup., 910.)

NEW YORK.—Negligence—Contributory Negligence—Pleading—Carriers—Street Railways—Injuries to Passengers—Position—Collision—Res Ipsa Loquitur—Negligence of Carrier — Damages — Personal Injuries — Conclusiveness—Earning Capacity—Impairment—Issues.

1. Contributory negligence in an action for injuries is an affirmative defense which must be specially pleaded.

2. Where a street railway company adopted a rule requiring users of tobacco to occupy the rear vestibule of a car, and plaintiff was occupying such position in compliance with the rule at the time he was injured in a collision with another car, he was not guilty of contributory negligence because he was not seated in the car.

3. Proof that plaintiff was a passenger on a street car, and was injured by a collision between the car in which he was riding and a car approaching from an opposite direction, was sufficient to raise a presumption of negligence which would be conclusive against the carrier on the issue of negligence, unless the carrier produced rebutting evidence.

4. The motorman of a street car, on which plaintiff was riding, drove the same onto an embankment, where the tracks were so close that cars could not pass. At this time, a car having the right of way approached from the opposite direction, a third of a mile away, and could have been seen by the motorman, but he failed to stop his car. The motorman of the car having the right of way saw the danger and stopped his car before it reached the danger point, but a collision occurred, the only excuse given for which being the slippery state of the rails. Held, that the motorman of the car on which plaintiff was riding was guilty of gross negligence.

5. Plaintiff, a teamster 43 years of age, was injured while a passenger on defendant's street car. He sustained slight injuries to his head and shoulders, and a serious permanent injury to his left hand, the bones of which were broken, and healed so that the hand was so stiff that the fingers could not be closed. Plaintiff suffered great pain, and was disabled from following his vocation, or from doing any work that required the use of both hands. Held, that a verdict of $1,500 was not excessive.

6. Where the petition alleged that plaintiff's injuries were permanent and lasting in character and effect, and had caused plaintiff in the past, and would cause him in the future to suffer great bodily pain and mental anguish, and that his earn-

ing capacity had been impaired, it was sufficient to present the issue of plaintiff's total disability to earn money in the future as a result of his injury.—(Goodloe vs. Metropolitan St. Ry. Co., 96 S. W. Rep., 482.)

NEW YORK.—Railroads—Injuries to Pedestrians on Track—Contributory Negligence.

A pedestrian, intending to take passage on a train at a station, was struck by a train, which did not stop there. No warning was given that the train would not stop. Trains customarily stopped at the station which fact was known to the pedestrian. The pedestrian first saw the train about 700 or 800 ft. from the station. She next saw it about 120 ft. from her and instead of attempting to cross there, she walked a distance of 35 or 40 ft. to a place at or near the center of a street and without looking for the approaching train she stepped on the track and was injured. While walking the distance of 35 or 40 ft. she was in a place of safety and could, at every instant, have commanded a full view of the approaching train. Held, that she was guilty of contributory negligence as a matter of law.—(Cranch vs. Brooklyn Heights Ry. Co., 78 N. E. Rep., 1078.)

NEW YORK.—Carriers—Injuries to Passengers—Acts of Conductor—Negligence.

Where a passenger on an electric car while on the running board for the purpose of changing his seat was injured by a collision of his body with one of the trolley poles between the tracks, the conductor's assent to such change of seats without warning the passenger of his danger was not negligence, where the distance between the trolley poles and the car was great enough to enable persons ordinarily to stand upon or pass along the running board in safety, and where the construction of the road at the place where the accident occurred was not unusual, or the distance between the running boards such as was likely to endanger passengers making ordinary and customary use thereof.—(Tietz vs. International Ry. Co., 78 N. E. Rep., 1083.)

NEW YORK.—Street Railroads—Crossing Accident—Death of Pedestrian—Contributory Negligence—Subsequent Negligence—Appeal—Review—Verdict—Sufficiency of Evidence.

1. Intestate was struck and killed by an electric street car, at 12:30 a. m., as she was endeavoring to cross the track between streets in an outlying district, where the road was rough and badly washed. There was an electric light at the street corner. When intestate was within 4 ft. of the track, and about to cross, the car, with a headlight burning, which could be easily seen, was approaching her at a distance of from 75 to 100 ft., and at a rate of from 6 to 9 miles an hour. Held that intestate was guilty of contributory negligence as a matter of law.

2. After intestate was struck by a street car at night, and while she was under the car, the motorman and conductor were unable to find her, whereupon the conductor directed the motorman to move the car ahead, which he did, when intestate was found, dead. Plaintiff, in an action for such death, however, did not prove affirmatively that the moving of the car caused injury to intestate, nor that she was not dead before the car was moved. Held that plaintiff was not entitled to recover, irrespective of intestate's contributory negligence, on the theory that defendant was guilty of negligence in so moving the car after intestate was struck.

3. Where, under the instructions, a verdict for plaintiff might have been reached by a finding that deceased was killed by the original accident, not contributed to by any negligence of the deceased, which was unauthorized, the verdict could not rest on proof of negligence on the part of defendant's employees in moving the car after the accident had happened.—(Healy vs. United Traction Co., 101 N. Y. Sup., 331.)

NEW YORK.—Street Railroads—Injury to Pedestrians—Contributory Negligence—Evidence—Action—Instructions.

1. In an action against a street railway company for injuries received at a crossing, it appeared that the accident occurred at 8 o'clock at night; that the only time plaintiff saw the car before it struck him was when he was on the sidewalk; that while crossing the street he was walking slowly; that when he came within 5 ft. of the track he looked again, and when asked why he looked both ways for a car when within 5 ft. of the track he stated that there might be a horse coming. The car which struck plaintiff had a brilliant headlight then burning, and while plaintiff was completely deaf his eyesight was good and he could have seen the car. Held that he was guilty of contributory negligence.

2. In an action against a street railway company for injuries received while crossing defendant's track, an instruction that if the jury found that, when plaintiff started across the street, the car was at such a distance as to warrant the assumption of safety by plaintiff in the attempt to cross, it was immaterial whether he looked or did not look to observe the approaching car, was erroneous, as authorizing the jury to ignore circumstances that supervened from the time at which plaintiff observed the car until he was struck.—(Marguiles vs. Interurban St. Ry. Co., 101 N. Y. Sup., 499.)

NEW YORK.—Carriers—Injuries to Passenger—Evidence—Sufficiency.

In an action against a street railroad for injuries to a passenger, it appeared that he was standing on the step of the car preparatory to alighting when it should stop on the further side of a cross street, which the car was then crossing, when the car, according to his evidence, "jumped," and he fell within a few feet from tracks laid in the cross street. It was shown that when crossing the other tracks there was no power on the car on which he was riding. Held that the facts were insufficient to show negligence on the part of defendant.—(Adams vs. New York City Ry. Co., 101 N. Y. Sup., 570.)

NEW YORK.—Street Railways—Contributory Negligence of Person in Vehicle.

In an action for the death of plaintiff's intestate in a collision between defendant's street car and an automobile in which intestate was riding with his employer, it appeared that the car was a north-bound one, and that as the automobile, moving westerly along a street, approached the railroad tracks, there was to the left of the automobile a sign 16 ft. long and 9 ft. high, lengthwise with the street, the end of the sign nearest the railroad track being about 30 ft. therefrom, and that in the space between the sign and the track the view to the south was unobstructed, and that before reaching the sign the view in that direction for 450 ft. was unobstructed after the vision ceased to be in any way obstructed by a house on another street, which was 113 ft. away from the street that the automobile was on. There was no evidence that intestate looked or took any precaution, and the employer testified that after passing the house line he looked to the south and saw no car coming, but that he did not look again until the automobile was on the track. Held, that a judgment for plaintiff could not be sustained.—(Ward vs. Brooklyn Heights Ry. Co., 100 N. Y. Sup., 671.)

NEW YORK. — Street Railways — Equipment — Guy Wire Poles—Negligence—Contributory Negligence—Evidence—Question for Jury.

In an action for injuries to a fireman by striking a guy wire pole maintained by a street railway company, as he was riding from a fire house to a fire on the fire wagon, evidence held to require submission of the railway company's negligence in placing the pole too near to the driveway, and plaintiff's contributory negligence, to the jury.—(Lambert vs. Weschester Electric Ry. Co., 100 N. Y. Sup., 666.)

NEW YORK.—Master and Servant—Injuries to Servant—Negligence—Failure to Warn—Question for Jury—Contributory Negligence—Electric Wires.

1. In an action by a servant working on an elevated track for injuries received from a short current passing from a wire on which the insulation was broken, evidence considered, and held to require submission to the jury of the question of defendant's negligence in failing to warn as to the latent danger.

2. Contributory negligence of a servant working on an elevated track, who was injured by a short current passing through the heavy iron tool with which he was working in close proximity to a wire which passed under the structure connecting with the third rail, is not necessarily shown from the mere fact that he himself accidently broke the insulation, where it further appears that he had never been warned as to such wires and was ignorant of the danger lurking therein.—(Carey vs. Manhattan Ry. Co., 101 N. Y. Sup., 631.)

NEW YORK.—Street Railroads—Streets—Track—Defects—Persons Liable—Railroads—Tracks in Street—Injuries to Pedestrians—Damages—Personal Injuries—Excessive Verdict.

1. Plaintiff stepped on a railway track laid in a street. His foot slipped from the rail, which was defective, into a hole or rut in the crosswalk adjoining the rail, and went under the rail flange, breaking his leg. The track was owned by defendant railroad

company, and defendant street car company was authorized to run street cars over the same, without any obligation to keep the track in repair or any right to interfere therewith. Held that the street car company was not responsible either for the defect in the street or in the track.

2. Where an injury to a pedestrian was proximately caused by a defect in a railroad track laid in the street, which track had negligently been allowed to become out of repair and dangerous, the railroad company owning and operating the track was answerable for the injury.

3. Plaintiff's foot slipped under the flange of a railroad rail laid in a public street by reason of a defect in the rail, and his leg was so twisted as to cause a fracture between the ankle and knee. Held that a verdict against the railroad company for $15,000, which the trial court reduced to $9,000, was still grossly excessive, and should be reduced to $5,266.20.—(Ross vs. Metropolitan St. Ry. Co. et al., 101 N. Y. Sup., 932.)

WASHINGTON.—Master and Servant—Injury to Servant—Fellow Servants—Negligence of Master.

1. The motorman and conductor of one car on a street railroad, the cars of which run on schedule time, are fellow servants of the motorman and conductor of another car on the line, so that one of the motormen injured through the negligence of the other motorman is not performing his duty of turning on the lights of a block-light system, and of the conductor of the other car in not performing his duty to see that his motorman performed such duty, cannot recover of the company.

2. A street railroad does not fail to furnish a sufficient block-light system, so as to be liable for injury to a motorman from collision with another car on the block, where it appears that the accident could not have happened had the motorman and conductor of the other car performed their duty of turning on the light before entering on the block.—(Berg vs. Seattle R. & S. Ry. Co., 87 Pac. Rep., 34.)

WASHINGTON. — Carriers — Injuries to Passengers — Evidence — Trial — Instructions — Language — New Trial — Grounds—Misconduct of Parties—Prejudicial Pleading.

1. In an action for injuries to a passenger caused by a collision of defendant's street railway cars, the speed at which the cars collided and the injury to them was material to show the force of the collision, and the force of the collision was material to show the probabilities as to whether plaintiff was injured, and the nature and extent of the injury.

2. An instruction that the "preponderance" of evidence means the "best" evidence was not inappropriate nor objectionable as tending to mislead the jury, the term "best evidence" obviously not having been used in the technical sense.

3. Though it is reprehensible to plead allegations tending to prejudice the jury, with no intention of attempting to prove them before a new trial should be granted upon that ground alone, the abuse should be flagrant, and its prejudicial effects plainly evident, or exceedingly probable.—(Johnstone vs. Seattle R. & S. Ry. Co., 87 Pac. Rep., 1125.)

WEST VIRGINIA.—Street Railroads—Use of Streets—Superior Rights — Negligence — Excessive Speed — Signals — Street Intersections—Due Diligence—Contributory Negligence—Regulation of Speed—Ordinances—Fenders.

1. A street railroad company has an equal right with the public to the use of streets at street crossings. Neither has a superior right to the other.

2. It is negligence for a street car company to operate its cars at such a rate of speed as not to have them under control and to be able to stop them readily as they approach intersecting streets, in case it may be necessary to avoid a collision or prevent an accident.

3. A street car company should give proper warning of the approach of its cars at street crossings. For a failure to do so it will be guilty of negligence.

4. More care is required in operating street cars at street intersections than at other points, and, if a street car company at such intersections runs its cars at an excessive and unusual rate of speed, it will be guilty of negligence.

5. It is not contributory negligence for one to attempt to cross a street railway track in front of an approaching car, if, in doing so, he exercises that judgment and care which a reasonably prudent and careful person would have exercised under like circumstances.

6. An municipal corporation may, within reasonable limits, regulate and prescribe the speed at which street cars may be operated over its streets, and, when it has done so by valid ordinance, it will be negligence per se for a street car company to run its cars at a speed exceeding that fixed by the ordinance.

7. Where, by valid municipal ordinance, street cars are required to be equipped with fenders of an approved make, it is negligence per se to operate such cars without such equipment.—(Ashley vs. Kanawha Valley Traction Co., 55 S. E. Rep., 1016.)

WISCONSIN.—Street Railroads—Injury to Person on Track—Contributory Negligence.

A passenger, on alighting from a street car, passed over the track behind the car and towards a parallel track, where he was struck by a car coming from the opposite direction. He was familiar with the surroundings and the ordinary speed of cars. He looked for an approaching car on alighting, but did not look again until he was struck. The approaching car was well illuminated by electricity and by a headlight. Had he looked he could have seen the approaching car at a distance of about half a mile. Held that he was guilty of contributory negligence as a matter of law.—(Morice vs. Milwaukee Electric Ry. & Light Co., 109 N. W. Rep., 567.)

WISCONSIN. — Carriers — Injuries to Passengers — Negligence—Violation of Municipal Ordinances—Evidence—Sufficiency—Street Railroads—Operation of Cars—Ordinances—Construction—Non-Compliance with Municipal Ordinance.

1. In an action against a street railway company for injuries to a passenger in a collision with a train at a crossing, the conductor and motorman testified that the car was stopped before crossing the railroad track, and that the conductor passed in front of the car and ascertained that there was no danger in sight before signaling the motorman to cross. The gatekeeper at the crossing testified that he saw the conductor in front of the car before it passed the track, and that he saw the car moving, but did not state that the car did not stop. Held to show, as a matter of law, that the conductor and motorman complied with an ordinance requiring every motorman to stop his car at least 20 ft. from a railroad crossing, and every conductor to pass in front of his car to enable him to ascertain whether there is any danger, before signaling the car to cross.

2. A city ordinance required every motorman to stop his car at least 20 ft. from a railroad crossing, and every conductor to pass in front of his car to enable him to ascertain whether there is any danger before signaling the car to cross. The tracks of two railroads crossed a street car track. The distance between the main railroad tracks was about 80 ft. Held, that the ordinance did not require the bringing of the cars to a standstill between the two railroad tracks.

3. In an action against a street railway company for injury to a passenger in a collision with a train at a crossing, the evidence showed that the conductor preceded the car to a point where he had a clear view of the railroad track in both directions, and then signaled the motorman to proceed. Held to show, as a matter of law, a compliance by the conductor with a city ordinance requiring every conductor to pass in front of his car, approaching a railroad crossing, a sufficient distance to enable him to ascertain whether there is any danger before signaling the car to cross.

4. In an action against a street railway company for injuries to a passenger in a collision with a train at a railroad crossing, the evidence showed that the car was partly over, or immediately adjacent to, the first rail of the first main track of the crossing, when the noise of the train was heard or made known to the motorman or conductor. There was no headlight on the engine of the coming train, and no whistle was sounded to signal its approach. When the conductor heard the train he immediately apprised the motorman thereof, and directed him to speed the car, which was done, but it failed to clear the crossing before the train collided with it. The evidence was contradicted by calculations based on statements of witnesses as to the speed of the approaching train, the speed of the car before, and at the time, and after the persons in its control heard the approaching train, etc. The calculations were speculative in their character, and could have no probative force as against the positive evidence. Held that the evidence, as a matter of law, showed that the employees in charge of the car were not guilty of negligence.—(Bartholomaus vs. Milwaukee Electric Ry. & Light Co., 69 N. W. Rep., 143.)

FINANCIAL INTELLIGENCE

WALL STREET, Feb. 13, 1907.

The Money Market

The most important development in the monetary situation during the past week was the heavy loss in cash sustained by the clearing house banks, which carried the surplus reserve to below $3,500,000, or the lowest point recorded in many years. This reduction in the bank reserves was due in part to the return to the Federal Treasury government money deposited by the Secretary of the Treasury during the closing months of 1906 to relieve the money stringency prevailing at that time, and to the payments for the $30,000,000 New York City bonds, which were sold on Feb. 1. These heavy drafts upon the local institutions, together with the increased demand for funds resulting from a more active speculation in and higher prices for securities, caused the large lenders of money to advance interest charges on both call and time loans. The higher rates for money, however, are regarded as only temporary, and in well-informed quarters the belief prevails that money will rule comparatively easy for several weeks to come at least. Secretary of the Treasury Shaw announced that he would purchase at 101½ flat, $25,000,000 of the Government 4s, maturing on July 1 next, but it is not expected that the offer will be fully taken advantage of. The price offered by the Secretary is ½ per cent higher than his offer of Dec. 10 last, but at the same time these bonds can be sold in the market at the price offered by Secretary Shaw. Borrowings by the railroads have continued during the week, the most important of which were the placing of $6,500,000 4½ per cent notes by the Rock Island, and the negotiation of a loan by the Delaware & Hudson of $6,000,000 at 6 per cent for one year, the money to be expended for equipment and improvements on one of the company's subsidiary companies. It is expected that while further borrowings by railroads will continue from time to time, the bulk of the corporate demand has been largely satisfied at least for the present. The foreign exchange market has continued weak, and despite the advance in prices for bar gold and American eagles in the London markets, gold imports are still profitable. Our bankers, however, failed to secure any part of the gold arriving in London from South Africa, and some disappointment was expressed on that account. However, the arrivals of gold from the Cape in London will be rather large during the coming week, and our bankers may succeed in securing part of the late arrival of gold. The European markets have ruled steady, especially at London, and while New York is in the market for the yellow metal, no change in the Bank of England discount rate is probable. Money on call has loaned at 3 and at 6 per cent. Time money advanced ¼ per cent for all maturities, making the quotations at the close 5 per cent for sixty days, 5¼ per cent for ninety days, and 5½ per cent for four to six months.

The bank statement published on last Saturday was very unfavorable. Loans increased $1,518,900. Cash decreased $12,077,600, and as the reserve required was $2,789,375 less than in the preceding week, the surplus reserve was reduced by $9,288,225. The surplus now stands at $3,345,875, and compares with $12,634,100 in the previous week, $5,943,575 in the corresponding week of last year, and $11,036,925 in 1905.

The Stock Market

The past week has witnessed a decided change for the better in the securities market. Trading on the Stock Exchange was somewhat larger than in the preceding week, and although prices at times yielded to bear pressure, the general trend of values was toward a higher level. Foreign investors continued to buy moderately of the standard shares at the prevailing level of prices, but the improvement that occurred during the week was largely the result of extensive covering by shorts, based upon the fact that prices have had a large decline, liquidation has been thorough, and in view of general conditions there should be a change for the better. The rally in prices, however, was less than had been expected, but this was due in some measure to the very unfavorable bank statement of last Saturday, which revealed a loss in cash of more than $12,000,000, and a decrease in the surplus of upwards of $9,000,000. Notwithstanding this heavy loss in cash, less apprehension was felt regarding the immediate future of the money markets, and in banking circles the opinion is expressed that rates for both call and time accommodations will rule comparatively easy for some weeks to come. This belief is strengthened by the offer of the Secretary of the Treasury to purchase $25,000,000 of Government 4s of 1907 at 101½ flat. Sterling exchange rates continued at the gold import point, and it is probable that local bankers will be able to secure additional amounts of the yellow metal for import in the near future. Advices from Washington are more encouraging, and there appears to be some hope for the passage of a currency reform measure before the adjournment of Congress next month. Industrial activity shows some abatement, but the United States Steel Corporation reports an enormous business, and earnings for the calendar year are estimated at record totals. The railway equipment companies are far behind in orders, and some of the important railroad companies are curtailing expenditures for improvements. The strong features of the week included St. Paul, Great Northern preferred, New York Central, Illinois Central, Union Pacific, Southern Pacific, Atchison, Baltimore & Ohio and Reading. At the close the improvement was still under way with prices at about the highest of the week.

Nothing of importance has developed in the local traction sitnation and the shares of those companies will be governed by general market influences.

Philadelphia

Although the trading in the local traction shares during the past week was considerably smaller than for some time past, the general trend of values was upward, and in most issues substantial gains were recorded. A noteworthy feature was the active buying of Philadelphia Company common, which was accompanied by an advance of 2 points to 47, most of which was maintained. Philadelphia Rapid Transit also was very quiet but firm, less than 3000 shares changing hands at from 20¾ to 21⅜, and closing within a small fraction of the highest. Union Traction rose ½ to 58 on light purchases, and Philadelphia Traction was steady, with transactions at 94¼ and 94⅜. United Company's of New Jersey sold at 253, and Consolidated Traction of New Jersey brought 74¼. Fairmount Park Transportation sold at 15, American Railways at 50⅝ and 51, and United Traction of Pittsburg at 47.

Baltimore

Very little activity developed in the traction issues at Baltimore during the week, and while prices moved with some irregularity the general tone was strong. United Railways 4s ruled fractionally higher, about $50,000 selling at 89⅞ and 90, but the incomes and the refunding 5s displayed weakness, the former declining from 57⅝ to 56¼, and the latter from 86½ to 86. Sales of the free and deposited stock were reported at 12¾. Knoxville Traction 5s were quite active and strong, $38,000 changing hands at from 106¾ to 107. Norfolk Railway & Light 5s advanced ½ to 97½. City & Suburban 5s brought 108½ for $4,000, and Washington City & Suburban 5s sold at 102½.

Other Traction Securities

Trading in the Boston market was extremely dull and devoid of special feature. Boston & Worcester common alone displayed activity, upwards of 500 shares selling at from 27½ to 27, while sales of the preferred were reported at 76. Boston Elevated sold at 150, ex. the dividend, and West End common and preferred brought 93½ and 108 respectively. Other transactions included Boston & Suburban at 13¾ and 14, preferred at 55; Massachusetts Electric at 19 and 19½, and the preferred at 69¼ and 69. The Chicago market was practically at a stand-

still. South Side Elevated sold at 86 and 85¼, and Metropolitan Elevated preferred at 69½ and 68½. The City Council has passed, over the veto of Mayor Dunne, the ordinance granting twenty-five-year franchises to the present street railway companies of Chicago. The vote was 57 to 12. The ordinance will become valid if ratified by referendum vote at the city election in April.

On Monday a block of 500 shares of Aurora, Elgin & Chicago common was sold, sixty days, at $35 a share. This is the largest block that has been sold in some time, and traders have been wondering what it means. Last April, it is said, that some traders sold a big block of this stock at $40 to be delivered a year from the time, and it is possible that they are buying to cover their shorts. On the other hand, the road has been showing handsome gains within the past year, and for the past month or two, especially. This may have been the cause of the buying. In all, about 1000 shares of the stock changed hands within the week and it is possible that investors have been looking into the proposition. New connection, almost completed, will make the Aurora, Elgin & Chicago a better paying road than it has been in the past. On account of the prospects of the road, considerable strength was shown by the Cleveland & Southwestern. Cleveland Electric has not been active and the offers were put half a point higher than last week. Forest City was offered at 100, with 97 bid.

Security Quotations

The following table shows the present bid quotations for the leading traction stocks, and the active bonds, as compared with last week:

	Feb. 6	Feb. 14
American Railways	50½	50¾
Boston Elevated	149½	149
Brooklyn Rapid Transit	73½	75
Chicago City	a180	150
Chicago Union Traction (common)	4¾	5¼
Chicago Union Traction (preferred)	16	16¾
Cleveland Electric	63½	62
Consolidated Traction of New Jersey	75½	75¼
Detroit United	77	80¼
Interborough-Metropolitan	35½	35¾
Interborough-Metropolitan (preferred)	71¼	71½
International Traction (common)	59	56
International Traction (preferred), 4s	80	80
Manhattan Railway	142¾	145
Massachusetts Electric Cos. (common)	19	14
Massachusetts Electric Cos. (preferred)	69	69
Metropolitan Elevated, Chicago (common)	a26	25
Metropolitan Elevated, Chicago (preferred)	67¼	68
Metropolitan Street	104	—
North American	81½	82
North Jersey Street Railway	40	40
Philadelphia Company (common)	45	46¼
Philadelphia Rapid Transit	20¾	21½
Philadelphia Traction	94¼	94½
Public Service Corporation certificates	68	68
Public Service Corporation 5 per cent notes	96½	96½
South Side Elevated (Chicago)	86	84½
Third Avenue	117½	119
Twin City, Minneapolis (common)	103	103
Union Traction (Philadelphia)	56½	57¾

a Asked.

Metals

According to the "Iron Age," the blast furnaces have not been working well lately, and the output has not been as large as it should be. Prices for spot iron are lower in the South, and $21 for No. 2 Birmingham has been quoted. The pig-iron markets are quiet throughout the country, with little pressure to sell, and very little anxiety to buy. An interesting event in the steel-rail trade has been the sale, for export, of 50,000 tons of 80-pound rails for delivery during the second half of the year.

Copper metal holds very strong, but prices are unchanged at 25c to 25¼c for Lake; 24¾c to 25c for electrolytic, and 24¼c to 24¾c for castings.

ANNUAL REPORT OF THE DETROIT UNITED RAILWAY COMPANY

The Detroit United Railway Company has issued its full pamphlet report for the year ended Dec. 31, 1906. The income account compares as follows:

	1906	1905
Gross	$6,063,182	$5,125,503
Expenses and taxes	3,718,621	3,041,523
Net	$2,344,561	$2,084,040
Other income	58,757	44,076
Total income	$2,403,318	$2,128,116
Charges	1,243,273	1,113,293
Surplus	*$1,160,045	$1,014,823
Dividends	625,000	562,500
Balance	$535,045	$452,323
Depreciation	250,000	....
Surplus	$285,045	$452,323

* Surplus is equal to 9.28 per cent earned on the $12,500,000 capital stock. Deducting the amount appropriated for depreciation, $250,0000, the surplus available for dividends would then be equal to 7.28 per cent on the capital stock.

The traffic situation of the Detroit United Railway and subsidiary companies is presented as follows:

	Revenue	Transfer	Employees	Total
Detroit United Railway	105,068,377	32,362,869	4,590,218	142,021,464
Railroad system	4,689,535	311,670	265,071	5,266,276
S. W. & A.	2,264,999	165,720	39,872	2,470,591
D., M. & T. (10 mos.)	988,398	......	44,063	1,032,461
Total	113,011,309	32,840,259	4,939,224	150,790,792

Mileage statistics:

	Car-Mileage	Earn. per Car-Mile	Exp. per Car-Mile	Net per Car-Mile
Detroit United Railway	22,274,234	.2265c.	.1373c.	.0892c.
Railroad system	2,344,597	.2551c.	.1728c.	.0823c.
S. W. & A.	435,490	.2328c.	.1207c.	.1121c.
D., M. & T.	820,205	.3596c.	.2353c.	.1243c.
Total	29,973,526	.2334c.	.1432c.	.0902c.

On Jan. 1, 1906, the mileage operated by the Detroit United Railway was 541.537. During the year 1906 78.619 miles were added, making the total mileage operated on Jan. 1, 1907, 620.156.

There was expended and charge to "additions and betterments" during the year $1,025.922, of which the principal items were: New tracks, $447,130; cars, $305,035, and power houses, $95,946. In addition to the above there was expended on the various lines in the system amounts as follows:

Rapid Railway System	$159,124
Sandwich, Windsor & Amherstburg Railway	130,080
Detroit, Monroe & Toledo Short Line	117,467
Various investments, including purchase of Detroit, Monroe & Toledo Short Line	1,040,260

The company does not issue a consolidated balance sheet, but puts out instead individual financial exhibits for the four companies comprising the system. During the last year an attempt to settle the question of the company's franchise in the old city limits was made. The offer made by the company for its renewal was, however, rejected by the voters of the city. The franchise in question expires in 1909, but it covers the lines in the old city limits only. Other franchises expire at different times within the next eight years, but it is claimed by the Detroit United that overlapping franchises and franchises in parallel streets place the company in a position to compete destructively with any concern entering the field, inasmuch as the competitor would have no through communication.

It is telegraphed from Cleveland that the Interstate Commerce Commission has decided that the electric lines are common carriers. This opens a number of questions which are extremely important for the traction properties. One of them is whether the traction lines will have to submit their printed tariffs to the commission. Another is whether the Interstate Commerce Commission can compel the steam railroads to enter an exchange arrangement with the trolley lines.

CHICAGO TRACTION ORDINANCE PASSED OVER MAYOR'S VETO

The Chicago City Council passed the Chicago traction ordinance over the Mayor's veto, Feb. 11. The vote was 57 to 12 in favor of the ordinance—a gain of one vote over the original number in favor of the ordinance. The acceptance or rejection of this ordinance is now dependent upon the referendum vote of the people at the coming April election. If sustained by the people, it becomes law as soon as accepted by the companies. The conservative element of the city is overwhelmingly in favor of the ordinance which will settle Chicago's nine-year traction controversy and settle it on terms most remarkably favorable to the city. Mayor Dunne and certain radical elements in the city are opposed to the ordinance and it is uncertain what strength they will show at election. Mayor Dunne is apparently trying to make the traction question a political issue upon which to make his campaign for re-election in April, as it is only recently that he has faced about and opposed settlement on the terms mentioned in the ordinance.

THE SITUATION IN CLEVELAND

In order to have plenty of time to complete the appraisements and estimates on the properties of the Cleveland Electric Railway Company, the armistice has been continued indefinitely, and the courts will be asked to suspend the actions of the injunctions until President Andrews and President Du Pont are ready to resume. Both feel now that they will be able to make a report within a comparatively short time.

Max F. Goodman is promoting a 3-cent belt line in the city, and within the past week has done considerable work in finding out what the people think of it. His idea is to build a line that will connect with every other road in the city, and in addition give service to sections of the city that is now without street railways. The route, as planned by Mr. Goodman, will start at West Third or Seneca Streets and Lakeside Avenue, run east to East Twentieth Street, then to East Twenty-Second Street, then to Broadway, thence over the Jefferson Avenue Bridge and up what are known as "the flats" to Lakeside Avenue and back to the starting points. The lumber section and many manufacturing plants are located in the flats, and there has been a demand for street car service from there for years. It is said that Mayor Johnson opposes the idea, and is reported to have remarked that a franchise for that purpose would have a hard time in the City Council.

At the annual meeting of the Forest City Railway Company a few days ago the following directors were chosen: M. A. Fanning, Otto Leisy, C. H. Mueller, John H. O'Brien, Thomas P. Schmidt, A. W. Willard, Francis E. Wright and Charles F. Seelbach. According to the reports submitted the earnings of the road were as follows:

November	$2,926.50
December	4,811.67
January	7,702.03
Gross car earnings	$15,441.20
Earnings from other sources	1,830.75
Gross income	$17,271.95
Operating expenses for the period	16,085.09
Net surplus	$1,186.86

The operating expenses, as given, include interest and dividend to the amount of $2,246.55. The cost of building the road has been given as $50,000 a mile, and there are 11 miles of track, which would make an investment of $550,000. It would seem that the interest on this amount of money for three months would be more than given. The report has been criticised, but it seems that the stock keeps well up on the exchange, having gained a few points the past week.

It is said that Mr. Du Pont and Mr. Andrews have reached a mutually satisfactory basis for arriving at the values of the franchises. With plans for ascertaining the physical value and the value of the franchises, the two men are well on the way to results.

ELECTRICITY FOR PHILADELPHIA SUBURBAN LINES OF PENNSYLVANIA COMPANY

The statement is made that Charles M. Shaeffer, superintendent of passenger transportation of the Pennsylvania Railroad, who acted as chairman of the commission appointed to investigate the conversion of steam lines to electricity in Europe, will report in favor of the substitution of electricity for steam on the company's suburban and short-haul lines out of Philadelphia. Mr. Shaeffer, it is understood, will present his report within a few days. Inquiry of the representatives of the company resulted in the statement that nothing official would be available for publication until after the report had been formally rendered to the officials of the company.

MEETING OF NEW YORK TRANSIT COMMISSION

The Rapid Transit Commission, at its meeting on Thursday, Feb. 7, had a public hearing on the proposed contract for the Lexington Avenue subway. The Merchants' Association, City Club, Citizens' Union and various other bodies had representatives present to object to some form of the proposed contract. The main objection seemed to be to the manner of construction of the tunnel, which is proposed to be built by the open-cut method. It was stated that the business men along Broadway and Fifth Avenue do a business of $1,000,000,000 per annum, and it is estimated that they would suffer a loss of $100,000,000 were this tunnel to be constructed by an open cut and their places of business be obstructed.

Some objected to the proposed loop connecting the new tunnel with the present subway at Forty-Second Street on the ground that the contract as drawn would permit of the construction of the tunnel along the whole route, or, only that portion above Forty-Second Street. This would, in the opinion of the objectors, give the Interborough an unfair advantage over other possible bidders, and the opinion was advanced that the Interborough would be the only bidder and the new route would then become merely a feeder for the present overcrowded subway, thus defeating the primary object for which it is proposed to build it.

In the proposed contract is a clause which reserves the right to the Commission to order the operating company of the Lexington Avenue road to increase the equipment whenever it thinks the same may be necessary, the violation of such an order to be considered a breach of the contract of operation and rendering the operating company liable to a forfeiture of its lease. This clause was objected to by counsel for the Interborough on the ground that it was too arbitrary and there should be some appeal possible from an order which the operating company might consider onerous and unnecessary in its provisions.

Chief Engineer Rice submitted a report on the result of his examination of the elevated cars of the Brooklyn Rapid Transit Company. He stated that in his opinion the newer elevated cars of the Brooklyn Rapid Transit were as safe as the wooden cars at present in use in the subway and could be used with safety in the new subway loop if they were provided with more powerful motors necessary on account of the heavy grades. He recommended that any additions to the rolling stock to be used in the subways should be of steel construction throughout and as nearly fireproof as possible.

The chief engineer also submitted a report on the desirability of granting the request of the Pennsylvania, New York & Long Island Railroad for permission to open Thirty-Second and Thirty-Third Streets, in order that the tunnel now being built by that road may be finished as soon as possible and the street surface and the adjoining property safeguarded. He stated that, in his estimation, the request was a reasonable one, and is to some extent necessary because of the treacherous nature of the soil, which will not permit boring with any degree of safety in the places desired to be opened. He says that the work should be finished in twelve months and recommends that the request be granted.

This matter was opposed by property owners on these streets, and it was referred to a committee to report at the next meeting. Counsel for the company stated that the company was suffering from a loss of $1,600 per day while the work was stopped, and it was willing to enter into an agreement to protect the adjoining property owners from any loss of rentals and also to be responsible for any damage which might be done to buildings during the course of the work.

NEW YORK CENTRAL TO EXTEND ITS SERVICE

The New York & Harlem Railroad has announced that it will extend its electric service to that city by Feb. 17. The entire Mount Vernon freight yard is being moved back to give room for a 1000-ft. platform and a yard for the storage of the electric trains. In reaching out to Mount Vernon the New York Central will go a little beyond its first electric zone. Its next step will be to continue the electric system to White Plains, but this cannot be done until several important grade crossings are eliminated. It is announced that as soon as the electric service is extended to Mount Vernon two additional expresses between that city and the Grand Central station will be added, for the convenience of the Mount Vernon commuters.

THE T-RAIL AGAIN IN COLUMBUS

The Indiana, Columbus & Eastern Traction Company announces that when it gets ready it will lay T-rails in Columbus, Ohio, regardless of the attitude of the city authorities, who favor the grooved rail. The law firm of Pomerene & Pomerene, of Columbus, attorneys for the traction company, says the company has the right to lay T-rails in the city under its franchise. The franchise provides that any rail of an approved standard type may be laid, and the company claims the 90-pound "T" laid with the special block paving is an approved standard type and meets the requirements of the franchise.

The controversy over the T-rail in Columbus came up some weeks ago, when the city authorities attempted to compel the company to replace its T-rails on an unimproved street of the city with grooved rails, preparatory to improving the street. The company declines to remove its T-rails, but does agree to replace them with heavier T-rails and put in the special paving, which it is claimed answers all the purposes of a grooved rail. The situation is in a state of deadlock at present, as neither the city nor the company will concede anything further than has already been conceded. It is expected the city will make the first move by trying, through the courts, to compel the company to lay grooved rails on this street, when it is ready to improve it. The city expects to improve a number of streets during the coming summer, and has notified the traction companies operating over them to put down the grooved rails in preparation for the paving. The Columbus, Urbana & Western Traction Company has agreed to lay grooved rails on Water Street, between Gay and Spring Streets, and on Spring Street west of Dennison Avenue, and has ordered the rails and will comence work as soon as the material arrives.

ANNUAL MEETINGS OF BROOKLYN SUBSIDIARY COMPANIES

The annual meetings of stockholders of the subsidiary companies of the Brooklyn Rapid Transit Company, held last week, resulted in additions to several of the boards of directors and in changes in two instances. Nine directors were added to the board of the Brooklyn Heights Railroad Company. The reelected members are: J. G. Jenkins, D. H. Valentine, H. C. Du Val and Eugene N. Foss. The new directors are: A. N. Brady, E. W. Winter, T. S. Williams, A. R. Flower, H. H. Porter, E. H. Harriman, W. G. Oakman, Norman B. Ream and Henry Seibert.

The following were added to the board of the Brooklyn, Queens & Suburban Railroad Company: D. H. Valentine, Henry Seibert, J. G. Jenkins, H. C. Du Val and Bernard Gallagher. The re-elected directors are: A. N. Brady, E. W. Winter, T. S. Williams and J. F. Calderwood.

C. D. Meneely was substituted in place of J. T. Nelson in the board of the Sea Beach Railway Company. Otherwise the board remains the same as last year. G. D. Yeomans took the place of E. H. Harriman in the board of the Coney Island & Gravesend Railway Company. No changes or additions were made in the boards of the Nassau Electric Railroad, the Brooklyn Union Elevated, the Transit Development Company, the American Railway Traffic Company and the South Brooklyn Railway Company.

REPORT ON BRIDGES FOR HUDSON PROPOSES PROVISION FOR SPECIAL ELECTRIC LINES

The New York Interstate Bridge Commission, in its report to the New York Legislature, made public Thursday, Feb. 7, expresses the opinion that three bridges properly situated will best establish the desired direct communication between New York City and New Jersey. One of these, it thinks, should be somewhere between Fourteenth and Seventy-Second Streets, and the two others should span the Kills which flow between Staten Island and New Jersey. These bridges should be considered strictly as public highways and as works of public improvement, and the expense should be borne either by the States of New York and New Jersey or by the State of New Jersey and the City of New York in just proportion. The cost of construction of the Manhattan Bridge proper and the anchorages would not be less than $25,000,000, and might easily run to $35,000,000, says the Commission. It recommends that in view of the large space needed for terminals if they were to include trans-continental trunk lines and passenger and freight traffic, the bridge should be primarily for vehicles, foot passengers and trolley lines, rather than for trunk lines. The trolley lines should include, however, a special union line crossing and connecting with all the trunk lines in New Jersey. There should be provision for a union passenger station to Manhattan for such special union trolley line, where tickets could be sold and baggage checked for points on the trunk lines with which this trolley line would connect.

ANOTHER ACCIDENT FAKIR RUN DOWN IN PHILADELPHIA

The Philadelphia Rapid Transit Company is having more trouble with accident fakirs, despite the punishment meted out not so long ago to this class of criminals. Carl O. F. Nordlander, of New York, is the man apprehended this time. He was arrested in the company's office in the Land Title Building while trying to settle a $30,000 claim for $1,000, and was taken before Magistrate Beaton and held in $2,500 bail on a charge of conspiracy to defraud. Incidentally, the representative of the company who was responsible for the arrest, declared that the claim adjusters who were acting for Nordlander in his effort to get $30,000 damages had left town.

According to a representative of the company Nordlander has worked at various times as an insurance and real estate collector, but neither of these pursuits proved very profitable, and one June 27, 1902, he made $10, and again on December 11 last he made $100 in the form of damages from a Brooklyn company by falling from trolley cars. The effect of these accidents was heightened, according to Nordlander's own admission, by a sort of self-mesmeric power, which enabled him to appear unconscious.

On Jan. 4 Nordlander came to Philadelphia, spent the day looking over the city and the next day, while riding in a Market Street trolley car, was thrown to the floor by the car's sudden stopping at Twentieth Street.

Mrs. Margaret Olwell, whom the company's representatives say was a runner for the law firm that took up Nordlander's case, happened to be on the car, and the case was placed in their hands. Nordlander was first taken to the Olwell house, at No. 20 Sickel Street, and later to a house at 123 North Dearborn Street. There Nordlander's clothes were taken from him and he was locked up in a room so he couldn't escape. In the meanwhile he had signed a power of attorney agreeing that the law firm should act as his agents and that they should get one-half of the damages recovered. On Feb. 4, says the company's representatives, the lawyers disappeared from the city, and Nordlander made for the company's office. Mrs. Olwell had filed a claim, through attorneys, for damages, alleged to have been sustained at the same time Nordlander claimed to have been injured. In investigating her case the company's representative learned that she had settled a similar claim in August last. This led to an investigation of Nordlander's case, and when he called at the company's office he was allowed to draw up the papers for his acceptance of $1,000. He was then arrested.

B. R. T. EARNINGS FOR SIX MONTHS

Below are given the gross and net earnings, operating expenses and surplus of each of the four subsidiaries of the Brooklyn Rapid Transit Company for the six months ended Dec. 31, 1906, compared with those for the six months ended Dec. 31, 1905, as compiled by the "Wall Street Journal":

Gross earnings—

	1906	1905
Brooklyn Heights	$7,084,440	$6,627,459
Nassau Electric	1,674,840	1,689,529
Brooklyn, Queens Co. & Suburban	811,653	750,427
Coney Island & Gravesend	41,172	33,959
Total	$9,612,105	$9,101,374

Total percentage increase 5.61 per cent.

Operating expenses—

	1906	1905
Brooklyn Heights	$3,815,212	$3,518,825
Nassau Electric	1,003,553	922,828
Brooklyn, Queens Co. & Suburban	553,742	355,813
Coney Island & Gravesend	31,477	15,566
Total	$5,403,984	$4,813,032

Total percentage increase 12.27 per cent.

Net earnings—

	1906	1905
Brooklyn Heights	$3,269,228	$3,108,634
Nassau Electric	700,560	785,928
Brooklyn, Queens Co. & Suburban	257,911	394,614
Coney Island & Gravesend	10,254	18,608
Total	$4,237,953	$4,307,784

Total percentage decrease 1.62 per cent.

Surplus after charges—

	1906	1905
Brooklyn Heights	$764,968	$869,730
Nassau Electric	235,386	298,314
Brooklyn, Queens Co. & Suburban	146,298	168,708
Coney Island & Gravesend	*9,345	2,262
Total	$1,137,307	$1,339,014

Total percentage decrease 15.06 per cent.

* Deficit.

The reason for such a small percentage increase in gross earnings in the face of much heavier traffic is probably due in a large measure to the fact that the Brooklyn Rapid Transit is to-day giving out 84 per cent more transfers than it did a year ago, says the "Journal." Then, too, the Coney Island fare trouble of last summer caused a heavy loss in gross to the company. During the six months covered by these reports the company has expended a large amount in construction, betterments and additions. Just how much of this has been charged up to operating expenses is not known, but it is possible that operating expenses have been called upon to stand an amount sufficient to account in part for their considerable increase.

BOSTON & WORCESTER AND THE NEW YORK CENTRAL COMPANIES ARRANGE OPERATING RIGHTS FOR ENTRANCE OF FORMER TO BOSTON

A tentative agreement, involving important changes, has been entered into by the officials of the Boston & Worcester Street Railway Company and the New York Central Railroad Company. Among the interesting changes promised as the result of it is the reduction of the running time of the Boston & Worcester trolley air line cars between Worcester and Boston, to 1 hour and 30 minutes, and the establishment of the trolley freight business that has been under consideration by the Boston & Worcester Company for some time.

The agreement is to the effect that the Boston & Worcester road run from Newton Highlands into Boston over the Boston & Albany circuit branch, and have its Boston terminus at the old Park Square station, which the New York Central recently secured on a conditional sale, awaiting legislative sanction. By the carrying out of this agreement, the railroad can electrify its circuit branch, a thing that has been under consideration.

Another plan that the Boston & Worcester has in mind is the construction of a 3¼-mile boulevard from a point in South Framingham, opposite the South Framingham muster field, to Fayville, at the Southboro and Framingham line, to cost $300,000. This last is probably to be the outcome of a proposal of the town of Framingham, after long dickering with the road.

The acquisition of the trolley line by the New York Central would give the steam road the facilities it needs to electrify its circuit branch, the trolley roads power station solving the question of power. The establishment of an hour and a half schedule on the trolley line with the cars running right into the Park Square station the same as steam trains, would give Worcester patrons better service to Boston than the local Boston & Albany trains now give. The time would be about the same, but the advantage would come in more frequent cars and the opportunity to get aboard at City Hall without having to go to Union Station. The advantage to the steam road would lie in the fact that the excellent trolley service would divert most of the local Boston & Albany passenger traffic from the steam road, leaving the tracks clear for through trains and freights.

Anything that would help relieve the congested condition of the Boston & Albany division would, no doubt, be welcomed by the management, and if it could take some of its rolling stock now used in local traffic and use it for other purpose the chance would be snapped up eagerly. Those most familiar with the facts put it that the acquisition of the Boston & Worcester by the New York Central is the logical thing. The establishment of a trolley freight service by the Boston & Worcester means an additional revenue estimated at $100,000 a year, and it is a service the road is anxious to get started.

Recent developments indicate that a select freight and express business and also a fast passenger service over the Boston & Worcester will be a reality soon. This is to be brought about by a skilful move on the part of the Boston & Worcester officials, who, it is said, are negotiating to run their cars into the Hub from Newton Highlands over the Boston & Albany division steam road right of way, by way of the Brookline branch of the Newton circuit.

Another point in the new arrangement quite as important as the carrying of select freight and express, will be the fast passenger express service that will be made possible. The present running time between Boston and Worcester is 2 hours and 15 minutes, at least 15 minutes of which is lost by the slow service between Chestnut Hill and Park Square. That 15 minutes and more will be saved by having the cars run over the Boston & Albany right of way from Newton Highlands is assured. Moreover, the Boston & Worcester officials are planning the completion the coming spring of their double track along the entire line from Worcester to Boston.

AN IMPORTANT OHIO AGREEMENT

An understanding has been reached between the Everett-Moore syndicate and J. W. Holcomb and associates, by which the Cleveland, Alliance & Mahoning Valley lines will be constructed to operate in harmony with the Northern Ohio Traction & Light roads. It is even said that the new road will be constructed with the idea of merging the two later on. C. R. Morley and the Stark Electric are also brought into closer touch with the Northern Ohio, as he is interested in the Cleveland, Alliance & Mahoning Valley. Under the agreement the new road will be built in sections, the portion between Ravenna and Warren being undertaken first. The stretch of track leased from the Baltimore & Ohio will be electrified and the link from Newton Falls to Warren built. This portion, with the Kent-Ravenna division of the Northern Ohio and the Mahoning & Shenango Valley between Warren and Youngstown, will complete the trolley connection between Akron and Youngstown and between Cleveland and Youngstown, for that matter. This leaves the portion of the route between Cleveland and Alliance, which will be divided into two sections, one from Cleveland to Revenna and the other from that point to Alliance. As yet it has not been decided which will be taken up first. At Bedford the new road will probably join the Northern Ohio, thus saving about 3 miles of track construction. From Randall the company will build south to the Northern Ohio tracks, but will come into the city over the original Kinsman Street route. This will allow the limited cars of the Northern Ohio to take the same route, to shorten the route through the city.

IMPORTANT PROJECTS AFFECTING THE PITTSBURG WHEELING LINE

It is expected that electric railway lines will soon be built which will complete electric railway connections between Pittsburg and Wheeling, via Wilmerding, Trafford City, Hunker, Uniontown and Masontown. It is proposed to extend the Uniontown-Masontown line to New Geneva or Point Marion, where connection will be made with an extension of the Wheeling system. A connecting link is to be built between Scott Haven and Hunker, a distance of 11 miles; also an extension from Greensburg to Irwin. Plans have been prepared by the West Penn system for an extension of the Greensburg line northwardly to New Alexandria, with a branch from Jamison No. 1 westwardly to Latrobe, where it will connect with the Latrobe Street Railway Company on Ligonier Street. An extension is to be built from Baggaley through Whitney and Tranger to Hecla, where connection will be made with the Greensburg & Southern. The West Penn Railways also intend building an extension of the Greensburg & Southern to Irwin via Jeannette and Manor. The Pittsburg, McKeesport & Westmoreland Railway Company proposes building a line from Donora north to Claridge near Manor. The lines have been financed, and $200,000 worth of bonds underwritten and mortgages recorded, while franchises are being sought in a number of towns. Scottdale Borough Council has passed the ordinance granting a franchise to the Pittsburg, McKeesport & Greensburg Railway Company, and the company will build the line at once. Notice has been given by W. S. Kuhn, J. P. Kuhn, J. H. Purdy, J. B. Van Wagner and R. P. Watt of their intention to ask for a charter for the Greensburg & Western Railway Company, a constituent corporation of the West Penn system, which will build the line from Greensburg to Irwin, passing through eight towns in the 10-mile route, viz.: Rodebaugh, Grapeville, Jeannette, Penn Manor, Shawtown, North Irwin and Irwin. The line will skirt the Pennsylvania Railroad tracks the greater part of the distance. It is the intention of the Pittsburg, McKeesport & Greensburg Company to build into the heart of the Connellsville coke region this year, and a right of way has been secured in Mt. Pleasant. The local lines in Greensburg also contemplate an extension to Latrobe.

FAVORABLE ACTION ON ELECTRIC RAILWAY FREIGHT BILL IN PENNSYLVANIA

Favorable action has been taken by the House electric railways committee on the Housher bill, permitting electric railways to carry freight, and its early passage is expected. This bill extends the right to all railway or railroad companies in the State to transport freight and to charge and collect a reasonable compensation, any limitations in the charters of said companies to the contrary notwithstanding. There is only one proviso, that the transportation of freight by the trolleys in cities shall be under such regulations as the municipal authorities may prescribe. Many legislators are anxious that there shall be the same local regulation of the freight carrying in boroughs, and an amendment for that purpose will be offered on the floor of the House.

Passes on railroads and street railroads cannot be used by legislators or State officials under a bill put in by Senator Roberts, of Montgomery, which makes the officials of the company and the public officers subject to a fine of $5,000 or imprisonment for one year for violation.

The House passed finally the bill allowing municipalities to institute quo warranto proceedings to compel public service corporations to forfeit their franchises when they fail to perform their duties properly. The vote was unanimous.

Representative Dearden, of Philadelphia, has introduced a bill requiring street passenger railway companies to provide a seat for each passenger, otherwise to collect but half-fare from passengers compelled to stand. This rebate does not apply to a passenger who gives his or her seat to another passenger. Any employee declining to refund half the fare to a "strap-hanger" or to give an order on the company for this rebate is liable to a fine of $100.

Another bill introduced strikes from the act of May 6, 1897, the proviso that any bridge shall be used only for general public travel and shall not be occupied by any railroad, transportation company or private corporation; also, providing for the strengthening of bridges used by street railway companies.

A bill providing for an initiative and referendum system of legislation in cities and boroughs of the State and affecting the granting of franchises has also been introduced. It directs that no measure, save those necessary immediately for the temporary preservation of peace or health of a community, shall become a law until thirty days after its enactment, that no franchise shall be sold or granted for a longer period than six months, nor shall it include a provision for the sale or purchase of real estate. During this thirty days interval 3 per cent of the voting population may by referendum petition demand a submission of the ordinance to a vote of the people, a majority vote to decide. Ten per cent of the voting population may propose the enactment of legislation by initiative petition, and such measure shall have precedence over all but emergency measures, and shall be formally acted upon either by its enactment without change or by the said legislative authorities proposing a competing measure within three months from the filing of the voters' petition. Special elections can be held if demanded by the majority of Councils or by 20 per cent of the voting population. The Mayor cannot veto a measure the people have approved. Any measure passed by a referendum can be repealed only in the same manner.

PRESIDENT WINTER OF B. R. T. DEFINES HIS ATTITUDE WITH REGARD TO EQUIPMENT FOR BRIDGE LOOP

In connection with the proposal to permit the Brooklyn Rapid Transit Company to operate its present elevated equipment through the subway to be built to connect the Brooklyn and the Williamsburg Bridges, President Winter, of the company, has sent to Commissioner Orr, of the Rapid Transit Commission, a letter in which he makes the attitude of the company to the proposal very plain. Mr. Winter explains in detail the equipment which will be suitable for the subway, which consists of 558 motor cars. The rest of the equipment, trailer cars, rebuilt from the old steam elevated equipment and described in the Street Railway Journal some time since, he deems not available for the new service. To replace this equipment with steel cars, he explains, would cost $3,000,000. President Winter's letter follows:

Brooklyn, Feb. 6, 1907.

Alexander E. Orr, Rapid Transit Commission, New York:

Dear Sir—Lest the magnitude of cost, which would be involved in the one item of composing the elevated trains of the Brooklyn Rapid Transit system, exclusively of motor cars, as suggested at the conference yesterday, should be underestimated by your Commission through lack of technical information on that phase of the subject, I beg leave to supplement what I then said with the following brief statement:

The Brooklyn Rapid Transit elevated equipment consists of 558 motor cars and 269 trailers. A motor car is constructed after plans quite different to those of a trailer. It is heavier, of somewhat different proportions and stronger, in order to accommodate and to carry the equipment and bear the strain incident to its operation. The trailer now being designed for that purpose cannot be adapted to motor service; hence if the elevated trains should be composed exclusively of motor cars the 269 trailers now owned by the company would have to be thrown out and motor cars substituted. This would mean an outlay in the first instance, and without increasing train capacity of say $3,000,000 and a proportional increase in the cost of all new elevated trains.

I mention this because in the somewhat hurried discussion yesterday afternoon it was not brought out. It will readily be seen that this item alone will be an important contribution to the list of serious questions involved in the plan under consideration.

Nor can I see how the operating company could be secured in the right against contingencies permanently to operate other than strictly fireproof cars through the proposed subways, however remote the risk, and I believe with His Honor the Mayor, that it would be remote, but I have not consulted our legal department on this point. It is the earnest desire of this company to co-operate to the fullest extent in your effort to solve the troublesome problem, and we feel that we would fall short of this if we did not put before you in all frankness the grave question, physical and financial, which from our point of view the operation of a subway loop would be invested. Now is the time to consider them.

Yours respectfully,

E. W. WINTER, President.

NEW PUBLICATIONS

Electric and Magnetic Measurements and Measuring Instruments. By Frank W. Roller: New York. McGraw Publishing Company. 398 pages. Illustrated. Price, $3.50.

It is somewhat remarkable that in the wealth of literature upon electrical topics the subject of measuring and recording instruments should have been so comparatively neglected in the past. There has been, it is true, a large number of works upon testing, but they have related to the finer requirements and conditions of laboratory work rather than those of commercial practice. The increase both in the number of instruments used and in the size of the manufacturing industry devoted to their production is sufficient justification for the volume by Mr. Roller. The author describes both the instruments themselves and the principal work for which they are designed. The list in the appendix shows thirty-nine makers of instruments of the kind described.

Concrete Factories. Compiled by Robert W. Lesley. Published for "The Cement Age" by Bruce & Banning: New York. 152 pages. Illustrated. Price $1.00.

The newest contribution to cement literature, and one for which there has been a demand for a long time, is "Concrete Factories," a series of papers descriptive of the uses of cement and concrete as applied in the construction of industrial plants. It offers in condensed form a very complete review of the principles underlying reinforced concrete construction, and contains the report of the United States Advisory Board on Fuels and Structural Materials, the report of the sub-committee on tests, the French rules on reinforced concrete just issued by the Ministry of Public Works in France, and a number of profusely illustrated articles showing the methods of reinforced concrete construction, including all the well known reinforcing systems.

The Prevention of Accidents. Second edition. By F. W. Johnson. New York: McGraw Publishing Company. 37 pages. Price of single copies 25 cents; special price on larger quantities.

The first edition of this pamphlet was prepared by the claim agent of the Conecticut Railway & Lighting Company, to assist the management in instructing its carmen concerning practical means of preventing the more common class of accidents and the proper handling of those accidents, and was given to the men in pamphlet form. The instructions contained were in no sense intended to supplement the rules, but were intended as suggestions for action in case of emergency, and were based on the experience of the company on its different street railway systems in Connecticut. The results of putting into the hands of the men information of this kind was remarkable; not only did the accidents decrease but a spirit of emulation was instilled among all the men to make a record so far as immunity from casualties was concerned, and to take the same measure of responsibility which the management itself felt as to the care of passengers. The demands upon the author from other companies for copies of this book was so great that it was decided by him to publish a second edition for more general circulation. In this edition, which has been prepared with this use in mind, the pointers contained in the first edition, which had a local value only, were either omitted or were changed so as to make them of general application. At the same time the text was considerably expanded by the addition of new matter. As now constituted the book is intended to be of such a character that it can be put directly into the hands of all motormen and conductors and will not interfere with the local rules in force on any road.

A Dictionary of Electric Railway Material, 1907 Edition. New York: McGraw Publishing Company; 164 pages.

This dictionary of electric railway material is a revised edition in book form of the information published in the Street Railway Journal of Oct. 13, 1906, giving a brief description of a very large percentage of the principal types of electric railway apparatus and supplies manufactured in the United States; also several pages of information regarding leading dealers, engineers, contractors, financial institutions, etc., doing business in this field The dictionary had its beginning in the Souvenir Edition of the Street Railway Journal for 1905. It was revised and reprinted in book form shortly thereafter, and again was revised and reprinted in the souvenir Street Railway Journal for 1906. The edition just issued contains thirty pages more than the edition of 1906, and the many cross references in the index make ready reference very easy. The book is intended for general distribution to street and interurban railway companies, and may be had upon application to the Street Railway Journal.

Relazione Sugli Studi e Lavori Esequiti dal 1897 al 1905. Published at Rome, by the Italian Mediterranean Railroad Company. 2 vols.; 382 pages and 54 plates.

This magnificent set of volumes is an example of the way foreign railway companies sometimes chronicle the progress made by them. Other publications of similar purpose issued by the Grosse Berliner Strassenbahn and other German companies have been noticed in these columns, but none has been on such an elaborate scale as that issued by the Società Italiana Strade Ferrate del Mediterraneo. Of course, the completion of the Simplon tunnel, which forms the outlet to the north and northeast of this railway system, and which was celebrated by the Milan Exposition of last summer, offered an unparalleled reason for a publication of this kind. A very full account is given in these two volumes of the construction of the railways which were built by the Italian Government to connect the Italian side of the Simplon tunnel with the through lines of the Mediterranean railway system to Milan on the southeast and Turin on the southwest. The work is very handsomely illustrated throughout with half-tone engravings and working drawings.

The Peabody Atlas: Coal Mines and Coal Railways in the Central Commercial District of the United States. By A. Bement. Published by the Peabody Coal Company, Chicago; 150 pages. Price, $5.00.

This atlas is the successor of several wall maps issued by the publishers, giving the location and information of the coal areas of Illinois and Indiana. The favor with which these maps was received by railway officials, coal producers and consumers led to the publication of the present atlas and the expansion of the territory treated so as to cover Ohio, Michigan, Western Kentucky, Iowa and Missouri in book form. In addition to the maps and comprehensive index, the atlas includes a discussion of the subject of smokeless furnaces and smoke suppression.

The Engineering Index, Vol. IV., 1901-1905. By H. H. Supplee and J. H. Cuntz. New York: The Engineering Magazine; 1234 pages. Price, $7.50.

The value of a comprehensive index in any field of effort is generally recognized. The publishers of the "Engineering Magazine" have covered the general engineering field very acceptably for the past fifteen years, and are to be commended for the thoroughness with which they have done their work. The present volume is carefully cross indexed and gives a short description of the article as well as its length and the paper and date at which it appeared. Over 250 technical journals are indexed, and more than one-fourth of this number are published in languages other than English. Hereafter the index will be issued annually.

Street Railroad Accident Law. By Andrew J. Nellis. Albany, N. Y.: Matthew Bender. Law sheep, 850 pages. Price, $6.00.

The author of the present volume is a member of the Albany bar, and is known to legal and railway circles through his previous volume, "The Law of Street Surface Railroads." The enormous increase in the volume of street railway accident litigation through the electrification of roads and the consequent increase in weight and speed of cars has created a demand for a book of this kind. Mr. Nellis has gathered together, classified and analyzed the principles and rules of law of liability as applied by the courts of the different States and Territories and those in Canada to street railway companies. The volume opens with a general discussion of the use of streets by street railway companies and the nature of their liability for accidents. This is followed by chapters on the principles of the law of negligence as applied to passengers, to employees and to others. Other subjects discussed are pleading, evidence, presumptions, burden of proof, damages and court and jury. Under "damages" a list of cases is given with awards which were considered excessive and others which were not so considered.

SUBWAYS IN LOS ANGELES

The West Fourth Street subway ordinance was the first act of legislation signed by the new Mayor. The permit provides for either single or adjacent tunnels, but the Los Angeles-Pacific Company says that single tunnels containing two stacks will be built at this time; later, a second tunnel will parallel the first; then outgoing cars will run through one tunnel and incoming trains through the other. The subways provide for about 4 miles of tunnels. The cars will cross but one street on grade between Hill Street and Vermont Avenue. Through trains will reach the city limits in 6 minutes. Outside the city crews are now at work on the air lines that will complete the rapid transit road. Many lines of the Los Angeles-Pacific west of the city are being rebuilt. The Los-Angeles Pacific owns practically all the land under which the subways run except the city streets.

After much delay the Mayor has at last signed the last of the special permits to the Harriman interests, giving them the right to tunnel in the north end of town through Sunset Boulevard. The Mayor thought the company should pay as much as $10,000 for the privilege of tunneling under the old cemetery, but the company refused to give more than $1,000. A veto message was dictated by the Mayor, whereupon he was besieged by North End property owners who wanted the ordinance to go through.

"I never thought so many people could get started on a thing all at once," said Mayor Harper. "The question resolved itself into whether the city should accept the subways as the railroad company wants to build them, or whether the project should be abandoned," he went on. "North End citizens assured me that they will accept without protest increased assessments on their property sufficient to raise the $9,000 difference. Subway building is comparatively a new undertaking in the West. Such a system of underground railways as that promised by the Los Angeles-Pacific Company is unprecedented in a city the size of Los Angeles.

"As the Mayor of the city I could not afford to stand right in the path of progress and block the way for the sake of $9,000."

This permit supplied the missing link in the short line from Hollywood to Fourth and Hill Streets. Fifteen minutes to Hollywood is the schedule for the new line. Cars will run from Fourth and Hill Streets along the surface of Hill Street to First, then they will pass through a two-block combination railway and driveway tunnel from First to Temple Streets. This tunnel alone will cost $150,000, and will be built and used jointly by the city and the railway. North of Temple Street the cars will pass through a private subway underground owned by the railway company, and under one end of the old city cemetery. At Hill Street and Sunset Boulevard the new line will join the present Hollywood road.

STREET RAILWAY PATENTS

[This department is conducted by Rosenbaum & Stockbridge, patent attorneys, 140 Nassau Street, New York.]

UNITED STATES PATENTS ISSUED JAN. 29, 1907

842,202. Railroad Track Construction; Solon G. Howe, Detroit, Mich. App. filed Sept. 4, 1906. Relates to a method of constructing the roadbed.

842,222. Catenary Suspension for Trolley Wires; George A. Mead, Mansfield, Ohio. App. filed Nov. 23, 1904. The trolley wire is suspended from a messenger wire which is supported by brackets which laterally extend from poles at the track side.

842,241. Mechanical Ear for Trolley Wires; Thomas E. R. Phillips, London, England. App. filed Aug. 1, 1905. Comprises an inverted U-shaped frame in which are mounted a number of pairs of plates in pivotal and removable connection, said plates being adapted at their lower ends to embrace and retain an electric conductor and means for connecting up said frame to a span-wire.

842,285. Block Signaling System for Railways: Adoniram J. Wilson, Westfield, N. J. App. filed Aug. 21, 1906. A signaling system employing the same source of electric energy as that employed for the propulsion of the trains.

842,298. Car Seat; Edward G. Budd and Charles A. Conde, Philadelphia, Pa. App. filed May 25, 1905. Details of construction of a seat of the "walk-over" type.

842,300. Railway Signal; Clyde J. Coleman, New York, N. Y. App. filed March 9, 1903. A semaphore arm is raised and lowered by means of liquid carbonic acid gas, controlled by valves which are opened and closed by relay circuits including track rails.

842,315. Single Track Signaling System; Robert J. Hewett, Westfield, N. J. App. filed Aug. 22, 1906. An overlap system of signals operated by short-circuiting the track rails by a passing train. Employs polarized relays for securing the overlap feature.

842,358. Wireless Balance for Electric Generators; Robert C. Taylor and Edward Taylor, Brooklyn, N. Y. App. filed Aug. 8, 1904. One of the objects of this invention is to provide means in an air-braking system whereby upon the operation of one pump the remaining pumps in the same system are automatically started without the use of additional wires or other connections between the cars in which the system is installed.

842,366. Electric Block Signaling System; Adoniram J. Wilson, Westfield, N. J. App. filed Aug. 21, 1906. Employs among other features the same source of electric energy as utilized for the propulsion of the trains.

842,367. Electric Block and Block-Section Signaling System; Adoniram J. Wilson, Westfield, N. J. App. filed Aug. 21, 1906. Modifications of the above patent.

842,380. Switch Operating Mechanism for Cars; Junius Barnes, Burlington, Vt. App. filed May 24, 1906. A switch-throwing lever extending through the car platform and having a shoe to engage the switch point, said lever having spring means for normally holding the lever out of operative position.

842,424. Fluid Pressure Brake; William H. Sauvage, New York, N. Y. App. filed May 25, 1906. Provides novel means whereby a second or auxiliary cylinder may operate its piston to reinforce or increase the brake pressure after the main cylinder has operated its piston to take up the slack and set the brake-shoes against the wheels with an initial pressure of less degree.

842,425. Fluid Pressure Brake; William H. Sauvage, New York, N. Y. App. filed Sept. 1, 1906. Consists in the combination of a telescoping piston rod for the auxiliary cylinder, a latch arranged to hold the telescoping members extended, and means for tripping the latch before the piston completes its return stroke, said means comprising a fixed dog having a beveled face located in the line of travel of the latch.

842,432. Electric Signal for Railways; Horatio Smelser, Ashton, Neb. App. filed Oct. 7, 1905. Semaphore signals are operated through circuits by the engagement of the car wheel with tappets in the roadbed.

842,460. Railway Switch; Philip D. Hibner, Seattle, Wash. App. filed March 15, 1906. The flange of the car wheel depresses a lever whereby a pin is thrown into position to be engaged by the car to throw the switch.

842,474. Brake Rigging; James A. Lightbody, Waterville, Me. App. filed Oct. 12, 1906. Consists of a truck-bar, a bracket having upper and lower bars joined together and fixedly connected to upper and lower portions, respectively, of the truck-bar, a brake beam and a connection intermediate the bracket and the beam for hanging the latter from the former.

842,475. Fare Register; William L. Lightford, Indianapolis, Ind. App. filed Feb. 2, 1906. Details of a portable receptacle for fares having registering means.

842,476. Fare Register; William L. Lightford, Indianapolis, Ind. App. filed Feb. 2, 1906. Improvements in above patent relating to means for registering different classes of fares.

842,508. Rail Joint; Benjamin Wolhaupter, New York, N. Y. App. filed Sept. 28, 1906. Comprises a longitudinal girder plate having interlocking connection with one side margin of the base plate, a joint bar interposed between the rail ends and the girder plate, and track bolts extending through the rails, the joint bar and the girder plate.

842,545. Electrical Connection for Railway Rails; Eugene Hayward, Clayton, Mich. App. filed Aug. 21, 1905. The webs of the adjoining rails are receded to receive a bond over which the fish-plates are bolted.

842,559. Car Fender; James E. Kinnebrew, Sharpsburg, Pa. App. filed June 6, 1906. Comprises fixed front and back sections and a movable intermediate section.

842,574. Electric Danger Signal; Alexander McCahon, St. Joseph, Mo. App. filed April 30, 1906. A railroad signal comprehending among other features a specially constructed arm projecting from the locomotive, which carries five contacts to

ride on five trolley wires extending on the under side of an insulating board or support.

842,581. Rail Anchors; Fred A. Poor, Chicago, Ill. App. filed Jan. 8, 1906. Interlocking clip members engage the base of the rail and have a depending flange to engage a tie or other support.

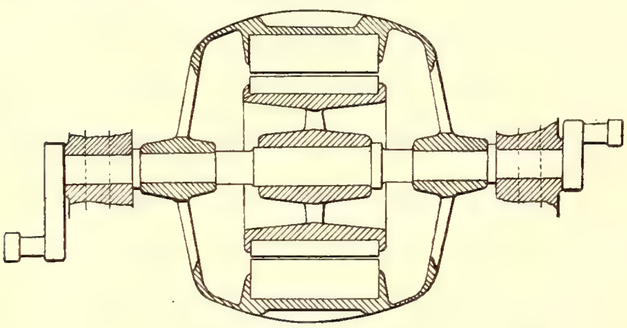
842,646. Self-Locking Switch-Operating Mechanism; Robert F. Gaunt, St. Louis, Mo. App. filed Nov. 6, 1906. Details of an automatic switch-locking and operating mechanism.

842,673. Electrical Apparatus for Setting the Points and Signals on Railways; Lorenz Mottmair and Rudolf Zwack, Munich, Germany. App. filed July 3, 1903. The switchpoints and signals on a railroad are set by means of electrical devices which act thereon in succession so that when an electric circuit belonging to a line is closed, each succeeding actuating device after operating closes the circuit of the next.

842,740. Trolley; Pearl J. Wires, Osborn, Ohio. App. filed March 13, 1906. A pair of trolley wheels are journaled in yokes on a swivel support so as to continue in alignment with the trolley wire regardless of the direction of the pole.

842,781. Insulated Cross-Over for Electric Railways; Edward E. Gilmore, Philadelphia, Pa. App. filed Sept. 27, 1905. A cross-over by which one line is kept electrically separated from the other, as is desirable in case of different railroads or different circuit potentials.

842,774. Air Brake System; William H. Eichelberger, Royalton, Pa. App. filed Oct. 10, 1905. Relates to hose connection between cars and provides means whereby any injury to the hose will cause the air to be automatically cut off.



PATENT NO. 842,957

842,815. Rail Joint; Edward H. Schwartz, Chicago, Ill. App. filed May 25, 1903. The fish-plates are formed with portions which underlie the base of the rail so as to make a tight connection therewith and to press a contact bar into close engagement with the rails to serve as a bond.

842,828. Railway Signal; Clarence W. Coleman, Westfield, N. J. App. filed March 1, 1904. Provides means interposed between the motor and the signal for increasing the efficiency or effectiveness of the motor, consisting of a connection which operates to increase the mechanical leverage.

PERSONAL MENTION

MR. L. RUSSELL GODWIN, at one time treasurer of the Citizen's Street Railway Company, now the Memphis Street Railway Company, is dead.

MR. WILLIAM SCHWERTFOGER, of Fredonia, has been appointed superintendent of the local lines of the Buffalo & Lake Erie Traction Company, to succeed Mr. W. N. Marinan, resigned.

MR. A. S. MURPHY has resigned as purchasing agent of the Indiana Union Traction Company to accept the position of assistant general manager of the Illinois Traction system, with headquarters at Springfield.

MR. E. L. SCHMOCK has resigned as auditor of the Kokomo, Marion & Western Traction Company, of Kokomo, Ind., to become assistant secretary of the Cleveland, Painesville & Eastern Railway Company, with headquarters in Willoughly, Ohio.

MR. H. R. GOSHORN has been appointed general claim agent of the Philadelphia Rapid Transit to succeed Mr. S. L. Rhodes, resigned, who, as previously noted in the STREET RAILWAY JOURNAL, has become general supervisor of claims of the Casualty Company of America.

MR. J. W. SMITH has been appointed general manager of the City & Elm Groove Railway Company, of Martins Ferry, Ohio, to succeed Mr. L. S. Kirker, resigned, who retired from the company because of ill health. Mr. Smith formerly was manager of the Electric Traction Company, of Philadelphia.

MR. F. W. BROOKS, assistant general manager of the Detroit United Railway Company, has been appointed general manager of the company to succeed Mr. J. C. Hutchins, who formerly has held the offices of president and general manager, but who hereafter will act only as president. Mr. Brooks became associated with the Detroit system in 1895, as general manager of the Rapid Railway Company. Before his connection with that company he was with the Illinois Central, the Queen & Crescent and the Texas Pacific Railroads. When the Rapid Railway was taken over by the Detroit United a few years ago, Mr. Brooks was appointed to the position of assistant general manager under Mr. Hutchins. His appointment as general manager is in recognition of the services rendered in the capacity of assistant to Mr. Hutchins.

MR. J. H. PARDEE has resigned as general manager of the Rochester & Eastern Rapid Railway Company, of Rochester, N. Y., to become operating railway manager of J. G. White & Company, of New York. Mr. Pardee was born at Lysander, N. Y., in 1867, and in 1889 was graduated from Hamilton College. In 1891 he was admitted to the bar of New York, and began to practice as a member of the firm of Petrie, Zimerman & Pardee, with whom he continued until 1898. In 1897, however, he perfected the reorganization of the railway, lighting and gas company at Canandaigua. Since 1898 he has, besides acting as general manager of the Rochester & Eastern property, also managed the Canandaigua Gas Light Company and the Ontario Light & Traction Company. Mr. Pardee has been connected with the Street Railway Association of the State of New York as an officer since 1903, and is at present secretary of that body.

MR. WALTER W. WHEATLY, president and general manager of the Mexico Electric Tramways, Ltd., of Mexico City, Mex., has resigned from that company. He expects, however, to remain in Mexico, with which he is pleased as a residence and where he has important business interests. Among the enterprises in Mexico outside the railway field with which he is now identified as a director are the Mexico City Bank, the American Banking Company of Guadalajara, a new insurance company known as La Latino-Americana Mutualista, Compania de Seguros Sobre la Vida, S. C. Ltda., and the Mexican Title & Surety Company. Mr. Wheatly, who formerly was connected with the Public Service Corporation of New Jersey and the Brooklyn Rapid Transit Company, accepted the management of the Mexico City Company at the solicitation of Werhner, Beit & Company, of London, and after serving as manager for about two years he was appointed about a year ago president and manager of the company. So successful was Mr. Wheatly in this capacity that at the last meeting of the Mexico Electric Tramways, Ltd., in London, Colonel Sir Charles Euan-Smith, K. C. B., C. S. I., chairman of the board of directors, who had just returned from Mexico, where he made a thorough inspection of the company's property, said, among other things: "It is with sincere pleasure that I am able, with the concurrence of your board, to bring to your notice the services of Mr. William Walter Wheatly (the general manager), and of the able staff which he has succeeded in gathering around him. Most of these gentlemen are well known in the tramway world as having successfully filled responsible positions in important concerns of a similar character in the United States. Of Mr. Wheatly himself, of his capability and of his devotion to the company's interests, it is impossible to speak in too high terms, and I beg to submit for your appreciation the proposal that we pass a cordial vote of thanks to him and to his colleagues for their services during the past year." It has since become known that when the London board transmitted to Mr. Wheatly this resolution there accompanied it a draft for £3 000, equal to approximately $30,000 Mexican currency, as a substantial token of its appreciation. Mr. R. C. Brown, of Toronto, one of the directors of the new Canadian company, known as the Mexican Tramways Company, and to whom has been given the title of managing director, is now in Mexico City and will perform the duties of general manager for the present at least.

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During 1906 *the Street Railway Journal printed and circulated* 426,950 *copies, an average of* 8210 *copies per week. Of this issue* 8200 *copies are printed.*

Parks and Pleasure Resorts

This is the season in which practically all of the electric railway companies are making plans for the summer business. In these arrangements the question of the park business and the proper attractions to be presented at the pleasure resorts owned or reached by the company's lines constitutes one of the principal problems. This has led the publishers of this paper during February or March of each year to devote one or two issues largely to this subject. We believe that no excuse need be offered for discontinuing for one week the usual quota of discussions on engineering and operating subjects printed in this journal, and for considering the park question. There is hardly an electric railway company in the country to which it is not an important question. Even the steam railroads are learning the relation between amusement parks and the transportation business. This is illustrated by an incident which happened recently in the case of the president of one of the most important steam railroad companies in the East. In looking over the vouchers for payments in the accounting offices of his company he discovered one which called for the expenditure of $50 for four ring-tailed monkeys. He did not at first understand what use his company could make of the simians, but it was soon explained by the fact that they were destined for one of the parks which belonged to a trolley line recently taken over by his company.

Although this issue does not contain a discussion of the relative popularity at park resorts of monkeys with straight or ring tails, we believe that the park practice of the companies in Baltimore, Joliet and Minneapolis, the hints offered in the extended article on park resorts by Mr. Hulse, and the descriptions of some of the latest pastimes devised for parks will prove of interest. While many managers are ready to leave the actual details of park management to some one who has had training along amusement lines, very few are willing to jeopardize the future success of their pleasure resorts by leasing them or otherwise turning over their management to outside control. As has been repeatedly pointed out in these columns, a park property can be almost irreparably injured in reputation during a season or two if not conducted along proper lines, and in not a few cases electric railway companies which have turned over the management of their parks to others have been obliged to rescue them at considerable expense and conduct them directly, purely as a matter of self-protection.

An idea of the extent of the investment at present in street railway parks can be had from the descriptions of the elaborate and extensive buildings and grounds at the parks described elsewhere in this issue. During the days of the horse railways, few street railway companies which had parks boasted of anything more pretentious than a grove at the end of their line where family parties could spend the day. The patrons carried their meals in lunch baskets, and practically the only amusements provided were improvised swings with an occasional small merry-go-round. The change from these primitive methods has been brought about either through the introduction of the electric railway or through an increased desire and demand for luxuries of all kinds, or from both causes. The merry-go-round with its single line of wooden horses has given place to the three-row carrousel equipped with every kind of fantastic creature,

which will perform all sorts of rhythmic movements. The peanut stand has been replaced by the restaurant. Scenic railways, roller coasters, shoot the chutes, amusement palaces, skating rinks and shows of all kinds have been added; in fact, every new amusement feature which can be thought of is a drawing card and must be had. People have been educated up to this sort of thing, they expect it and are ready to pay for it.

The management of parks has as many sides as that of a transportation business, and the chances of losing money by mistakes are even greater. We believe, however, that as a whole the street railway companies of the country are well satisfied that an amusement resort judiciously located and properly conducted is a paying investment when taken in connection with the transportation, and can often be made self-supporting.

Progress in Axle Manufacture

In view of the importance of securing such strength in car axles that breakages in service may be as infrequent as possible, a recent paper by Mr. Henrik von Z. Loss before the Franklin Institute on the manufacture of railway car axles is of considerable interest. In a general way axle specifications are now pretty well standardized, and there is not much doubt that operating companies can secure any reasonable steel composition which they are prepared to pay for. Any improvement in methods of manufacturing, however, is an indirect benefit to the consumer, for it tends to give him a better product for the same money, regardless of any positive decrease in selling price.

Mr. Loss pointed out that the ordinary methods of axle manufacture are more or less unfinished and crude, involving large wastes, both in material and labor. The hammering of the billet in open dies tends to compress the material of the axle imperfectly; the greatest hammering is not close to the wheel seat, where the maxima stress moments occur, so that the billet is hammered where it is less needed, at the middle and center; axles are generally not annealed, though they should be, and they should be straightened to avoid waste of material in rough turning; the usual method of hammering frequently causes a waste of 15 per cent, repairs to hammers are heavy, and the fuel consumption is excessive.

Recognition of these defects has led to the use of vertical forging presses, tending to decrease the repair and fuel cost, and to give a product better in texture, closer to dimensions and less wasteful of material. The use of additional mills for the production of round bars has not given the general satisfaction anticipated, and some improved forging process seems to promise the best results so far. The production of axles on a machine embodying the principle of upsetting a billet with hydraulic power has been successfully carried out, the forging process being conducted in a longitudinal direction. With the upsetting process the wheel fit and adjoining parts receive the greatest amount of forging; press repairs are nominal barring the wear of die-sleeves; the flow of metal at the center is just about as great as at the surface; the axle when made is true and smooth throughout, and there need not be as much allowance for turning the wheel fit and journal. The surface is true and smooth between wheel fits; no rough turning is necessary, and the hard outer scale therefore remains intact—an advantage of no little value in relation to the strength of the axle. Allowing for the cooling of the dies, such a machine should be able to make 20 axles per hour, and from 60 to 90 lbs. of scrap are saved on each axle. The blank or billet need not be round, but can be octagonal if desired.

Preventing Rolling Stock Failures

The efforts of the modern physician are, or should be, quite as much to prevent the occurrence of disease as to cure the patient after he becomes sick. In the same way the work of maintenance on a street railway system should include, in its broadest aspects, the prevention of rolling stock failures no less than the repair of broken-down equipment. Repairs cost more after the cars are hauled into the shop in a crippled state than does the proverbial stitch in time. The mere cost of repairs, however, is but an incident in the larger expense caused by the interruption of traffic on the streets by breakdowns and the temporary loss of earning capacity of cars which are out of service.

It is generally accepted that a thorough system of inspection is the real safeguard against rolling stock failures in service, but in many shops this work is done in a very perfunctory way. Records of heavy repairs on car equipments may be religiously tabulated on index cards and the expense of shop work on each piece of rolling stock sharply analyzed by the manager, but unless inspection results in definite statements of conditions prevailing which can be properly passed upon and filed, there is a good deal of danger that the value of the work performed will not be fully realized. For this reason "trouble report" cards on which are listed all the important parts of each equipment, with either blank or printed spaces left for entries of the car's condition, have come into such general use.

The fact is that the increasing weight, power and complication of modern car equipments call for a much more thorough system of inspection than was needed in the older days. The apparatus beneath a heavy car equipped for high-speed multiple-unit service may be better protected than the older practice afforded, but it is certainly less easy to inspect quickly and effectively because there is so much more of it. A pretty high degree of mechanical and electrical intelligence is demanded on the part of a shop force capable of maintaining electro-pneumatic brakes, control circuits, contactors, reversers, motors and such equipment in good condition, and it is a question if new men in the shops should not be given the special training which car service employees are required to have prior to taking up the work of regular operation on the road. It is always difficult to credit any system of inspection with specific prevention of equipment failures, but by recording the light repairs and replacements carefully and comparing individual car-mileage records for corresponding months, a management in close touch with its shop conditions can secure some interesting information in regard to the efficiency of its inspections in preventing breakdowns. Of course, one cannot draw too sweeping conclusions from isolated light repair jobs like the replacement of motor brushes and controller fingers, but the value of inspection methods must be judged on a material basis. This the use of the inspection and repair record, accompanied by a proper study of all of

the failures and an effort for their future elimination, should accomplish.

The New Jersey Suburban Traffic

The announcement made last week by one of the officers of the Erie Railroad that, after reducing its service recently, the management had decided to take off twenty-five more of its suburban trains from Jersey City because they do not pay, affords a striking example of the two different aspects of the suburban passenger business taken by steam and electric railway managers. This reduction means, on certain of the lines at least, fewer trains of this kind than at any time since 1890, although the counties in New Jersey served by these lines increased in population between 47 and 66 per cent between 1890 and 1900, and during the last seven years have undoubtedly maintained almost if not entirely the same ratio in growth. The sentiment generally expressed by steam railroad managers that the carriage of freight is the most profitable part of railroading, that the through passenger business comes next, and that the transportation required by suburban passengers at best is done at cost is so different from the attitude and experience of the electric railway manager as to suggest comment.

In some respects both views are right. The average electric road carries its passengers with no other equipment than rails, power station and rolling stock, The steam railroad manager has to add to track and motive power the tremendous expense of a terminal station, which with steam operation usually means a considerable area in a territory where real estate is valuable, provided with stub tracks and extensive switching facilities. The extent and initial cost of these terminal facilities required vary practically with the size of the business done, so that from an accounting standpoint the fixed and operating charges of the station should be proportioned on a "per capita" basis among the total number of incoming and outgoing passengers. That this is not a trifling amount but constitutes a serious charge is shown by the testimony on this subject of Mr. Samuel Rea, vice-president of the Pennsylvania Railroad before the Royal Commission on London Traffic in connection with the suburban passenger business from that company's Broad Street station, at Philadelphia. Here the terminal expense and proportion of fixed charges for every passenger passing in and out of the station was 3 cents. This amount had, of course, to be deducted from the gross receipts per passenger before the receipts from the actual transportation of the passenger could be obtained. It practically constituted the difference between profit and loss on that company's short suburban business and confirmed it in its present policy not to compete with the trolley companies for the short-haul traffic.

One of the great advantages to be derived from the electrification of steam roads is the economy to be obtained in this particular item. It is true that the trackage facilities for terminal purposes provided in the new Pennsylvania Railroad station in New York City, in which electricity will be used, are very large, and will be so expensive that it is questionable whether any suburban business can be conducted from this station with profit. This particular instance, however, and that of the New York Central Railroad Company's new electric station at Forty-Second Street are so special as to afford no general rule. More typical instances are offered by the few electric railway terminal stations which have been built in the large cities of the Middle West, and by the Cortlandt Street terminal station of the Hudson Companies, where eight-car trains will be dispatched on a 1½-minute headway from an underground station on two levels. The upper of these levels will contain waiting rooms, ticket offices, etc., while the lower will have five loops. The whole area occupied, with platforms, is only 160 ft. x 500 ft., including the space occupied by the 90 ft. entrance and exit curves. Another example, perhaps more striking because it comes from actual service, is offered by the experience on the electrified section of the Lancashire & Yorkshire Railroad, which has been quoted so frequently by recent writers in the last few issues of this journal, in connection with the increase in gross receipts from electrification. On this point the remarks of Sir George Armytage, chairman of the company, as given in the issue of this paper for Aug. 4, 1906, were that one especial advantage of the introduction of electricity "has been the reduction of operations necessary at the terminal station, as the train can leave the platform at which it arrived without any shunting. This alone will postpone the necessity for enlarging the Liverpool station for some time."

Outside of this question of terminals, the suburban passenger business of the Erie if conducted electrically would seem on the face of it to be profitable. In the interview already mentioned, the average commutation rate quoted for rides of from 10 to 25 miles is 10 cents per passenger, or $6 per month. The cars seat about 60 passengers each, and during the rush hours usually carry a considerable number of standing passengers besides a full seated load. Trains at other hours of the day are not so crowded, but of course carry a very much larger proportion of passengers on family or single-trip tickets which are sold at from two to three times the commutation rate. If we assume the usual proportion of unused commutation rides to total commutation tickets sold, and that the smaller number of passengers during the slack hours is counterbalanced by the higher fare, the passenger gross receipts should average at least $6 per car and probably more for a trip of from half or three-quarters of an hour to an hour, depending on the run. The car-hour basis is a more satisfactory unit of comparison to use in this connection than the car-mile, on account of the difference in speed, and while the power charge would be higher than in ordinary electric railway service, the "platform" expense should be lower, as two men per car would not be required when the cars are run in trains. The difference between even $6 per car-hour and the $2 or $3 to which the average electric railway manager aspires should go a long way toward defraying the terminal charges on an electrical basis, even if they should include ferriage to New York.

We hope, now that the Hudson tunnels are so near completion, the trans-Hudson steam railroad managers will appreciate the financial possibilities of a rapid transit service on their roads to the suburban regions of New Jersey and will make early arrangements for the use of a power which will go far toward eliminating "terminal charges" and leave the present yards free for the precious freight.

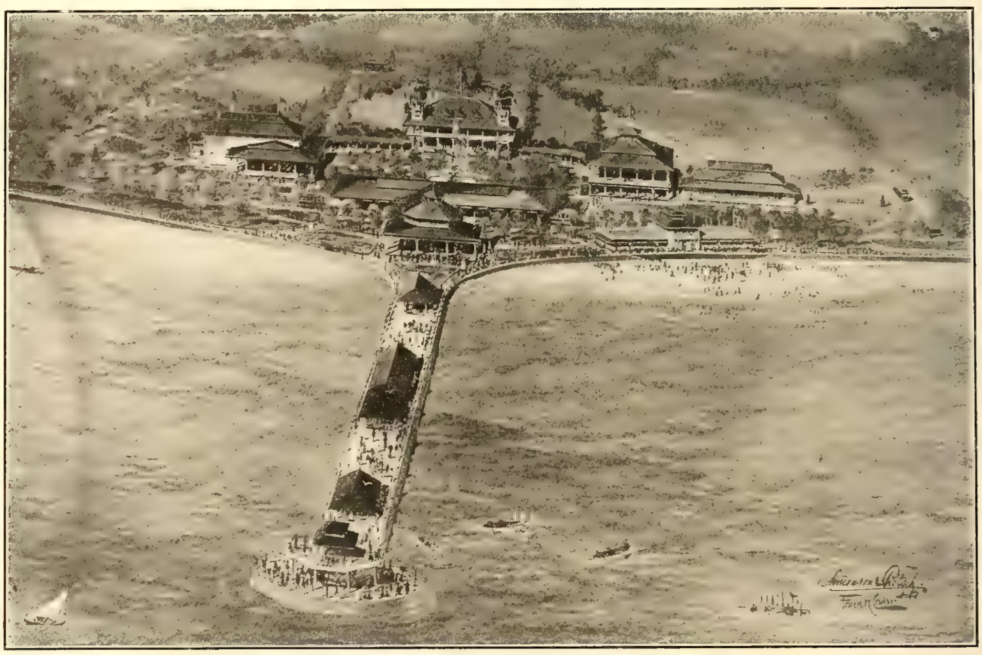
BAY SHORE PARK NEAR BALTIMORE

One of the most elaborate street railway parks in the country is that which was opened last August at North Point, on Chesapeake Bay, 16 miles from Baltimore. It is owned, with the extensions reaching to it, by the Maryland Electric Railways Company, and is leased on a 6 per cent basis to the Baltimore, Sparrow's Point and Chesapeake Railway Company, a subsidiary company of the United Railways & Electric Company, of Baltimore. The park is connected with Baltimore by a double-track line on which the United Railways & Electric Company expects to conduct five-minute service of multiple-unit trains during the coming summer. At the park the cars traverse a loop 4½ miles in length which enables the company to serve quite a territory and carry the passengers along the shore for a considerable distance. The new trains to be put in service this summer will consist of two motor cars each and will be equipped with the Westinghouse multiple-unit system. Eighty of these equipments have been ordered for delivery next spring.

RESTAURANT AT NIGHT

BAND-STAND AND FOUNTAIN

Baltimore is provided with a large number of parks, some of which are owned by the city and others by the street railway company. Druid Hill Park is probably the most famous. It is an immense tract within the city limits and is owned by the municipality. Gwynn Oak Park is another well-known pleasure resort and is owned by the United Railways & Electric Company. It covers about 76 acres of wooded land and is about 3½ miles out from the center of the city. A ten-cent fare is charged to it on the cars. The United Railways and Electric Company has spent considerable money in developing this park, and it is especially designed for high-class patronage. The average attendance on Sundays is from 4000 to 5000 persons. Vaudeville entertainments are given twice a day, and last year daily balloon ascensions were made for a period of four weeks. In addition there is a dancing pavilion to which an admission fee of 25 cents for men is charged, as well as restaurant, carrousel, shooting gallery, doll rack, swings, boating, and about fifty bath houses. River View and Electric Parks are within the 5-cent zone and their average attendance is about 10,000 to 12,000 on week days and 20,000 to 25,000 on Sundays.



PERSPECTIVE VIEW OF BAY SHORE TERMINAL

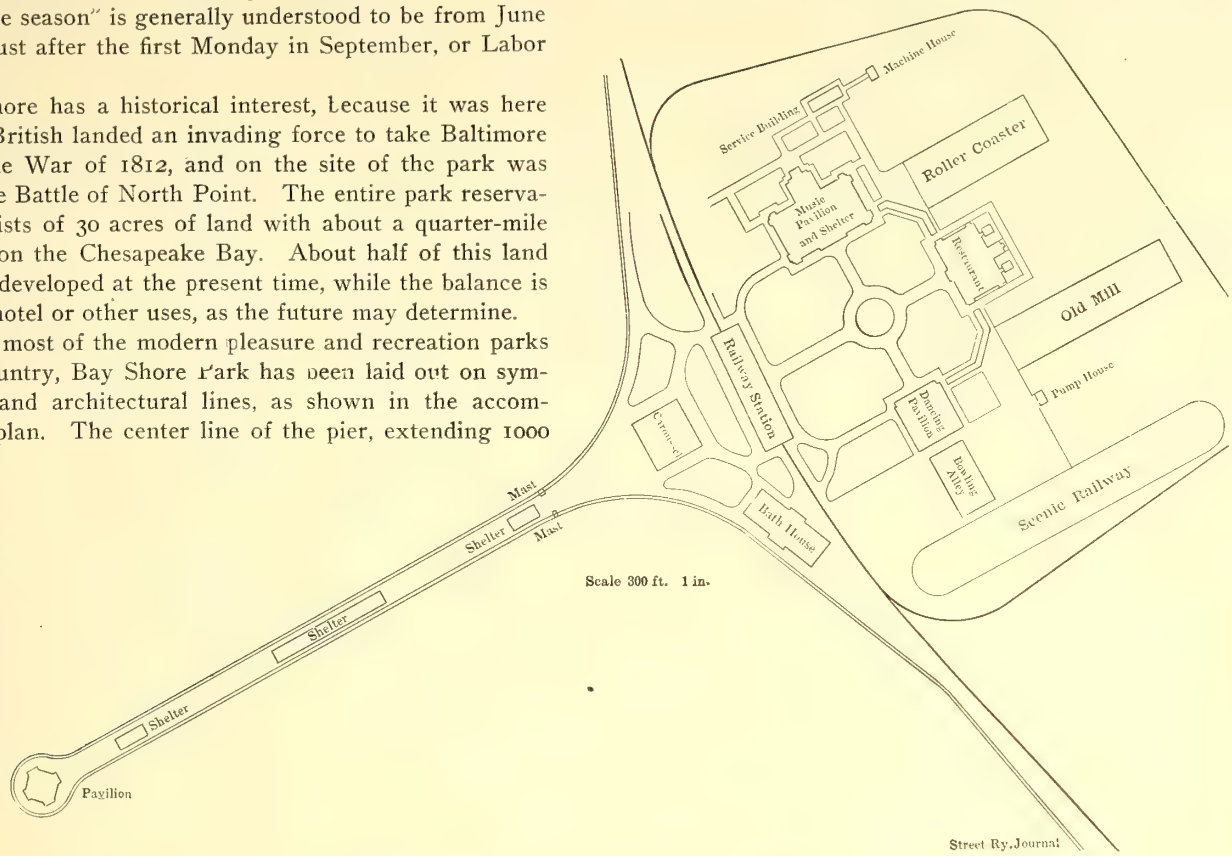
None of the parks mentioned, however, is on the salt water. In fact the Patapsco River, on which Baltimore is located, is so narrow and shallow and is so given over to commercial purposes that the nearest desirable shore locations are on the Chesapeake Bay. But the experience with Bay Shore Park last year during the short time in which it was open indicated that Baltimoreans are ready with their patronage to support a park where salt-water bathing and the other attractions available at a shore park can be had. It should be borne in mind that Baltimore is the farthest south of any of the large cities on the Atlantic seaboard, and its park season is generally recognized as extending

from the Saturday before Decoration Day, or May 30, until the Sunday after "Old Defenders' Day," or Sept. 12. This makes the length of time during which a park will be well patronized about four weeks longer than that in New York, where "the season" is generally understood to be from June 15 until just after the first Monday in September, or Labor Day.

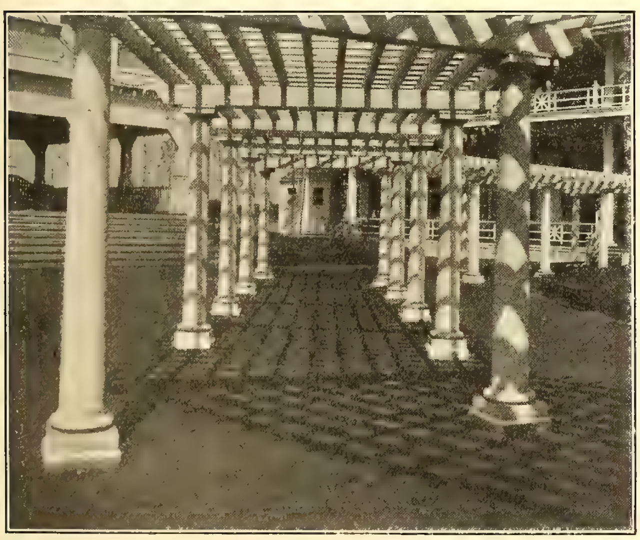
Bay Shore has a historical interest, because it was here that the British landed an invading force to take Baltimore during the War of 1812, and on the site of the park was fought the Battle of North Point. The entire park reservation consists of 30 acres of land with about a quarter-mile frontage on the Chesapeake Bay. About half of this land has been developed at the present time, while the balance is held for hotel or other uses, as the future may determine.

Unlike most of the modern pleasure and recreation parks in the country, Bay Shore Park has been laid out on symmetrical and architectural lines, as shown in the accompanying plan. The center line of the pier, extending 1000 ft. into the bay, is also the center line of the park proper. On each side of this center line are grouped the different buildings which will be described later, and which consist of a railroad station, music pavilion, restaurant, dancing pavilion, billiard hall, bowling alley and bath house. All of these buildings are grouped around the central court, in whose center a large fountain has been erected. The restaurant is connected with the music pavilion on one side and the dancing pavilion on the other side by open Roman pergolæ, thus separating the group of buildings from that part of the park set aside for amusements such as the roller coaster, old mill, scenic railway, etc.

The buildings are designed in the Colonial style of architecture and harmonize well in appearance. The restaurant building is unique, as it has large porches and verandas on both stories, extending around all four sides of the building. The roof line is broken by dormers and four corner towers, giving the building an exceedingly graceful and well-proportioned festive character. The floor contains a large dining hall with a spacious central open stairway leading to the second floor, which is intended to be reserved for ladies and children spending the day at the park. The kitchen, serving room, pantries, etc., are located in the rear of the ground floor, while two suites of rooms for the superin-



PLAN OF BUILDINGS AT BAY SHORE PARK



PERGOLA

LOGGIA OF BAND-STAND

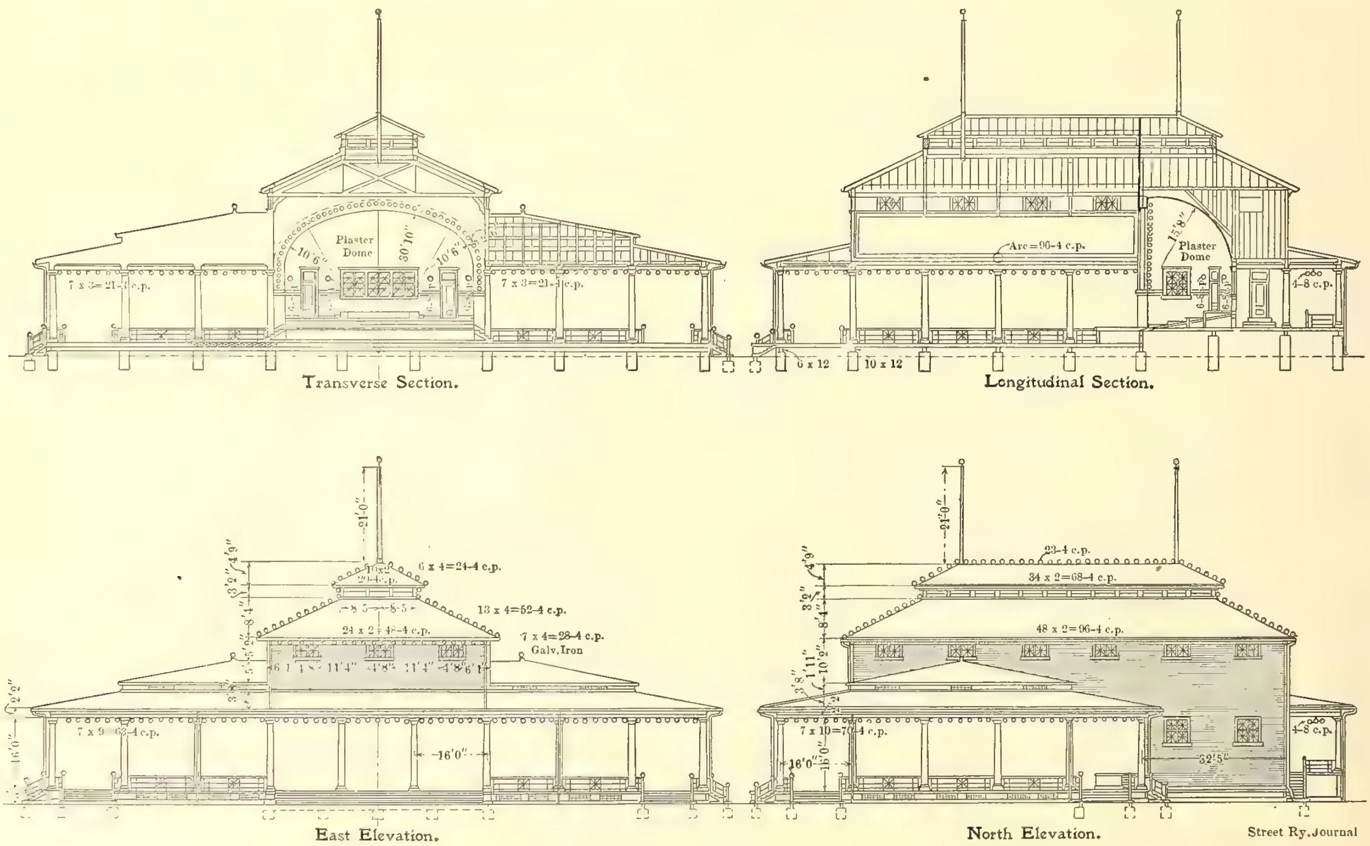
tendent of the park are provided on the second floor. The restaurant covers an area of 94 ft. x 104 ft.

The music pavilion is an imposing open structure, carried by ornamental columns and trusses, and measures 122 ft. x 144 ft. It has a seating capacity for more than 2000 persons. The musicians' platform is elevated and enclosed by a spherical shell designed to obtain best acoustics. Spacious steps lead to the music pavilion from all sides, and like all other buildings, it is designed to have four fronts, so that any of the other buildings can be seen from it.

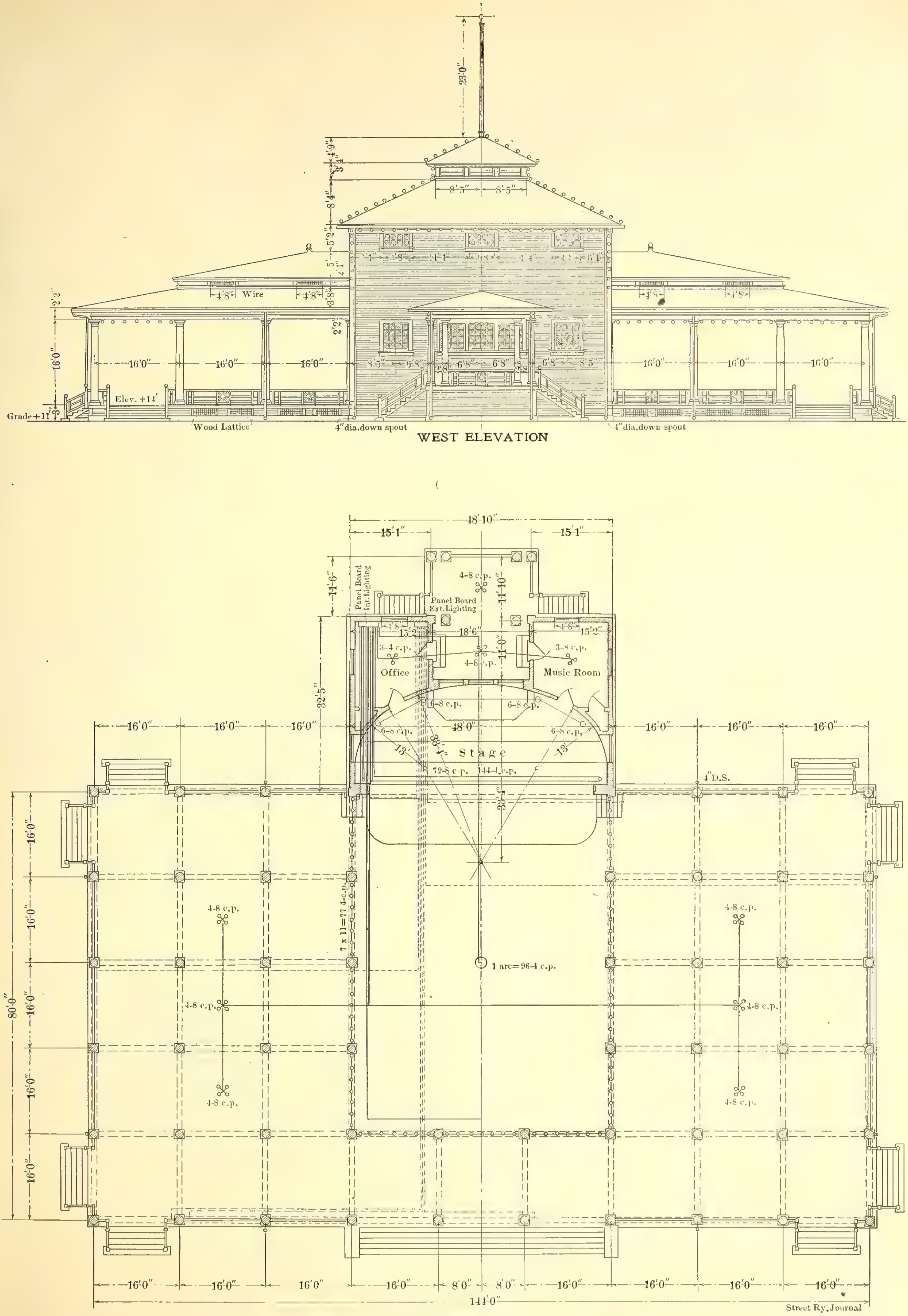
The billiard hall and dancing pavilion is a two-story building, 82 ft. square. The billiard tables are on the ground floor, while the dancing floor is on the floor above. Two large open front stairways give access to the upper stories. Immediately adjoining is the bowling alley building, which is 60 ft. wide and 108 ft. long, and which is equipped

FIG. 8 ROLLER COASTER

A DRINKING FOUNTAIN



MUSIC PAVILION

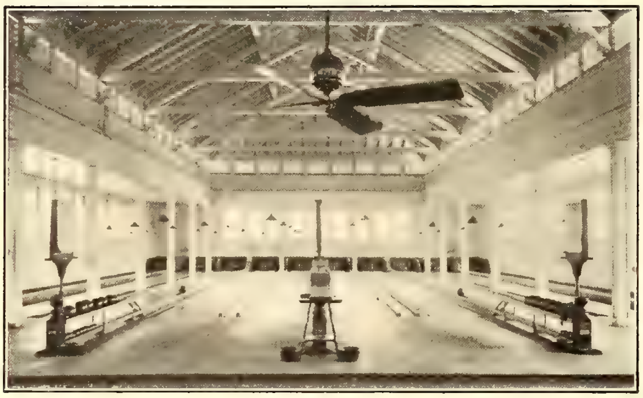


PLAN AND WEST ELEVATION OF MUSIC PAVILION

with ten modern alleys for both duck-pin and ten-pin games.

The railroad station is a covered structure, 48 ft. x 208 ft., with a car track in its center. Between the railroad station and the pier is the carrousel building, 86 ft. square. This is an open structure with an octagonal clere-story and lantern, and accommodates what is said to be the largest carrousel in the world. This carrousel was made by Dentzel and has three rows of animals. The intersection of the pier and sea walls at the entrance to the pier proper is emphasized by two large pylons, carrying flagstaffs.

THREE-ROW CARROUSEL AT BAY SHORE PARK



BOWLING ALLEYS AT BAY SHORE PARK

ENTRANCE TO BATHING PAVILION

The bath house building has been located at the bathing beach. It is a highly ornamental building, and has a length of 150 ft. and a depth of 50 ft. The central portion of this building is two stories high; the first floor contains the entrances, offices, with the requisite towel and bathing-suit rooms, while the second floor contains the women's bath rooms. The bath rooms for the men are grouped in tiers in the two adjoining wings leading from the central portion of the building at the first floor. All of the bath rooms are large and well ventilated.

As the water supply for the park is pumped from an artesian well, an artistic pump house has been erected to accommodate the pump and filtration plant. The water is piped to the different buildings as well as to artistic drinking fountains scattered throughout the grounds. One of these is illustrated on page 314.

At the further end of the concrete pier, which extends 1000 ft. into the bay, will be erected a two-story pavilion, while three shelters will be erected equidistant for the accommodation of the public.

TERMINAL SHED WITH PLATFORMS ON BOTH SIDES OF TRACKS

Besides the buildings already described, a service building has been erected for the accommodation of the railway employees. It contains offices for the superintendent, train

dispatcher, motormen and conductors. A shop and a machine house has also been provided.

All of the buildings are lighted at night by electricity and special attention has been devoted to the exterior lighting and illumination of the buildings, the architecture of which at night is outlined by thousands of incandescent lamps. The park proper is illuminated by a series of arc lamps. The grounds have been beautifully laid out, and sidewalks of granolithic pavement give communication between all of the above described buildings in the park.

The layout of the grounds and the buildings were designed by Messrs. Simonson & Pietsch, architects, of Baltimore. The total cost of construction, including the railroad track work, sea wall, pier, buildings, etc. was about $500,000.

LAYING OUT AN IDEAL INLAND AMUSEMENT RESORT

BY EDWARD P. HULSE

In making an electric railway pay, a well-located amusement resort will give much assistance. I think, as a general proposition, this is commonly assented to now, although there has been much divergence of opinion as to this in the decade or so of experimentation—coupled in many instances with financial loss and unfortunate results from ill-advised ventures or badly-worked-out plans—that led to the crystallization of this experience into the practical knowledge of what was essential to make a successful public playground. Even so, there are heard those embedded in the managerial seat who hold that catering to the diversion of the pleasure-loving percentage of the population should have no recognition in the operating policy of an electric railway, either street or interurban, and who anchor their enterprise in the shallows of this sufficient conclusion. From the standpoint of their particular experience they are probably right, since they have the figures from their own accounting department to go by.

A park is not a universal panacea for passed dividends. But the overbalancing opinion inclines to the satisfied determination that a correctly located and properly operated resort will aid in keeping red figures off the balance sheet. If the Columbus convention brought out one fact pointedly, it was this; and the conclusive symposium of the committee on the promotion of traffic,* which had labored hard and long to gather a comprehensive report on such matters, is the best presentation that has ever been given on this subject.

Locating and laying out an amusement resort is not by any means an exact science. There are too many local conditions of which it is necessary to take cognizance in each particular case to permit stating a set of formulas which should in every instance result infallibly in success; but enough is now known with the experience of the past to go by to warrant an expression of some things that should be avoided and of some that are advisable in the majority of cases.

In the first place, be prepared to spend enough in the original outlay to give the proposition a chance of being a success. There is such a thing as spending just enough to foredoom it to failure, just as there is a "faint praise which damns." If you go in, get in strong.

Traffic to an amusement resort ordinarily presents itself at a time of day or night when the power and equipment are not called on heavily as is the case during the peaks of business travel at noon and at evening. The advisability of establishing a park is augmented where this condition can be met—where the park can be so located that the handling of its patronage will be in a direction opposite to the regular business crowds. Park visitors belong to three general classes as regards their time of traveling: those who go out during the morning (generally ladies with large parties of children) prepared to stay for the day, returning at sunset; those who go out during the early afternoon, returning at 6 o'clock or staying over until the night exodus; and those who go out after their evening meal and stay until the last cars. The resort must be located so that this movement can be handled against the business rush. That is the first desideratum.

The next is to place it at a sufficient distance from the main centers of feeding population to warrant the collection of two fares. Many parks that were located on short hauls within the single fare radius paid splendidly the first year, while the novelty lasted, and were patronized by all classes. The second year usually showed a marked difference in the class of patronage. The better class of people began to stay away, asserting that there were "objectionable features." The third year usually found the park given up to the cheaper element, who spent only enough to buy a glass of milk and a piece of pie from the restaurant or a glass of moxie and a bag of peanuts from the refreshment stand. The latter class also patronized the amusements sparingly, if at all, usually only to the extent of an occasional dance ticket, cutting out all but the waltzes, a single ride on the roller coaster or the merry-go-round. By the "cheaper class" I mean just that class that every park manager knows about and would prefer to have stay away: the kind of people that do not go out with the predetermination of spending any money or having a good time on their own account and attending strictly to their own business while having it, but who go out to hang around, to stand outside the entrances of the various concessions, to pass remarks on those who patronize them, to mix in with others' enjoyment, to see "what's doing." The word that expresses that class is "mugs"—they will kill any resort except one gaged especially to suit them. Just the difference in the initial expenditure—the amount of fare necessary to get there and back—marks the difference between filling the grounds with this undesirable element and a better grade of patrons. I do not concede that the class of people that will eventually be attracted to a park run on a high plane is the smaller proportion; my experience is quite the opposite, and certainly the park is assured of a longer life in its popularity and good name. The class that you will always get will be just the class that you aim for, preferably the large class of well-behaved, fun-loving, money-earning young people—the class of people that it will pay to get to the resort because they spend dollars where the other class would spend dimes, and who do not destroy more in the value of the company property than the amount of their patronage. In large cities the solution is two, even three or four parks, each one differing in the class of patrons that its attractions are gaged to draw. A park can hold its popularity with the best-paying class longer if it is run up to the best standards.

A recent instance in point as to the kind of park that is found most profitable for an electric line to have is the case of the road operating in a large city in the Middle West which has had four parks on its lines and which recently sold off the land of two that were within the single fare limit, retaining the other two. One of these, with a ten-cent

* See Street Railway Journal, page 822, Oct. 27, 1906.

fare, has always been run on the highest plane, has always been popular and always promises to be because the orderliness of its patrons has never been questioned.

After deciding the direction from the centers of population in which the resort must be placed so as not to conflict with the regular heavy travel, and marking off a zone to include the two fares to the best advantage, the next thing is to find a suitable water location, either river or lake, within these predetermined limits. The inland park resort must have water. This must not be controlled by any manufacturing concern as a source of power nor must it be drawn on as the water supply of any municipality or town. In the first instance the water is apt to be reduced in the summer months to a level that would be exasperating; in the latter case the uses to which it could be put for park purposes would be very limited. It could not be used for swimming or for aquatic contests; even tub races would be barred. Those going into the water, even by falling overboard from a boat, would be liable to arrest. It could not be used for any of the long list of spectacular attractions such as marine battles with fireworks, diving horses, high diving, shooting the chutes, water walking, etc. As an alternative, in case the proper body of water, lake or river could not be found, it would be better to secure control of sufficient land, properly located, and make a lake by damming a small stream or brook.

Sufficient land should be taken to allow plenty of room for the park, and then a strip all around it should be secured, so as to avoid too close proximity of counter-attractions that might tend to hurt the character of the resort. In this belt of land outside the park fence proper, the ownership of the property could be made to pay by leasing lots for cottages or even renting camp sites for the season. I have in mind several instances where a source of revenue not to be despised originated in this plan alone, besides having the obvious advantage of controlling the park surroundings. The west to the south sides of the lake should be chosen for the park. If it were on the north to the east sides the sun would slant under the trees during the afternoon, making it warmer, and shining uncomfortably into the faces of those on the shore.

The site picked as the park location should not be too rugged in its topography. An occasional glen or dell adds picturesqueness, but if the whole site is hemmed in by hills it is apt to be stifling in the warmest weather. Moderately sloping land, located so the breeze can get to it, and not requiring much grading, is to be sought. Two-thirds should be woodland and one-third adapted for easy clearing. The wooded part should admit of being broken up into several scattered groves. This on account of proper landscape effect, but also for the more practical purpose, later on, of segregating picnic parties in separate, well-defined locations. The advisability of this can be attested by the manager of any park who has had the problem of accommodating two or more organizations of several hundred each which elect to have their outings on the same day; it is always difficult to impress them that they are getting the proper attention even though the grounds may be large enough to accommodate 25,000 people without giving the place a crowded appearance. I have seen very few excursions of this nature that did not almost resent the appearance of anybody else on the grounds on the day that they had chosen. All confusion in handling each crowd can be avoided, however. A pavilion in each grove or a clearing in which a tent may be erected will give each organization a separate headquarters for the day, where their impedimenta may be left under guard, and which will serve as their rallying point. The seclusion of picnic parties may be further advanced by having one or two private groves fenced in with light wire. Later on, when the park advertises for lodge and Sunday school outings and the picnics of organizations, the practicability of planning for their comfort from the beginning will be understood.

The natural features of the land will determine best how it must be divided—what should constitute a grove and lawn, athletic field, promenades, walks, flower beds, terminal station and the sites of the different buildings and amusements. Thinning out the unnecessary trees, removing rocks, clearing up the underbrush, platting the lawns, building the rustic features and rookeries, etc., had better be done under the direction of a landscape artist whose sole idea of beautiful effect can be held in check by the practical necessities of the purpose to which the land is to be put.

As a general rule, the respective locations of the terminal station and the main buildings will have quite an effect ultimately on the receipts. It is an axiom to place such features as the theater, the athletic field and any other amusement where crowds of people make a simultaneous exit on the opposite side of the park from the terminal station, or it will be an easy matter for the whole attendance to be stampeded to the cars by the few that are really in haste to return to their homes. Where all have to pass the other attractions on their way out, a larger percentage is apt to linger and take an interest in the other amusements. The theater especially should be placed as far as possible from the terminal loop so that the ringing of gongs and the blowing of whistles cannot interfere with the performance. The theater also should be far enough removed from the other concessions having music or making a noise so that there will be no annoyance. The dancing pavilion, merry-go-round, roller skating rink, etc., all employing music, need not be too widely separated, as the patrons of each can seldom hear the noise of the other attractions when their own music starts up, and to those on the grounds the sound of music coming from different directions as they pass along gives the desired "gala" effect, and is pretty apt to start them to getting their share of the fun. It takes a certain amount of excitation before people begin to think that they are having a good time. The crowds at a park can be "warm" or "cold" in the same degree as in a theater and with the same effect. They have to be stampeded into starting the fun for themselves, and some of the psychology by which this can be done, later on, can be assisted by laying out the park in a conforming manner

Isolated locations for each attraction are to be avoided. The closer all the amusements are grouped—with one or two evident exceptions—the better will all of them pay. An instance in point is in the case of a man who secured a merry-go-round concession in a certain park and insisted on a location all by himself. He did not want his crowd "drawn away." At the end of the season the company had to take over his property for his debt, his receipts having fallen below his guarantee. During the winter months, by attention to other things, he made enough to pay off his rent, and got his property back. He was prevailed upon the second year to allow several new attractions to be placed near his carrousel, and found that his receipts showed a profit from the very start. People will pass readily from one attraction to the others, visiting the majority of them, if the entrances are near together, where they would lose interest if they had to hunt each one up in a widely separated part of the grounds. Do not put in all the amuse-

ments that could be thought of the first year, but leave enough to be done in future years to keep up the novelty.

As to the buildings themselves, I consider the best effect is gained by artistic construction of rough-finished timber stained a combination of dark green and brown or other subdued tints, with the roofs of stained shingles. This color scheme harmonizes with the natural colors of any background of woodland or lawn, and is far more pleasing to the eye than the too frequent combination of smooth-finished boards, tin roofs and glaring ochre paint or other gaudy color. The inevitable slight shrinkage of parts of all buildings constructed of wood is not so observable or displeasing where rough-sawn lumber is used, and some fine artistic effects can be secured. No amount of fresh paint can remedy the barn-like effect of most park buildings toward the end of their first decade. Glass in the side walls, with artistic finish around, is better and handsomer than blank weatherboarding.

In laying out the water and drainage systems it is advisable, if possible, to have the sewerage carried off in a direction opposite to the lake, and to make this fact known. When the drainage and water pipes are laid, the private telephone and the main electric feed wires should be conduited also, if the whole park-like effect is not to be destroyed by spider-like criss-crosses of wires overhead and cutting across every view.

As the main drawback to park attendance in the summer is the possibility of showers, the inconvenience from this should be avoided as much as possible. A rainy day in the short summer harvest means a dead loss of thousands of dollars in gross receipts to many roads that have parks. There should be enough shelter provided in the different buildings on the grounds to accommodate the whole park attendance in case of a sudden downpour, especially if accompanied by a small windstorm, as is so frequent in the summer. The advisability of eliminating the discomfort and dread of this almost entirely by connecting the different buildings with a covered passageway is not to be decried. A solid board walk with side walls 3 ft. or 4 ft. high and widely roofed would protect from sun as well as rain. Starting from the terminal station, this protected walk, in the nature of an arcade, could make a circuit of the main attractions without in itself being very long or expensive to construct; and the fact that, once aboard the company's cars, the condition of the weather could give no concern would result in a larger attendance. For it cannot be denied that a large percentage of possible patrons are deterred from attending an open resort in summer where there is a possibility of their being caught in a shower. Any park that could provide amusement on a rainy day in summer would hardly lack for patronage. A small cloud in the sky early on a summer afternoon may easily kill the receipts for that day.

I believe in the advisability of roofing the theater in almost every instance. How often a five-minute shower has cut out the entire attendance, wetting the seats so that they cannot be dried out in time. I know of instances where a roof has paid for itself in one year, although roofed summer theaters are not the invariable rule. The theater should be located as far as possible from the terminal station and away from other attractions having music, and it would be as well if it were not placed too near the shore of the lake. Too often the singing of boating parties or the inevitable phonograph in slowly passing canoes mars the performance. A theater designed to permit of light opera and musical comedy, while calling for additional expense in the way of more extensive stage arrangement and facilities and more room overhead and in the wings, as well as additional dressing rooms, will be found in the end to bring in a larger compensating net return. Strong seats, folding and removable if in an outdoor location, are the best—strong enough in all parts to avoid dowels and rungs rotting in one season of exposed weather and preventing the annoying occurrence of several breaking down during each performance, with the attendant possibility of damage suits.

For band concerts the usual arrangement of a stand with seats grouped stiffly around it is not the most satisfying and belongs to a cruder period. People as a rule prefer to stroll when listening to the usual summer band concert, no matter how fine the organization; and with the object of satisfying the largest number and all classes, I always suggest that the band stand be located on a natural or artificial island about 90 ft. off shore. If the bank is slightly sloping opposite the band stand several rows of benches can be placed under the trees close to the water's edge for those who prefer to sit down and listen. A wide, shaded promenade directly behind will please those who prefer to walk up and down. The canoe and rowboat patrons can group around the stand, and all temperaments will get more satisfaction from this plan than by being stiffly huddled in a set location where the rays of the sun cannot be avoided and where their personal comfort cannot be considered.

The laying out of the athletic field is governed entirely by the use to which it may be put by local organizations for all possible sports and for field days, but the arrangement should also permit of giving some of the large spectaculars there when necessary.

The terminal station will go farther to make or mar your park than any other feature on the grounds. It is there that patrons get their first and their last impressions, and too much care cannot be expended in planning it. People who are having a good time at a park usually stay until the last possible minute before they must go home; a delay then will negative any previous good impression. Be prepared to send them away without any exasperating waits, and you will do much toward assuring their return. Avoidance of injury to patrons and attending damage suits are the first things to be considered; separating the crowds so far as possible into groups with reference to their destinations is the second. The expeditious and calm handling of the incoming and outgrowing crowds at the same time, with the entire elimination of the too frequent stampede and panic, can be attained by many types of terminal stations that do not look too much either like cattle pens or prisons. Plenty of trackage is necessary and plenty of cars. If two and three-car trains are run or a motor car and trailer it is sometimes advisable to have the last car swung back at a cross-over where experience has taught that the crowd on the cars begins to thin out, and announce when the car is loading for the return trip that this is to be done, also mark it with signs.

Do not cut out too many of the trees, especially around the sites of buildings. If your theater is open and unroofed, leave a few of the larger ones at the sides and through the back part. Build the roller coaster right in a grove, of course allowing for all possible free swaying of trunks and branches during a windstorm. The restaurant is more satisfactory if erected in the shape of a St. George cross so that all tables will be reasonably near to the windows. The best location on the grounds is none too good to be given to this, especially where it can command a good view of the lake. Consider at the start the possible locations of additional attractions that will keep up the novelty of the park

in the future years, so that the general effect of the completed park will be pleasing and convenient.

After the grounds are laid out avoid the burning tendency to mar the view with dozens of signs. I know of resorts which people are urgently invited through extensive advertisements to patronize, and on their arrival there they are confronted with endless "Keep Off the Grass" signs, hundreds of them, and large notices warning all sorts of penalties for picking flowers, barking trees, acting in a disorderly manner, bringing dogs, eating lunches, cutting woodwork, going in swimming or doing many other things that would not be suggested to them but for the signs placed before them. People are very apt to act on the suggestions conveyed as did the children of the nervous woman who told them on leaving them alone for an afternoon not to put beans up their noses, and who of course found on returning that they had tried it and were suffering the consequences. The usual billboard placarding of "Rules and Regulations" with several officials' names crowded on in large type is a favorite way of marring the vistas in an otherwise attractive scenic outlook. Park patrons understand generally that they are not supposed to turn handsprings in the flowerbeds, and if they take that inclination a sign printed in two colors with the general manager's name in four-inch letters will not deter them. A good police force patrolling all parts of the park and acting firmly and sufficiently when occasion warrants will soon spread the impression in the only quarters where that information is ever likely to be needed that ladies and children will be protected in that park safe from annoyance, and that its property cannot be recklessly destroyed. A little lock-up, conveniently but inconspicuously placed behind the fence of the ball park, with two cells and six cots, is a feature of one well-conducted park that I have observed. When it has been necessary to use it the effect is conclusive and widespread. Court is held that day or next morning in the small police headquarters centrally located on the grounds, and the fine is paid or the offender is handed over if the severity of the breach warrants it. Order in that park is easily maintained against the disposition to break it on the part of the few rowdies who have not learned its reputation beforehand. The cost of innumerable signs is checked off against the cost of the two buildings, the police headquarters and the lock-up. Instead of so many warning signs, provide sufficient direction signs, and in the proper sheltered locations have clocks, maps and time tables, with notices telling when the last cars leave for all points along the lines.

In keeping up the tone of the park, arrange so as to have the supply and removal system kept as far in the background as possible. Let the wagon entrances be placed to permit of inconspicuous ingress and egress. If supplies are brought by car, large piles of crates, empty soda-bottle cases, barrels, pie racks, etc., stored in the terminal station have a cheapening effect. A sidetrack or short spur track to the storeroom should be provided for at the beginning.

In laying out the grounds and buildings the possibility of a winter use of the park also should be taken into consideration. If a building or two is so constructed that it can be boarded in, and so located that it can get steam boiler heat from the restaurant there are many ways of making the park pay in the cold months. A dancing pavilion, close to the lake, could fill a double purpose, the broad piazzas surrounding the dance hall serving as a skating landing from which a pier could lead down to the ice. A toboggan slide could start from the roof of some building, if no natural conformation of ground is available, and terminate on the ice. The sheltered passageway from the terminal station again would come in handy in the winter time. Bowling and ice skating parties, snowshoe and skieing clubs, dancing and roller skating could keep the winter lively and make the resort pay even in the "retrenchment" season.

With these general directions the variation of detail that every individual location would call for could be easily arranged and a resort planned that would meet, from the experience of the past, most of the conditions necessary to provide a profitable adjunct to the equipment necessary to make a large electric system improve all its avenues of profit.

AN ELECTRIC RAILWAY PARK ON LAKE ERIE

The Ottawa Beach & Southern Railway Company, of Toledo, Ohio, is rushing work on its new waterside park as rapidly as possible. At present the company has under course of construction a large dance hall, a bath house of 200 rooms and a restaurant. These buildings will probably be completed by May 15. A dredge is also in operation excavating material to enable the erection of five miles of inland lagoons within the next nine months. Next year the company expects to have a hotel finished that will accommodate a large number of people.

This park will be complete in every detail, having all the popular amusements. It will be operated strictly on the temperance plan. The park covers 320 acres, having about one mile frontage on Lake Erie with an elegant bathing beach.

REPORT ON PROGRESS OF HUDSON COMPANY'S TUNNEL WORK

The report of Chief Engineer Jacobs, of the Hudson Companies, regarding the progress of the construction work on the tunnels of that company from New York to Jersey City contains some very interesting information.

The report shows that construction has progressed very favorably during the past year, the work being prosecuted continuously day and night. So far, 16,517 ft. of tunnel have been constructed, of which 12,160 ft. was lined with iron and the other 4,357 ft. was drilled out of the solid rock and will be lined with concrete. This part of the work has required the removal of 104,000 cu. yds. of material and the use of 35,000 tons of cast-iron lining plates.

The upper set of tunnels from the Lackawanna station in Hoboken to Christopher Street in Manhattan has been practically completed. The temporary tracks have been removed and permanent operating tracks are being put in place. It is expected that the Sixth Avenue extension of this portion of the system will be finished and trains will be operated from Hoboken through this set of tunnels as far as Fourteenth Street in Manhattan by Sept. 1 of this year.

The Church Street terminal of the lower set of tunnels is being rushed as rapidly as possible. This building will cover an area greater than a city block and will be one of the largest buildings in the city. Thirty-five caissons have been sunk for the surrounding foundations and two for the interior work. Twenty-five additional caissons are ready for sinking. Some idea can be gained of the magnitude of this part of the work from the fact that 36,000 cu. yds. of material have already been removed from the excavation, which has not as yet been completed.

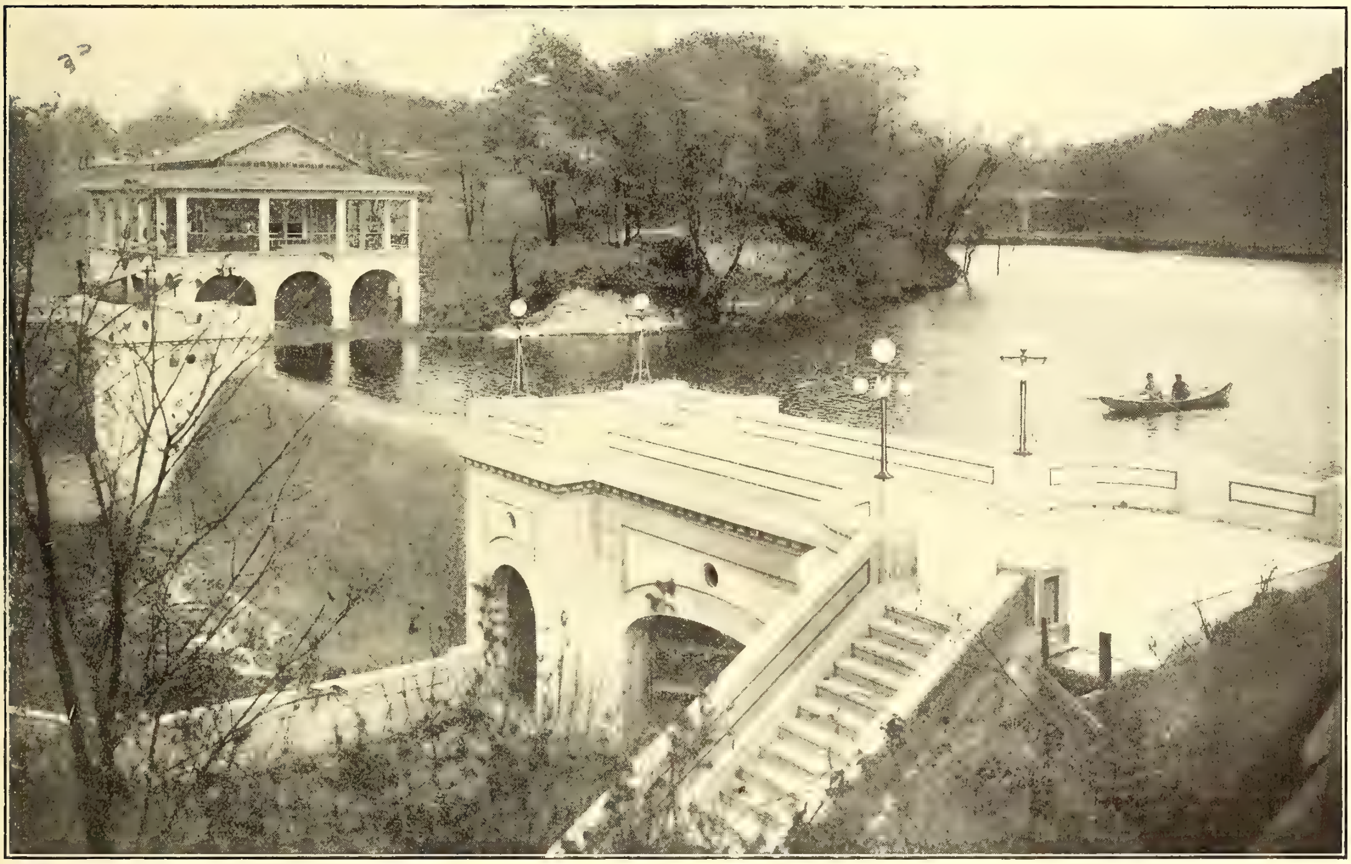
While the management of the Hudson Companies has not as yet set a time limit at which it expects the full system of tunnels to be in operation, at the present rate of progress the work ought to be practically completed and the roads in operation in the course of a year.

DELLWOOD PARK, THE NEW AMUSEMENT RESORT OF THE CHICAGO & JOLIET ELECTRIC RAILWAY, AT JOLIET, ILL.

Dellwood Park, which has been recently constructed at Joliet, Ill., and which will be operated in connection with the Chicago & Joliet Electric Railway, in beauty of natural scenery is far superior to the average electric railway or city park. In cost of construction and in the character of the buildings and structures erected upon it, the assertion can safely be made that it is equaled by no other electric railway pleasure resort in the Middle West.

The park, which contains 62 acres of land, mostly wooded, is located on the double-track Chicago-Joliet line of the railway Company, 4 miles north of Joliet and 26 miles distant from Chicago. The high ground upon which it is laid out overlooks the valley of the Des Plaines River, and the view reaching north and south as far as the eye can reach takes in the deep waterway or drainage canal connecting Lake Michigan with the Mississippi River. A deep ravine with limestone bluffs on either side, and which sheer off abruptly in places, winds through the tract diagonally. North of the ravine the ground rises gradually to an eminence near the northern boundary of the park, which is 82 ft. above the lowest level of the ravine. In deciding on the general layout of the buildings and other artificial features, General Manager J. R. Blackhall of the railway company, who conceived the idea of the park and had charge of its construction, utilized to best advantage the natural topography and scenery. The ravine has been dammed in two places, making a lower lake covering about five acres of ground and an upper one of three and one-half acres. On the high portion north of the ravine there has been laid out an amusement avenue on either side of which buildings for amusement features have been erected. Through the wooded portion of the park south of the ravine winding paths of crushed stone have been made, and to connect these with similar paths on the north side two concrete bridges have been built across the ravine. A tract of sixteen acres, including the upper or smaller lake, which is fenced off from the main portion of the ground, has been equipped to accommodate the Joliet Chautauqua Association and other similar assemblages. North of the Chautauqua grounds an athletic ground covering five acres is enclosed in a high board fence.

Practically all of the visitors to the park will reach it by way of the railway, and to accommodate passengers two stations provided with train sheds have been constructed. One which is on the main line between Chicago and Joliet is located on the highway on which the park fronts, and near the lower dam and boat house in the southwest corner of the park. The other is on a double track branching from the main track, and lies north of the amusement avenue and adjacent to both the Chautauqua grounds and the athletic field. Both stations are outside the fence enclosing the park. At each station is a concrete landing platform 112 ft. long and 16 ft. wide, covered by a shed consisting of a tile roof supported on a steel framework. The station on the main line is located between the double tracks of the main line of the Chicago-Joliet line, and to avoid the necessity of visitors to the park crossing one of the tracks, a concrete subway 7 ft. 6 ins. high and 10 ft. wide has been constructed under the track and the highway adjacent to the park. This subway is reached by inclines, one at the station and another which terminates at the main promenade of the park. Two flights of steps provide an addi-



LOWER DAM AND BOAT HOUSE IN COURSE OF CONSTRUCTION. LARGE CONCRETE BRIDGE IN THE DISTANCE

tional outlet south from the subway to a walk of crushed stone leading to the boat house near the dam at the lower end of the larger lake. This dam, which is built with a passageway through it, is probably, from an engineering standpoint, the most interesting feature in the park. It is built entirely of reinforced concrete and has a total length of 170 ft. The spillway is 83 ft. long, and at either end of this are abutments 40 ft. and 47 ft. long, respectively. From the promenade on top of the south abutment a stairway leads to a lower walk which, after passing in front of an electric cascade in the abutment under the promenade, enters through an arched opening the electrically lighted passageway under the spillway. The exit of the passageway at the north abutment leads up to a boat house near by. This building has a concrete substructure and the upper portion is finished in stucco. In winter the lower portion is heated and is used by skaters. The three other concrete structures of most interest are the two bridges carrying foot paths over the ravine and the dam forming the upper lake. The spillway of this upper dam is built on a plan similar to that of the larger one and is hollow. The dam has a total length of 140 ft., the spillway being 40 ft. long and 15 ft. high above the bed of the lake. The abutments carry the foundations of a scenic railway structure which crosses the ravine at this point directly over the dam. Both dams were built by the Ambursen Hydraulic Construction Company, of Boston. The larger footbridge consists of three 40-ft. spans, which carry the path at a height of 30 ft. above the level of the lower lake. The smaller bridge, consisting of one 40-ft. span, crosses the headwaters of the upper lake at a height of 15 ft.

BRIDGE AT THE HEADWATER OF THE LOWER LAKE

The amusement avenue in the northern portion of the park, 650 ft. long and 60 ft. wide, extends south from the upper railway station toward the central portion of the lower lake and terminates in a pine grove adjacent to the scenic railway station. It consists of two walks on either side, 15 ft. wide, with cross-walks connecting the two outer ones so that the central portion is divided into five flower beds measuring 90 ft. x 30 ft., and an isolated space about midway between the two terminals of the avenue, upon which is erected a steel framework 108 ft. high supporting a water tank. The lower portion of this framework is enclosed by a refreshment stand 50 ft. square, and the upper portion by a square building to form the appearance of a lighthouse. The entire structure will be outlined by electric lamps, and as the base of the tower is at the highest elevation of the

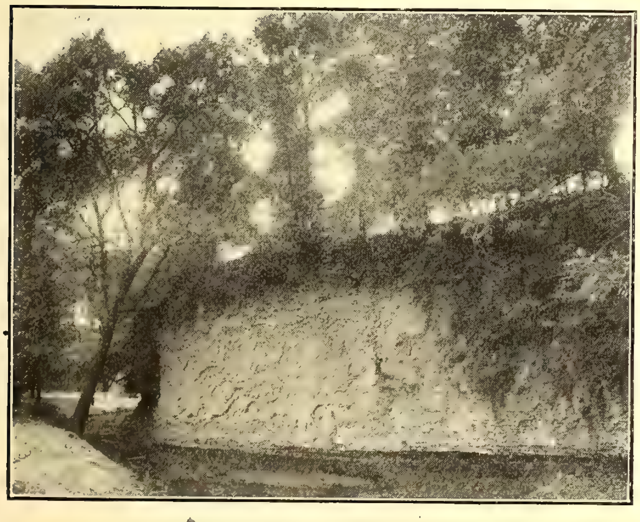
DELLWOOD PARK'S REAL SCENIC RAILWAY

UPPER BRIDGE AND CHAUTAUQUA GROUNDS

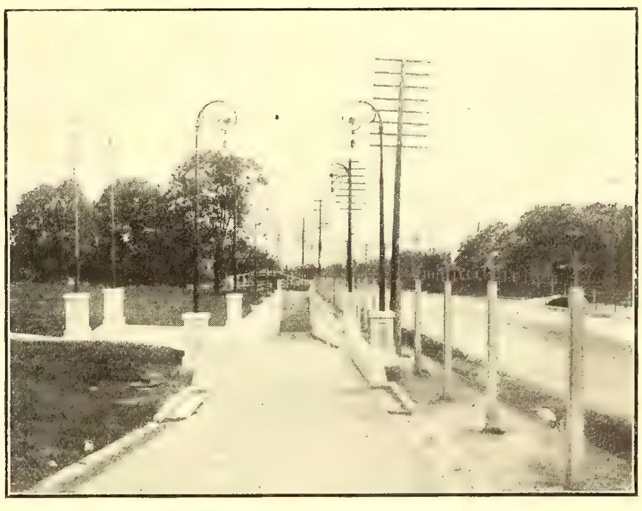
park it will be visible for many miles. The upper portion is built entirely of stucco on a steel frame, making a fireproof structure.

All of the amusement buildings on either side of the avenue are of the same general design. They follow the Mission style of architecture, have tile roofs, and the outer walls are finished in stucco. The largest of these buildings erected at the present time is the dancing pavilion. The floor, which is of 1½-in. maple strips, measures 50 ft. x 100 ft., and has surrounding it a 12-ft. promenade. The building is lighted with twenty-four Nernst lamps. The electric theater on the east side of the avenue has a seating capacity of 250. A band stand near the south end, 25 ft. in diameter, has a sub-structure and floor of concrete. The two other buildings already erected on the avenue are a combination amusement building and a laughing gallery. Before the opening of the coming season, however, there will be erected, facing the amusement avenue, a theater seating 1200 people, and buildings for a merry-go-round and a house of nonsense. The plans for the theater provide for a building 146 ft. long and 87 ft. wide. The proscenium arch will be 21 ft. wide and 20 ft. high. The stage will measure 34 ft. 6 ins. x 60 ft., and will have eight dressing rooms built on either side of it. The foundation will be of concrete and the upper portion of the building will be finished in stucco. The scenic railway station near the south end of the amusement avenue is a substantial shelter so built that the cars can be entered without the necessity of climbing stairways. The railway well deserves the name as, unlike most others, it is surrounded by natural scenery. It traverses the wooded parts of the grounds, crosses the ravine over the upper dam, passes under the larger of the two concrete bridges, and recrosses the ravine at a point where the bluffs on either side are almost 30 ft. high. It then skirts the rock walls of the ravine to a point 200 ft. from the starting point, where the cars are carried up an incline by an endless chain hoist to the station. The railway has a total length of 200 ft. In addition to the main hoist, which is driven by a 30-hp, three-phase, 2300-volt motor, there is a smaller hoist up which the cars are pulled just after they leave the station and which is driven by a 10-hp, single-phase, 220-volt motor.

THE DELLWOOD PARK DANCING PAVILION



THE CLIFFS, DELLWOOD PARK



EXIT OF SUBWAY INTO DELLWOOD PARK

The largest structure in the Chautauqua grounds is a steel auditorium building with a seating capacity of 3500, which was erected particularly for Chautauqua assembly meetings. The building, which was designed and constructed by the Joliet Steel Construction Company, is 150 ft. in diameter and consists of a steel roof framing supported by one center steel column and by about twenty steel columns at the periphery of the frame. On one side of the frame, which is covered with a tile roof, is built a stage provided with a music shell having a 40-ft. proscenium arch. Dressing rooms and reception rooms flank the stage on either side. The structure is erected on a bowl-shaped plot of ground sloping toward the stage, so that all of the seats at an equal distance from the stage have the same level. The athletic ground is provided with a baseball diamond and a one-quarter-mile cinder running track. Fronting on these is a steel-frame grand stand with tile roof having a seating capacity of 1000 and the bleachers 700 people.

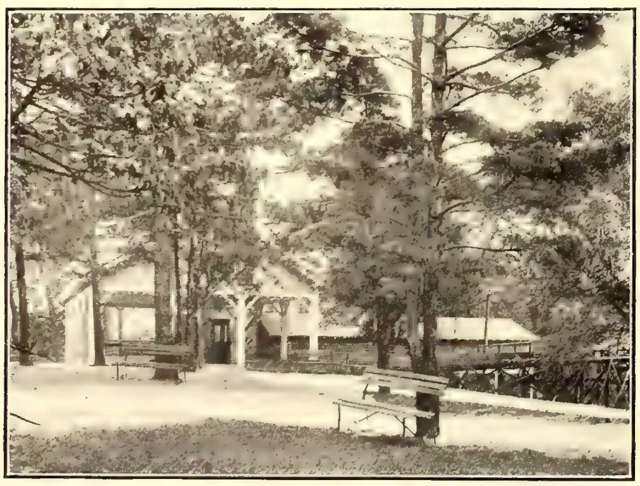
The park is lighted by 80 General Electric magnetite arc lamps, about 60 Nernst lamps and about 5000 incandescent lamps. Current for these and for the motors in the park as well is supplied at 2300 volts and 60 cycles to a sub-station outside the park enclosure and opposite the lower railway station. The sub-station, which measures 16 ft. x 20 ft. and

is constructed with buff pressed brick and tile roof, contains two 50-light General Electric mercury arc rectifiers and a switchboard consisting of three panels. All of the wiring in the park except that through the wooded portions is carried in underground ducts consisting of bituminized fiber conduits laid in cement. The magnetite lamps are employed in lighting the amusement avenue and the walks leading to it. These lamps are suspended on iron poles having ornamental iron brackets.

Complete water, gas and sewer systems are provided throughout the grounds. Eight-inch water mains extend

AUDITORIUM, CHAUTAUQUA GROUNDS

through those portions of the grounds on which buildings are located, and to these are connected fire hydrants and drinking fountains at frequent intervals and all of the refreshment stands and toilet rooms. From an artesian well equipped with a motor-driven deep-well pump having a capacity of 200 gallons per minute, water for the system is pumped into a wooden tank of 50,000 gallons capacity. This is supported on a steel tower 75 ft. high which, as has already been stated, is located at the center of the amusement



STATION OF THE SCENIC RAILWAY

avenue. The sewerage system, which has connections with the theater building, refreshment stands and toilet rooms, extends through the park and empties into the Illinois and Michigan Canal.

The entire park is enclosed with a 72-in. wire fence having reinforced concrete posts. In all 1500 posts were used, to which number two-thirds are 9 ft. and the remainder 7 ft. long. The longer ones were made at a total cost of about 65 cents each.

An idea of the extent of the work put upon the grounds may be obtained from the fact that about 5000 cu. yds. of concrete have already been used in the construction of the subway, the buildings, the bridges and the dams, and that the cost of the park when present plans are completed will be in the neighborhood of $250,000. The park was constructed by the Dellwood Park Company, a separate organization from the Chicago & Joliet Electric Railway Company, but closely identified with it. General Manager Blackhall of the railway company is also general manager of the park company, and under his supervision work on the park has been pushed rapidly. Construction work was begun in March, 1906, and at the close of the year the park was practically completed. The engineering features of the park were under the direction of A. S. Kibbe, chief engineer of the American Railways Company, of Philadelphia. During the design and construction of the work J. R. Lotz, as resident engineer, had immediate charge of the engineering and concrete work.

OLYMPIA PARK FOR 1907

Olympia Park will be operated by the owners, the West Penn Railways Company, of Connellsville, Pa., the coming season. O. C. Hartley, of Pittsburg, an experienced park man, has been retained as manager. The park will be put in first-class shape for the coming season, and already dates are being selected by schools, lodges, etc., for their annual meetings. The amusements will be closed on Sundays.

Arrangements have been made for thorough policing of the grounds. Objectionable characters will be excluded and disorder of any sort will be promptly discouraged. Many organizations from distant points are going to spend a day at shady Olympia, coming via the steam railroads.

In the theater will be presented good, up-to-date New York vaudeville attractions with an occasional week of musical comedy or minstrels.

The figure-eight roller coaster, the carrousel and swings will all be there to provide amusement, together with some new features, among which will be a roller skating rink and other attractions not yet settled upon.

A NEW JERSEY PARK TO BE BETTERED

W. Meredith Dickinson, of Trenton, N. J., and C. H. Oberheide, of New York and Chicago, operating under the name of the Trenton Construction & Amusement Company, have secured the lease on Spring Lake Park, Trenton, from Manager Peter E. Hurley and President John A. Rigg, of the Trenton Street Railway Company, and Peter E. Wurfflein, the present lessee, and plans are being prepared for the company which will entail an expenditure of about $200,000 and result in making Spring Lake very attractive. These plans include the transformation of the lake into a place fit for all kinds of aquatic sports and pastimes. Beautiful boats and launches will be put in the water; the driveway around the lake will be remodeled and thousands of electric lights will be placed around the lake for illuminative and decorative purposes. Mr. Oberheide, under whose direction the new park is to be built, has been connected with a number of the leading parks of the country and still has large interests in several summer resorts. He has gathered ideas from these numerous parks which he intends to use in the new "white city" at Spring Lake. There is to be the largest and best dance pavilion in the State, a fine roller skating rink, scenic railways, vaudeville theater, band stand, shoot the chutes, carrousels, miniature railway and all the other amusement devices popular in the best electric parks in the country. Another feature of the park will be the landscape work.

THE AMUSEMENT RESORTS OF THE TWIN CITIES—MINNEAPOLIS AND ST. PAUL

BY A. W. WARNOCK
General Passenger Agent, Twin City Rapid Transit Company

The Twin Cities of Minnesota, with a population of about half a million, are not only wonderful cities from a commercial standpoint, but nature has been so generous with her gifts to them as really to entitle them to the name of "The Park Cities of the Northwest."

Minneapolis, "the Flour City," has a cluster of glistening lakes within its limits, and St. Paul, "the City of Seven Hills," is enthroned on the high, rocky cliffs of the deep-gorged Mississippi, which binds the two with its ever-flowing waters. And in and around them there is a great land of Out-of-Doors, of fertile plains, busy villages, rugged ridges, cool forest, sparkling streams and falls, shimmering lakes, pretty country homes, broad farms and spots where Nature is seen in her virginal wildness, all forming scenery of unsurpassed beauty. Such, briefly, is the inadequate description of two cities which appeal to every visitor, whether on business or pleasure bent.

The Twin City Rapid Transit Company operates over 354 miles of high-class up-to-date track in and around Minneapolis, St. Paul and Stillwater, and reaches every lake resort, park and point of interest about the Twin Cities. It has been largely instrumental in building up the parks into the beautiful spots they are to-day. Perhaps a word or two about the different Twin City parks may be interesting to the readers of the Street Railway Journal.

ST. PAUL PARKS

Undoubtedly Como Park is the most beautiful city park in the Twin Cities. It embraces 400 acres and is the largest park in the Northwest. In the restful rural loveliness of its natural landscape, with its hills and dales, groves and meadows, and its shining lake nestling in the encircling arms of its tree-clad hills, it has few peers among the parks of America. Here will be found pretty fountains, grassy lawns and flower beds; a curiosity in the shape of a lily pond and a Japanese garden, containing dwarfed trees over 300 years old, as well as rare Japanese plants and shrubs. A large, handsome concrete pavilion affords many entertainment features and band concerts. Como Lake offers delightful boating as well as drives around its winding shores. Como Park is reached from the heart of St. Paul in about twenty minutes, fare 5 cents, and thousands and thousands of St. Paul people, young and old, journey to it every day during the summer season. It is also well patronized by Minneapolis people.

Copyright by Sweet, Minneapolis. THE JAPANESE GARDEN AT COMO PARK, ST. PAUL

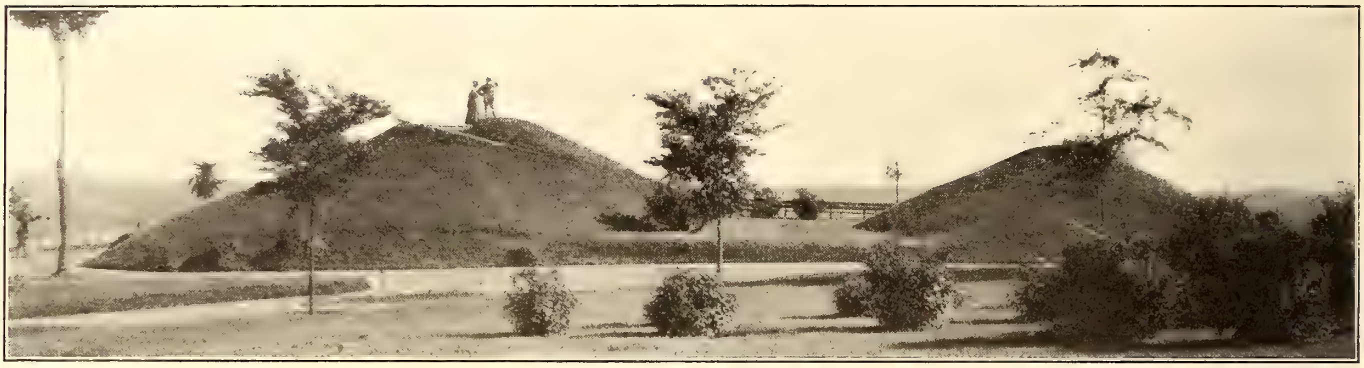
ST. PAUL'S INDIAN MOUNDS

Occupying 135 acres on the margin and slopes of the lofty bluff at the apex of the elbow of the Mississippi River, the Indian Mounds command far-reaching prospects of the hill-bound valleys of the Mississippi and Minnesota Rivers which are hardly equaled in America in their extent and magnificence. It is without doubt the "Prospect Park" of America. The edge of the bluff, which takes in this wide sweep of view and makes it a portion of the park itself, is crowned with five superb cone-shaped Indian mounds. The Indians visited the mounds every spring, conveying thence

their dead chieftains to inter them in the mounds. At the same time they held their annual grand councils. No attractions of any kind are provided at Indian Mounds except a pavilion for refreshments, but as the fare is only 5 cents from St. Paul, it is a great resort to attract residents as well as strangers. The interesting State Fish Hatchery is adjacent to these mounds.

PHALEN PARK AND LAKE

Directly north of Indian Mounds, in another part of St. Paul, is Phalen Park and Lake. Phalen Park is distinctly an aquatic park, although it might also be called a forest park, for the primeval woods which clothe its western border form one of the most characteristic features and are inviting for picnic parties. There is music and entertainment in the pavilion as well as a collection of Midway entertainments on the island, and the phrase, "Meet me on the Island," has come to mean "Meet me for a good time." The fare to Phalen Park from St. Paul is 5 cents.

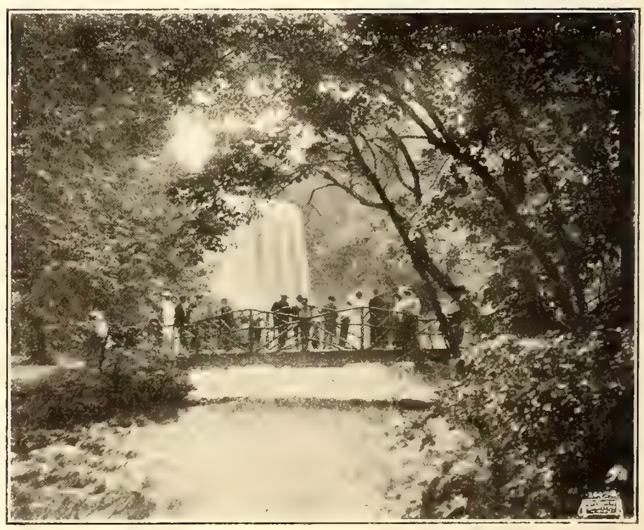


INDIAN MOUNDS AT ST. PAUL

BEAUTIFUL WILDWOOD ON WHITE BEAR LAKE

The trip from St. Paul to beautiful Wildwood, on White Bear Lake, is a charming one. The fare to Wildwood, each way, is 15 cents; time, forty minutes; distance, 15 miles. The trolley trip is through rural scenes whose beauty is the constant wonder of the thousands who travel this highway. You get fine distant views of the Twin Cities as the car rolls along over the broad, panoramic country. The line runs through North St. Paul and past Silver Lake, with pretty farms and ever-changing, verdant pictures on all sides, and then into Wildwood the Beautiful on the shore of White Bear Lake, where one may find rest, comfort, coolness, and kindred delights of the good, old, care-free summer time. Wildwood is on the south shore of White Bear Lake, and is, as its name signifies, a gem set in the wild wood. It is one of the loveliest spots in the Northwest, and combines all the features of a park, lake and summer resort. offering everything in the way of entertainment to make you forget your troubles. There are fine facilities for bathing, boating, dancing, and last year it had a "Tour of the World" as well as a "Fire Show." Fireworks, band concerts and other special entertainments are liberally provided, and it is the Mecca for many picnics and excursions from St. Paul as well as Stillwater, which is 8 miles beyond.

THE PAVILION AT LAKE HARRIET



MINNEHAHA FALLS AT MINNEAPOLIS

THE PARKS OF MINNEAPOLIS

The city parks of Minneapolis in point of importance are Big Island Park, in Lake Minnetonka; Minnehaha Falls Park and Lake Harriet.

BIG ISLAND PARK ON LAKE MINNETONKA

While Big Island Park was opened for two weeks during the season of 1906 and high-class band concerts offered, it was principally as an introductory bow to the public, as the park will not be finished and formally opened until Decoration Day, 1907. When it is completed it will be the most beautiful and up-to-date amusement resort in all America. This is superlative praise, but the facts warrant the statement.

In 1905 the Twin City Rapid Transit Company's lines

were extended from Lake Harriet to Excelsior a distance of 14 miles, through a meadow, lake and hill country. This line was built as good as money and brains could make it. Double tracks of 80-lb. rails are laid on a perfectly graded and ballasted, straight, private right of way, enabling the 300-hp in motors per car to clip off the distance with ease at a mile-a-minute rate. The line ends at Excelsior, on Lake Minnetonka, one of the finest lakes in the Northwest, and which has a shore line of something like 300 miles in extent, lined with handsome homes, pretty bays, inlets and islands, all forming a scene of surpassing beauty. Through cars from the heart of Minneapolis make the run of 18 miles to Excelsior in forty-five minutes, passing Lakes Calhoun and Harriet as well as any number of lakes and ponds between Lake Harriet and Excelsior. A second "Cottage Line" branches off from Hopkins to Deephaven, another point on the lake.

Passengers from Minneapolis on electric cars on arriving at Excelsior disembark at a most attractive dock station, which not only includes a pleasant lunch room and resting gallery, but combines all the good features of a first-class waiting station. These docks are the center of life in Excelsior, and accommodate the Twin City fleet of twelve up-to-date steamboats.

The three large double-end, double-deck ferries, Minneapolis, St. Paul and Minnetonka, will be ready for service in the spring, with a carrying capacity each of 1000 passengers. The large excursion steamers Excelsior, Puritan and Plymouth will offer round-trip tours on the lake at an unusually low rate over anything that has been quoted before, and will accommodate over 1300 passengers. The six fast Twin City Express boats, Como, Harriet, Hopkins, Minnehaha, Stillwater and White Bear will perform an express service between Excelsior and all principal cottage resorts on the lake. The capacity of the entire fleet will aggregate over 5000 passengers, and by a system of unususually low fares the Twin City expects to make steamboat riding on Lake Minnetonka an unusually attractive proposition next summer. You can travel between any two points on any one express boat for 10 cents, and the round trip from Excelsior to Big Island Park and return, including admission to the park, is 10 cents. The rate from any point in Minneapolis by transfer to Big Island Park, including a 2-mile steamboat trip and admission to the park, is 25 cents each way, a distance of 20 to 26 miles.

PICNIC KITCHEN, BIG ISLAND PARK (LEFT OF WATER TOWER)

STROLLING IN THE WOODS OF BIG ISLAND PARK

Boarding the ferries and making a delightful 2-mile trip over to Big Island Park, people will be amazed to see what money and genius have accomplished in the matter of transforming what was once a dense wooded island into one of the finest resorts in all America, if not in the world.

Big Island Park comprises approximately 65 acres, and under the magic wand of one of the best landscape artists will resemble a bit of fairyland. Delightfully situated in the center of a splendid inland lake, with an abundance of great trees, grass and inviting nooks, it will offer an ideal place for the tourist or "stay-at-home" to enjoy a few idle

hours, or a family picnic, which is always part of the summer season.

On landing at Big Island Park, visitors will find themselves at the beginning of "the long walk," laid out with flower beds, and leading directly to the electric water tower, from which the supply of water is furnished to the island. This tower is 200 ft. high, built of steel and covered with white cement. It will be studded with many electric lights, presenting a dazzling appearance by day as well as by night. Describing a circle from the dock to the water tower will be a peristyle composed of arches of concrete and tile, all in white and studded with electric lights. At the water tower will be a shelter house from which a fine view of the lake can be had.

Near by will be grouped the amusement features, consisting of an unusually fine coaster railway, enchanted river, penny theater, the merry maze and a number of other clean and inexpensive entertainments, which will delight the old as well as the young. Located conveniently on the trail around the island are also two absolutely fireproof dormitories, one for women and one for men, in which the help on the island will be housed. These dormitories are of the very best and latest construction.

There will also be four picnic kitchens, which will be provided with ranges, and the fires will be maintained by the company at its own expense for picnic purposes, where parties can make coffee and warm their lunches. These kitchens are real architectural triumphs in their way, being modeled after the old Spanish Missions, the same as all the other architecture on the island. By the amusement features will be a pavilion in which lunches and refreshments can be obtained at reasonable rates. Excellent toilet rooms will be located here and there on the island, fitted with the best plumbing.

But there will be two attractions which will appeal probably more thoroughly to the public, one of which is an excellent aquarium and aviary in which will be housed a collection of foreign and domestic fowls and fish, the only collection of the kind ever gathered in the Northwest. Most of the birds have just been purchased in Europe. They were selected by an expert bird fancier.

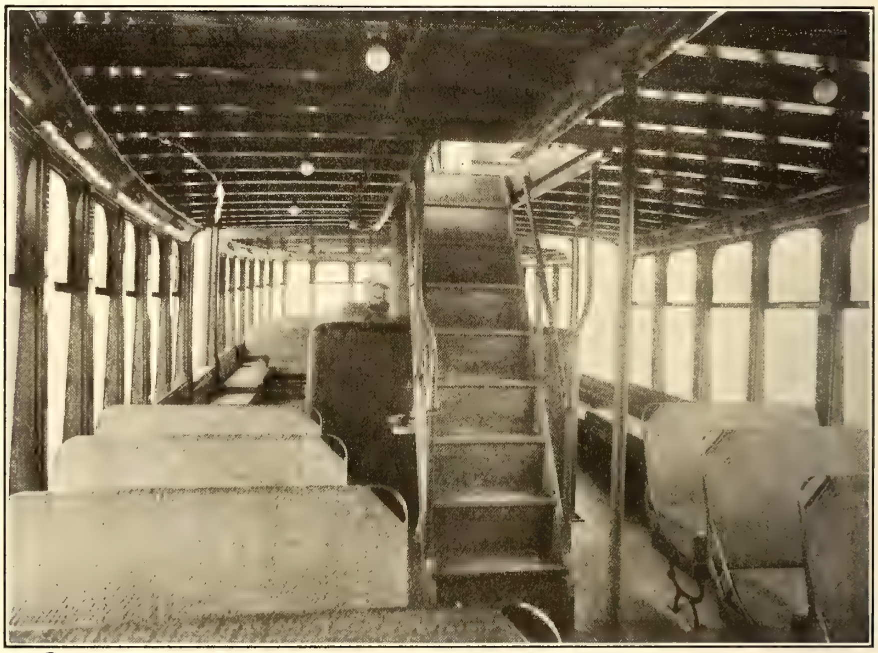
Near the aviary will be a music casino, built on the highest point of the island overlooking the lake. This casino will be built entirely of steel, concrete and glass, and will contain a splendid rostrum on which a band of sixty pieces may perform comfortably. The Twin City company has arranged for the appearance between June 16 and Sept. 1 of some of the best musical organizations playing in the United States. The auditorium will include a number of private boxes as well as 1500 opera chairs. With a system of curtains the auditorium can be closed up tightly in inclement weather and in fine weather the entire casino opened to the breezes of summer.

A novel feature of the island will be a Dancing Marquee. This will be located next to the casino and will afford a delightful place for those who wish to trip the "light fantastic toe." When it is considered that the music for the lively two-steps and waltzes will be furnished by the famous organizations playing in the casino, it can well be said that those who love dancing will have such inspiration as has never been offered before in the Northwest.

The Twin City company will make Big Island Park as accessible to St. Paul as to Minneapolis, showing in this way that Big Island Park is strictly a Twin City proposition intended for the enjoyment of St. Paul people as well as those of the nearer city of Minneapolis.

During 1906, the first summer of the Twin City Service on Minnetonka, there were any number of private and public excursions and picnic parties that journeyed to the lake by electric cars and enjoyed the steamboat service. Heretofore the rates on Lake Minnetonka were almost prohibitive, the round trip of the lake being 50 cents, whereas the Twin City company has cut the rate to 25 cents.

Experts who have traveled the world over concede that the Twin City company has the most wonderful proposition they have ever seen. It is not the intention to make Big Island Park a noisy Coney Island, but a delightful place for those who love beautiful trees and coolness, yet with enough entertainment given them to help while away the summer days. Everything connected with Big Island Park will be operated on the highest plane possible.



MAIN DECK OF EXPRESS BOAT, LOOKING AFT

MINNEHAHA FALLS AND PARK

Minnehaha Falls, immortalized by Longfellow, is truly a gem that is unapproached. No cascade has ever been so celebrated in American poetry, and none claims a surer charm for the visitor. The falls are about 40 ft. high, and the whole region about them has been made accessible by rustic paths and bridges. The falls are maintained in their original beauty in the heart of the largest park of Minneapolis, consisting of over 100 acres of hill and dale. Below the pretty falls, which "laugh and leap into the valley," the creek flows through a deep glen for half a mile to the Mississippi. At Minnehaha Falls is the old Stevens house, the first erected on the west side of Minneapolis, in 1850. On the other side of the glen is the pavilion and a good collection of wild animals, always interesting to young and old. Flowers, foliage, shrubs and velvety lawns make Minnehaha Park most beautiful and at-

tractive. The trip from Minneapolis to Fort Snelling and Minnehaha Falls is a pleasant one and the rate of fare is 5 cents. Minnehaha Falls is generally made the stopping off point for visitors en route to Fort Snelling, which is 3 miles below and reached by electric cars.

Fort Snelling is beautifully located at the junction of the Mississippi and Minnesota Rivers, and while there is no through line from St. Paul to Minneapolis at the present time via Fort Snelling, the line from Minneapolis ends at Fort Snelling on one side of the river and the line from St. Paul ends on the other side of the river, so that there is only a short distance to walk between the two lines, practically offering a fourth interurban line between St. Paul and Minneapolis.

LAKE HARRIET

Lake Harriet is on the main Minnetonka line between Minneapolis and Excelsior and Deephaven, and is a most picturesque resort, offering plenty of entertainment, boating, bathing, electric launch trips and band concerts. There are many places in the woods in which to enjoy a picnic or a few lazy, pleasant hours, and the beautiful parkways and terraced drives around the lake show a constantly changing picture of life. It is one of the best scenic gems of which any city may boast.

EXPRESS BOAT "HOPKINS" FOR TWIN CITY PARK SERVICE

GENERAL PLANS FOR DEVELOPING BUSINESS

It can thus be seen that the "Twin City Lines" have an unusual opportunity in the way of resorts for patrons, and the general policy followed is to bring business from the logical centers. That is to say, there is a certain class of business in St. Paul that wishes to be moved only to St. Paul local parks, Como, Indian Mounds and Phalen. There is another class of business that prefers another trip from St. Paul, and Wildwood is their ultimate destination. In Minneapolis, there is a certain class of business that naturally gravitates to Lake Harriet, and every day there is a constant stream of travel to Minnehaha Falls, which is probably the most popular resort in the Twin Cities. The advertising, if the term may be used, given it by the late Mr. Longfellow, certainly makes it the one place visitors to the Twin Cities want to see first of all.

Big Island Park, of course, is a brand new proposition, and at this time I am unable to make a prophecy for it other than one of success. It has all the elements, but of course, as the rate of fare is somewhat higher than to the city parks, it will be a matter of persistent advertising and education to bring the volume of business to it.

We will maintain a handsome city ticket office in Minneapolis, from which our Minnetonka cars depart, and which will also be an information bureau where passengers can secure folders, time tables and other information.

In the matter of publications this year, we will issue two very elaborate folders. A new edition of "Twin City Trolley Trips," a 48-page folder, printed on the finest kind of paper, containing a color map in the center, of our entire system and replate with handsome engravings of scenes along our lines will be one. Last fall we had all the principal points of interest on our entire system photographed, and we have now a collection of 200 of most beautiful electric car pictures. My theory has been that an electric car view should contain either a piece of track or a car somewhere in the picture. Suppose we have a picture of a pretty lake, and put in small print under it "Silver Lake on the Twin City Lines." The general idea is that the lake may be on the line or it may be some distance from the line, but my theory has been that if you can show at a glance that this lake can be seen from the car window it makes it doubly attractive. Accordingly, every one of our pictures has cars or bits of track in some parts of its makeup.

Our Twin City Trolley Trips folders educate people to travel over our entire system, and by means of little charts we believe we are developing the trolley instinct in residents as well as strangers. Last year we distributed vast quantities of these folders, a great many being mailed to all parts of the United States, which, of course, makes good advertising.

Another folder we will issue this year will be a 20-page folder entitled: "Airship View of Beautiful Big Island Park and Lake Minnetonka." Besides an attractive assortment of pictures of our steamboats and Big Island Park, one side of the folder will contain a large map 31 ins. wide and 9 ins. deep, being a panoramic map of Lake Minnetonka and Big Island Park, taken approximately from a point 1000 ft. above the Dock Station at Excelsior. We have had this prepared with the utmost care, and it will be a very attractive relief map, showing at a glance how people from the Twin Cities can reach our docks at Excelsior, where they change to our boats for all principal places of interest around the lake. It is a stunning picture everybody is anxious to keep.

We also furnish time tables and have arranged to take large quantities of space of display advertising in all the daily papers in Mineapolis and St. Paul, in which we will be represented every day during the season of June 1 to Sept. 15. We have also found cards displayed in the side windows of our cars very effective advertising. These cards measure 24 ins. wide by 13¾ ins. deep and are printed on both sides, being read by passengers inside the car as well as outside the car. We have eight of these spaces in use in the summer time in each car, four on each side, and divide them among the various parks, with a change of copy frequently—about once every two weeks. During the past winter we have used tin signs hanging on our back vestibule, advising passengers where free skating is to be had, and as all our parks offer this pleasure we are thus giving

information that the public appreciates. We confine ourselves largely to these four forms of publicity, and returns show that the methods we have pursued will be very effective. Of course, what we will do in the future we are unable to say just now, but the fact remains that we will do what we consider the sane and sensible thing to promote business for the various resorts. There is naturally a stream of business to the city parks which will take care of itself, but to Wildwood and Big Island, where the fare is higher, there must naturally be made a great deal of special effort. We will devote great efforts to induce clubs, lodges and societies to go to Big Island Park, and by sending them folders, maps and other information about the island we hope to get the people to work up considerable enthusiasm to take their excursions and picnics to that resort.

As I said before, the future is all before Big Island Park, and I cannot tell you the extent of its wonderful success this coming year, but that it will be a wonderful success there is no room for argument. Our Minnetonka rail lines, boat lines and park represent a great investment, and with energy back of it all they spell only Success!

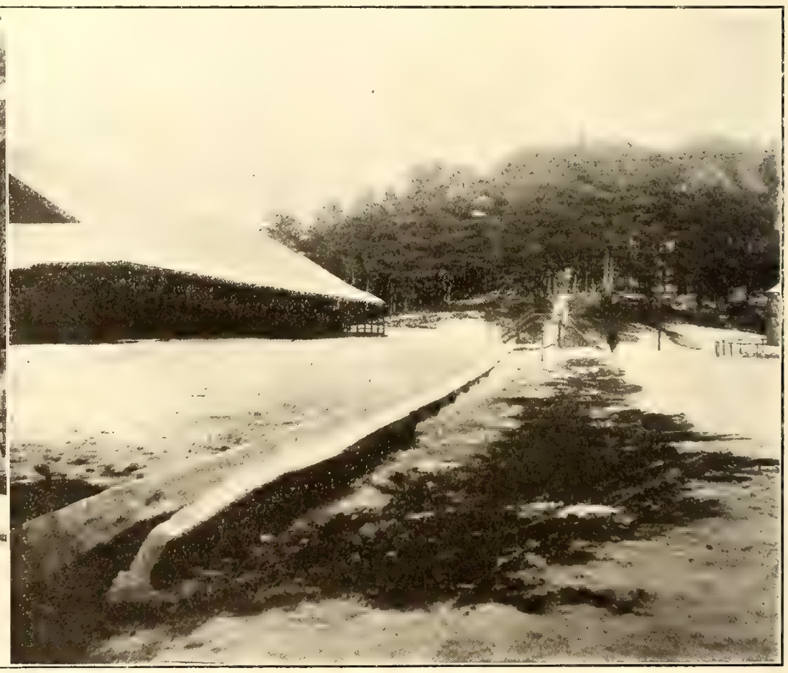
WINTER PLEASURE TRAFFIC ON THE BOSTON & NORTHERN STREET RAILWAY

One of the reasonable objections urged against pleasure park business by street railway companies is the one based on the fact that in northern climates the park property is used for only a few months in the year, so if the returns are not very large in that short period the investment is unprofitable. This of course applies also to the lines built to the parks, which often do not carry much traffic outside of the summer months. Within the last few seasons, however, a number of companies have devised several methods of making use of their parks during the winter, and several of them have met with very encouraging returns. Most cases these parks are furnished with lakes so that it is possible to use them for ice skating. By enclosing the dancing pavilions and similar structures and heating them, sufficient accommodations can be furnished to the winter visitors for rest and refreshment.

One effective way of securing traffic in cold weather is the building of toboggan slides. This idea has been taken up by the Boston & Northern and Old Colony Street Railway Companies under the direction of H. A. Faulkner, passenger agent of the company. For this season the companies have built toboggan slides and skating places at Lakeview Park, Lowell; The Pines, near Haverhill; Highland Park, at Brockton, and Sabbatia Park, at Taunton. Three of these slides are shown in the accompanying illustrations. The toboggan at The Pines is a particularly fine one, the slide being about 750 ft. long and covered in sixteen seconds.

TOBOGGAN SHUTE AT HIGHLAND PARK, BROCKTON, MASS.

TOBOGGAN SHUTE AT LAKEVIEW PARK, LOWELL, MASS.

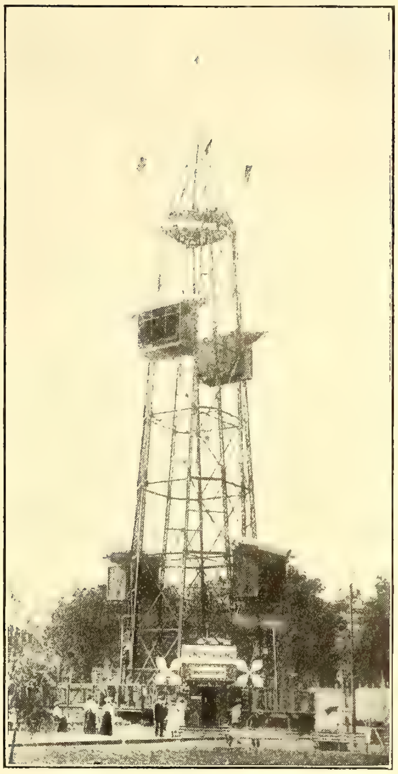


TOBOGGAN SLIDE AT THE PINES, HAVERHILL, MASS.

The recent cold weather in New England has brought out great crowds to all of the parks mentioned, and no doubt the increased business will soon repay the initial outlay. Undoubtedly, increased familiarity with this exhilarating sport will bring out even larger numbers next winter.

THE EQUIPMENT OF PLEASURE RESORTS

Many persons have deprecated the immense investment which is being made in street railway parks and the expenditure on them by the public as evidences of the loss of useful capital to the country. Viewed in the light that such parks were not common ten or fifteen years ago, they may be luxuries; considered more broadly, however, the modern street railway park is a direct benefit to the community in whose neighborhood it is. The crowded condition of the modern city, its stifling heat during the summer and the amount of nervous energy required in modern business make rest and recreation during the heated season a necessity, and a street railway park will many times return to the community at large in health the expenditure upon it. This does not imply that every city, regardless of its size, requires a Luna Park, a Dreamland or a White City. Their establishment depends upon the extent of the attendance possible. But practically every town or city, large enough to support an electric railway, can also support some kind of a picnic park, with attractions suitable to the number and habits of the people in the community. And as the question of transportation to such a park is naturally allied with the management of the park itself, the association of the railway and park interests have been brought about naturally.

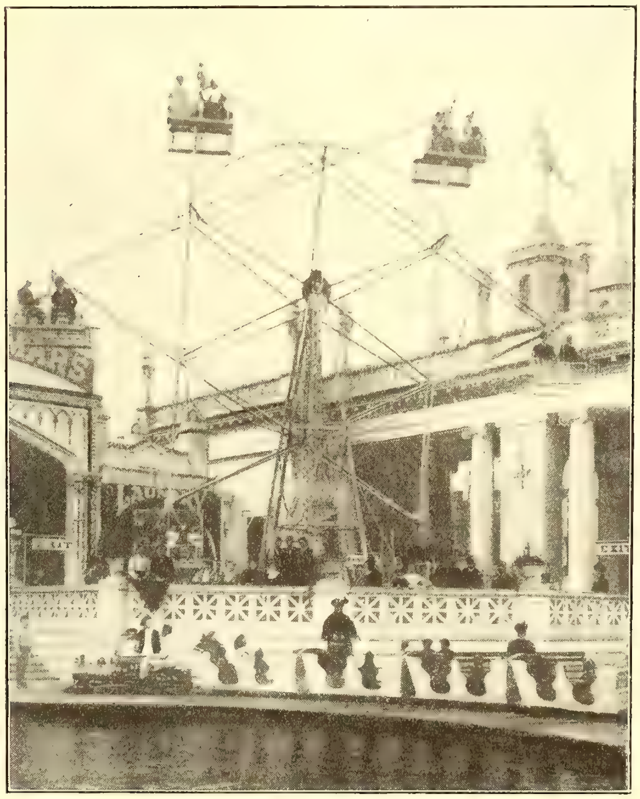


REVOLVING AIR-SHIP TOWER

The proper attractions to install in a park are quite as important as any other portion of the problem. Some pastimes, like the carrousel in its various forms, seem to be always popular; others, like roller skating, which at the present is rapidly returning to favor, appear in the past to have followed waves of popular favor. In other cases it is only the latest and newest which will draw the crowds. A thorough discussion of park resorts would not be complete without an account of the new apparatus and devices which the manufacturers who cater to this class of trade are preparing to present this year to electric railway companies. Several of these forms of amusement are entirely novel, others are improvements of well-known and well-tried devices. In some cases, as in the circle swing, which is only two or three years old, the popularity of the idea has led to the construction of a variety of forms differing in various points. It is impossible to enumerate all of the attractions which will be presented at the various street railway parks during the year 1907, but an attempt has been made in the following pages to gather together some of those which have already been announced to the trade.

AERIAL AMUSEMENTS

Many novel attractions have been devised from time to time with the end in view of affording sensation by whirling people through space at a greater or less distance from the earth, and have proved eminently successful as amusement features, mainly, no doubt, because of the peculiar fascination which attaches to the subject of aerial navigation. In fact, some of these devices have been designed with the very idea in mind of affording the sensation of flying. One such device is the revolving airship tower, made by the Revolving Airship Tower Company, of Chicago, Ill. It is built of steel, 15 ft. or more in height, mounted on a revolving platform about 150 ft. in circumference, operating four imitation airships. Each ship is raised and lowered by means of four steel cables, three-quarters of an inch thick, each cable having a breaking strain of 20,000 lbs. As the ships are raised and lowered the tower slowly revolves, giving those who are riding therein a sensation of flying through the air, the occupants seeing none of the ropes, mechanism or tower by which the ships are operated. The illusion of riding in airships is further increased by equipping the back part of each car with a large mirror which reflects the landscape and the sky through the open front of the car, together with the revolving fan propellers, which make it appear as though the cars were double-sided and open, and also suspended from a cigar-shaped balloon. Each car will seat sixteen passengers, and it takes four minutes to complete the round trip. The tower in Sans Souci Park, Chicago, has been so successful that the park management is negotiating now for its purchase.



THE WHIRLING STAR

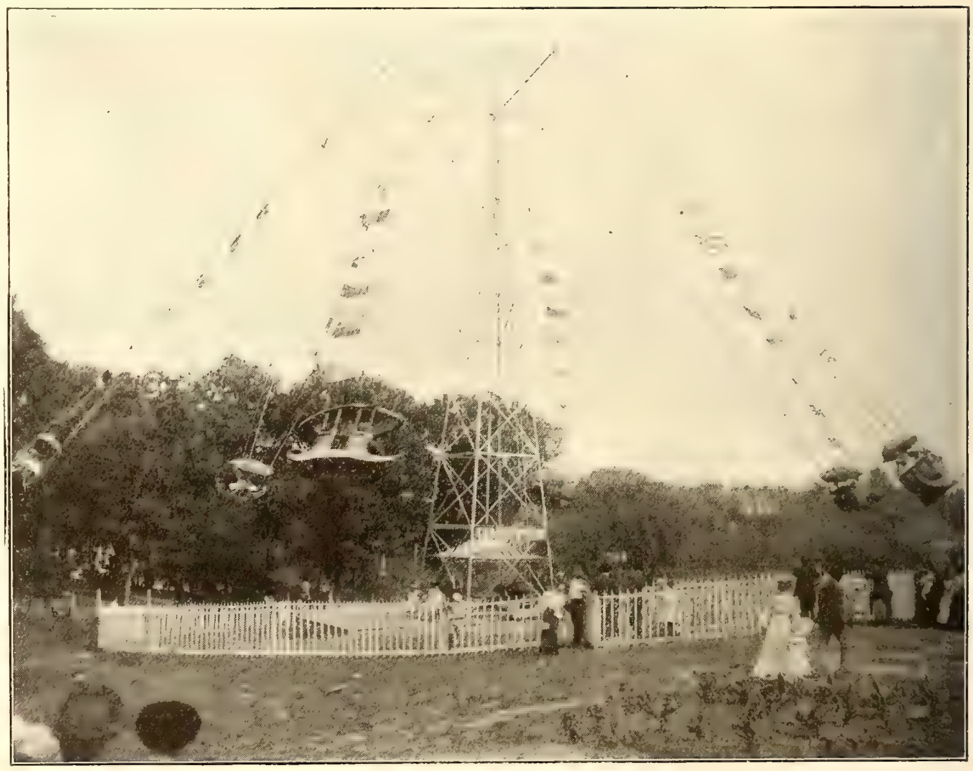
Another novel aerial amusement feature is the whirling star. The star itself revolves on a horizontal axis, supported by two A-frames, one at each end of the axle of the structure. These A-frames rest on a turntable platform and the circular platform and the turntable constantly revolve, so that passengers step on and off the rotating plat-

form while it is in motion. This does not necessitate shutting down the apparatus while the cars are being loaded and unloaded. Passengers turn around two ways in the air while going up and down; at the same time the cars are so arranged that the passengers have an unobstructed view of the surroundings. There are twelve cars in all, each carrying four persons. The average ride is about four minutes. At night, the six-pointed star revolving on two axes can be made especially attractive by suitable illumination by incandescent lamps. This machine is built by the National Concessions Company, of Chicago, which installed the first star in the White City, Chicago.

THE AEROSTAT

The ærostat, made by the Federal Construction Company, of Chicago, is a new type of circular swing built upon lines radically different from the swings of the customary type. The tower itself consists of a six-leg steel structure, gusset-plate bridge construction thoroughly braced and anchored to the foundation. Over the top of this structure is telescoped a six-armed cantilever steel-crown truss, in such a manner that the entire weight of the cars, passengers and crown truss is carried from the under side of top supports. The tower part of crown truss, to which the gear wheel is attached, is provided with anti-friction roller bearings to guide it while revolving. This crown truss, with its load, is supported on 154 one-in. steel balls traveling between two case-hardened ground-steel plates. Each ball, by the use of a special ball retainer, travels in its own individual path, reducing friction to a minimum. A 7½-hp motor which is located in the top of the tower, directly under the crown truss, is used as motive power. The swing may be brought to full speed in less than sixty seconds, and brought from full speed to a dead stop without discomfort to the passengers in thirty seconds, although no brakes are used. The structure weighs 11½ tons. The telescoping of the crown truss over the tower prevents any possibility of accident, while the method of operation is so simple as to be practically foolproof. The controlling and driving mechanism of the swing is self-regulating to the extent that no careless act of an operator, in suddenly throwing on or off the current, would affect the safety of the passengers or structure in any manner. A thirty-six passenger swing is shown in the accompanying illustration. The Federal Construction Company, which is the manufacturer of the aerostat, has undertaken the task of introducing a new feature each year, its efforts resulting in such popular attractions as the Katzenjammer Castle, velvet coaster and "Elter," besides the aerostat. Last season the company originated and introduced the aquatic mystery, "Elter," which was put on at the "Chutes," June 9, and ran through the season, growing stronger each succeeding week. The general interest and the various theories advanced regarding this mystery prompted the Chicago "American" to offer a prize of $150 for the best solution, and of a total of more than 8000 answers, less than 15 were eligible to competition. The company is now prepared to furnish plans, specifications and equipment at a very reasonable sum, for producing this act. As a distinctly new attraction for this year the company is building for Riverview Park, of Chicago, the largest water chute and velvet coaster ever constructed. This is a chute of new type that presents an unbroken surface of rippling water, which under the many incandescent lamps will glare with dazzling brilliance.

Another device that approximates in its operation aerial navigation is the circle swing flying machine or airship, made by the Travers Circle Swing Company, of New York. The device is in reality a stationary or captive airship, which provides the passenger with flight through the air at the rate of 25 to 30 m. p. h., and at an elevation of about 20 to 25 ft. from the ground. The swing is a steel structure, towering up 60 or 80 ft. in height, and has been tested to five or six times its full-load capacity. The structure is beautifully illuminated with from 500 to 1000 electric lamps, which, when revolving at night present the appearance of whirling rings of flame, and at a distance resemble an enormous sun-



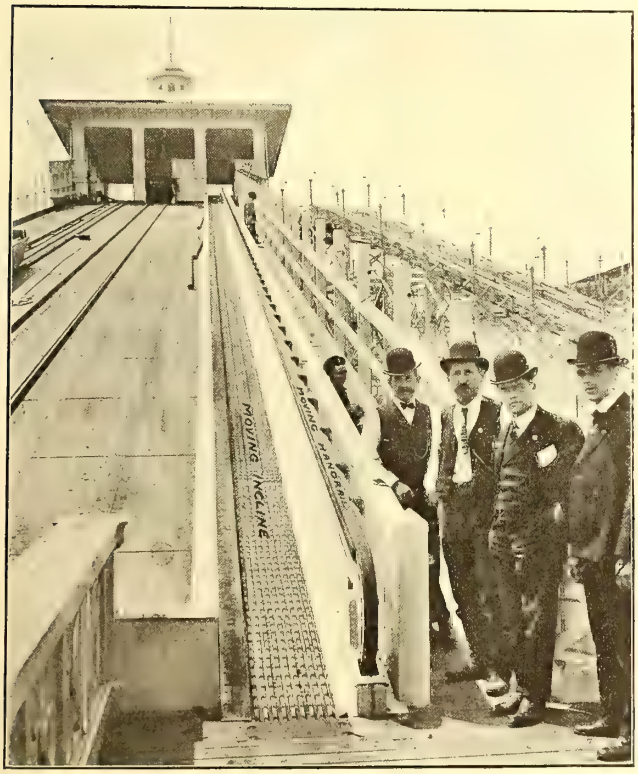
A TYPE OF CIRCLE SWING

burst. The 120 flags which are unfurled to the breeze during the day attract the attention and play upon the imagination and curiosity of all. The cars are built on the plan of an airship, the frame being of steel decorated with beautiful reedwork, which gives an artistic finish. They start from the ground level, revolving about the tower at an increasing rate of speed, and as they raise higher and higher an excellent view is given of the surrounding country and scenery. The Travers Company has built more than 120 of these swings, and in not a single instance has an accident been reported. Many of the swings in use in street railway parks are operated by the street railway company or by the Travers Company, which not only sells these devices but owns and operates twenty-five individual installations throughout the country.

Swings have also always been attractive. A company making a specialty of swings is A. Birch's Sons Company, of Elizabethtown, Pa. The company fits its swings with reclining chairs, thus affording extreme comfort. There are no shearing points in these swings and they are said to possess no element of danger.

THE MOVING STAIRWAY AND INCREASED EARNINGS

The moving stairway while not in itself an amusement device greatly augments the earning capacity of such attractions as chutes, scenic railways, etc., by increasing their capacity and removing the "rush" sometimes incident to the operation of park features. A moving stairway that has been developed with this service in mind and is now in use in a number of parks is made by the Reno Inclined Elevator

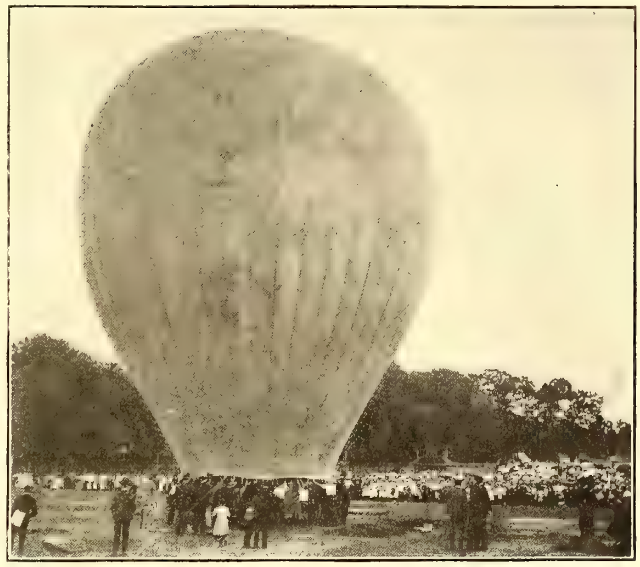


THE MOVING STAIRWAY

Company, of New York. As regards cost of operation, the manufacturer says actual tests set the figure at 1 cent to elevate 500 people to a height of 18 ft. The machines are built of various types, single file, carrying passengers either up or down, double file, carrying two lines of passengers either up or down, and "duplex," carrying passengers up and down simultaneously. The stairways can be installed in existing structures as their weight is not abnormal. An important improvement lately added to these machines is a step-tread, which enables the passenger to stand upon the moving treads with greater ease and comfort than in the old style. Reno elevators have been in operation upwards of eight years, and it is stated have the extraordinary record of operating without a single personal accident to a passenger.

THEATRICALS

For the busy man whose park property does not permit of his having a regular park manager, and for the park man-



CROWDS WAITING FOR BALLOON TO ASCEND

ager who wishes to change the program of his attractions from time to time, so as to offer new and striking features to induce traffic, there are available a number of agencies furnishing attractions that offer an excellent opportunity for the selection of such attraction or attractions as will meet local requirements best. Arrangement can be made with some of these companies for special short-time engagement or for a change of bill weekly. In fact, the advantages of the system make it possible to meet almost any contingency that may arise. These companies by assuring continuous service to their employees are able to secure better features and a higher class of artist than is possible where the tenure of office of the employee is uncertain. An instance that this is true is furnished by the case of the Prudential Vaudeville Exchange, of New York, which controls more than 200 attractions, covering all the various phases of the entertainment business and including the best artists in their respective lines. Out of this great number of attractions those can be engaged which suit the individual requirements of the manager, governed by the people to whom he is catering for patronage.

One of the most perplexing problems that usually confront the park manager is booking a free attraction. There are many so-called death-defying acts to choose from, but few of them for some reason or another are available. An attraction of this kind, however, which is sufficiently spectacular when performed properly to attract and hold large crowds is the hot-air balloon and parachute leaping, which by the very simplicity of its equipment makes it really adaptable where other attractions would be impossible because of the outlay of installation. A balloon can be seen for miles, and the spectacular descent of the aeronaut dangling beneath a frail parachute never fails to attract atten-

tion. Though the performance in itself is old, many novelties have been added to it from time to time during the past ten years, and it is on the whole more popular than ever, especially because there attaches to each performance a seeming uncertainty as to the outcome. Accidents, however, are rare among experienced balloonists. Compared as to earning capacity with some costly foreign introductions of feats of daring, balloon ascensions are a much better business undertaking. As showing strikingly the interest that attaches to the balloon ascension is reproduced a photograph of J. Mack, of Trenton, N. J., who makes a specialty of ascensions, preparing to "go up."

THE ROLLER-SKATING RINK

From all accounts the roller skating rinks established last year, following the revival of this pastime, were very successful, and the demand this year promises to be greater than ever, the fad having been especially pronounced during the past winter in the large cities. To add to the attractiveness of the sport, and especially to establish it as a permanent institution, and therefore continuous source of revenue, the plan has been adopted of holding competitions for amateurs and professionals, and also of engaging as a special feature from time to time professional and amateur fancy skaters. In this way there are attracted to the park or rink many persons who, while not perhaps skaters themselves, swell the admission fees and become a source of revenue by patronizing other attractions. From the experience of the past seasons it would seem that park managers can often provide this entertainment to advantage. Where a building is not available that can be easily converted into a rink it may be found both feasible and profitable to erect a special building just as a number of companies did last year. Local conditions govern in each case, however, and the questions of admission and prices of skates must be decided by each manager for himself. Two instances are on record for last year where the charges were 25 cents for admission and skates and 10 cents for the use of skates and no admission fee. An element that should enter into any consideration of prices is the cost of transportation. Efficient management will result in the suppression of disorderly persons here just as it has so effectively in the case of the dance pavilion. Of those companies dealing in skates the Union Hardware Company, of Torrington, Conn., reports a large demand for its products, not only from street railway companies themselves, but from the trade in general. Among the companies it has supplied with skates may be mentioned the New Hampshire Electric Railways, the Lynn & Boston, the Consolidated Railway, Light & Power Company, of Wilmington, N. C., and a number of others. The company makes several different styles of skates for both men and women, with either hermacite or steel rolls as may be desired when ball-bearing models are used, and with hermacite or lignum-vitæ rolls when plain bearing skates are used.

M. C. Henley, of Richmond, Ind., who has been making skates twenty-eight years, also reports an immense business for this season. In fact, the Henley plant, which has a capacity of 2000 pair of skates a day, is working overtime to keep up with orders. Mr. Henley reports that among the shipments made recently were the following:

"The Stadium," Montreal, 1000 pair; Luna Park, City of Mexico, 250 pair; Latrobe Amusement Company, Latrobe and Blairsville, Pa., 1000 pair; Louisville, Ky., 3500 pair; Bishop Clay's Mammoth Rink, Lexington, Ky., 350 pair; Victoria Rink, Toronto, 600 pair; Lakeside Park Rink, Dayton, 800 pair; two rinks, Johnstown, 1000 pair; Pittsburg, 100 pair; Meridian, Miss., 350 pair; Altoona, 500 pair; Jackson Rink, Jackson, Miss, 200 pair; Cataract Roller Rink and Riverway Rink, Niagara Falls, N. Y., 750 pair; Newark, 500 pair; twenty new rinks within a radius of 100 miles of Pittsburg, 10,000 pair. Shipments have also been made during the past sixty days to not less than two hundred other rinks requiring from 200 to 500 pair each, in addition to a large number of minor rinks all over the country. Although the season is advancing, Mr. Henley reports a rapidly increasing demand for skates.

The Samuel Winslow Skate Manufacturing Company, of Worcester, Mass., also reports a large demand for its various designs of skates. This company has a capacity of 15,000 pair of skates a day. Its product is in use throughout the United States and Canada and in practically every civilized country in the world.

THE MINIATURE RAILWAY

Ever since its introduction the miniature railway has been extremely popular, more especially where attractiveness has been added to the route of travel by tunnels and landscape features. An idea that has worked well in this connection is the distribution of improvised cities along the line, the scheme having been tried with success of representing a number of cities such as one would be likely to pass through, for instance, enroute between New York and San Francisco. Distinctive features of the cities, such as the stock yards of Chicago and the furnaces of Pittsburg, can be represented to lend zest to the entertainment. In the cases of parks or expositions covering a considerable area, the miniature railway has frequently been converted into a most handy means of transportation, as witnessed strikingly at the Louisiana Purchase Expostion. The road there was built by Cagney Bros., of New York, who also operate in a number of street railway parks and at Coney Island, Rockaway and other popular resorts. Cagney Bros. make several standard types of apparatus, the rolling stock being usually built for either 15-in. or 22-in. gage. The firm is, however, prepared to contract for equipment for any gages between those mentioned. Cagney Bros. have recently secured the concession for building a line to traverse the Jamestown Exposition grounds, which completes for them the exclusive concessions to all the great expositions in this country. Views of this miniature railway have appeared in former issues.

TICKETS

A seemingly small but an important matter in connection with park and amusement features is the subject of tickets. The ideal ticket should be both cheap and legible, every bit as much so as the railroad ticket, which receives the really serious attention it deserves. To entrust the printing of amusement tickets to local printers is generally not a satisfactory way to do, for the plants are not equipped for this class of work, and they are seldom able to do a satisfactory job. Nearly all the ticket makers who cater to the railways have a department where just such work is handled as tickets for amusement attractions, their very organization placing them in a position to meet promptly the requirements of park managers and also to act in emergencies. Then, too, such companies are a valuable asset in a consulting capacity, oftentimes suggesting means for overcoming difficulties in design, etc., as does the Keller Printing Company, of New York, whose organization is such that it can meet most any emergency.

The Rees Printing Company, of Omaha, Neb., also makes roll tickets for amusement parks.

WATER ATTRACTIONS

It is a recognized fact that many of the most successful parks are made attractive by a body of water. There are so many types of amusements which can there be exploited that it would be difficult to list them all, but one feature that is absolutely essential is boating. The canoe and rowboat appeal to certain classes, but there is a goodly number who consider that the labor involved is not in consonance with recreation and pleasure. As for women and children, who after all make up a very large part of park patronage, especially during the morning and early afternoon hours, the canoe and rowboat are not available for them. As the electric launch, in many respects, is best suited for electric railway parks, some particulars of the latest model of the Electric Launch Company, of Bayonne, N. J., will be of interest.

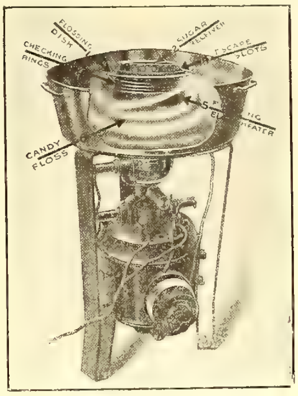
The motor is water tight and constructed to assume the thrust along the armature shaft produced by the propeller. Lubrication is simplified by the use of special metaline bearings. The controller, mounted on the same shaft as the steering wheel, is carefully protected under the forward deck. It is similar to the ordinary street-car type and has five speeds ahead and two astern. The batteries, which have been recently improved, are of a new lightweight type, and are placed under the floor of the launch on special insulated racks, and thus increase the stability of the boat. The mileage and speed of a boat, of course, depend on the number and size of the batteries. The batteries can be charged economically from the trolley circuit, if desired, at a time when the load is light and few cars moving. The operator or pilot of an electric passenger launch need not be more skilled than a motorman, as there is absolutely nothing more to do in the care of the motor than to keep the parts clean and batteries properly charged.

ELECTRIC LAUNCH FOR EXCURSION USE

Operating expenses, of course, cease when the boat is not in service, for there is no loss of energy. The other advantages are absence of odor, smoke, heat and noise. These launches are furnished in sizes from 18 ft. to 65 ft., and a large number are in use.

CANDY AS AN ATTRACTION AND SOURCE OF REVENUE

To appeal to the sweet tooth of the public the candy product must be both pure and attractive. That this is true is instanced in the large sales of candy made to resemble meats and sold for several seasons now at large attractions, such as Luna Park, Coney Island, at special booths made to resemble butcher's stores.. If to the product to be sold can be added some feature of the method of production, then a valuable asset in the shape of a drawing card has been gained. Ordinary taffy-pulling machines may be rigged up to operate in any one of a great many ways, none of which is without worth as a live exhibit. A device of this kind which is especially attractive is the candy floss machine. The Shaffer Manufacturing Company, of New York, says that with one of its machines 1 lb. of sugar, costing 6 cents, will make twenty bags of candy floss any color or flavor, which sold at 5 cents a bag returns $1.00. These candy-making machines can be driven by electric motor or by hand, the hand-power machines being supplied with a gasoline burner. The electric machine needs only to be connected to the electric railway circuit. Material to be used to make candy floss can be varied to suit the taste.



CANDY FLOSS MACHINE

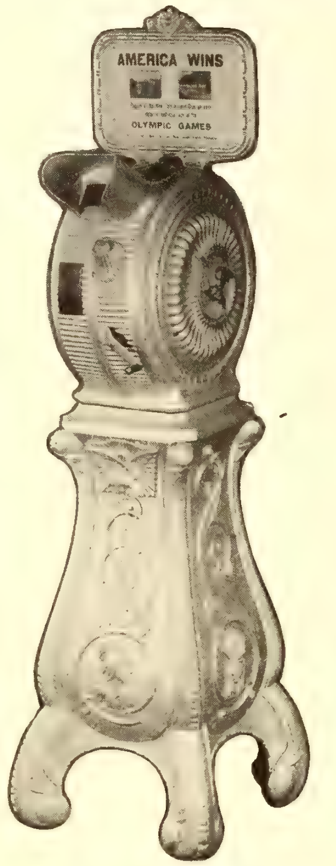
TOBOGGANS, SCENIC RAILWAYS, ETC.

The T. M. Horton Company, of Pittsburg, Pa., builds and operates figure-eight toboggan slides, carrousels, scenic railways, etc., and does a general contracting business in park equipment. The company has been engaged in the business for fifteen years. Its experience has fully demonstrated that "the better the machine, the better the results." A slight increase in the initial cost usually insures stability and removes the danger of breakdowns, and by making the amusement more artistic the patronage is increased. The carrousels made by the T. M. Horton Company are decorated by expert artists and are built to withstand the hardest kind of usage, and the figure-eight toboggan slides and scenic railways are equipped with the latest improvements to insure safety and speed and increase the earning capacity. The pavilions are especially designed to harmonize with the surroundings.

The Ferris wheel is another attractive, inexpensive and neat riding device. It is not expensive to operate and appeals to both old and young. Coming to the notice of park managers a few years ago and recognized as a great money-maker, it has found its way into a great many of the leading parks of this country and abroad. It also affords the same opportunity for lighting effect as some of the more pretentious attractions. A type of wheel extensively in use is the Conderman, built by J. G. Conderman, of Troy, Pa. Mr. Conderman has a number of standard models, but will vary his designs to suit individual requirements.

EQUIPMENT FOR ARCADES

The new Model "E" mutoscope, manufactured by the American Mutoscope & Biograph Company, of New York, embodies several new features compared with previous models. It has a new iron cabinet finished in silver aluminum, and is much handsomer and more artistic than heretofore. Among other improvements the base of the pedestal has been raised considerably above the floor, giving ample opportunity for cleaning beneath, while there are no rests for children to climb up on and deface. The joining of the cabinet is accomplished in a new manner so that additional rigidity is secured, with considerable saving in weight. Changes have also been made in the upper cabinet. The old style safe, which necessitated opening the cabinet door to collect the cash, has been done away with, and the money now falls direct into a cash drawer at the top of the pedestal, from which it may be readily collected. By means of this improvement the attendant, while able to change the pictures and get at any part of the mechanism to make repairs, has no access to the money. The slot device, whereby the penny first struck an anvil and then bounded to its position, has been changed to a direct contact. The entire mechanism is greatly strengthened; the driving gear is larger, and its contact with the work gear on main shaft wider, insuring greater power with less effort and variation of speed. The friction discs have also been improved, giving greater bearing surface. The coin register, which is supplied when desired, is located at the top of the upper cabinet, in clear view, easily read by electric lamp in the machine.



THE MUTOSCOPE

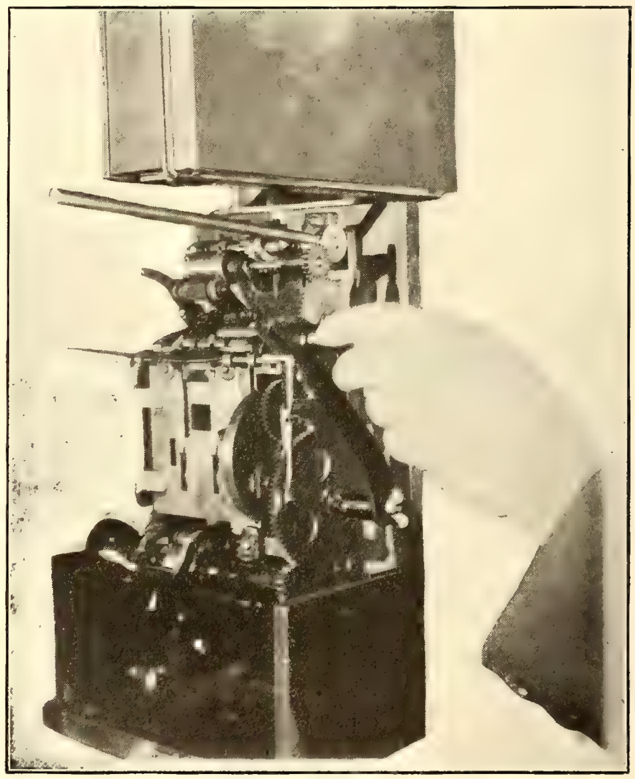
The automatic weighing machine also is an important acquisition to the arcade and for judicious distribution about the grounds. A company that makes a specialty of this device and other coin-controlled machines is the National Novelty Company, of Minneapolis, Minn. The company reports that perhaps the largest order ever given for automatic weighing machines in the United States has recently been placed with it. This order is for 765 machines for an Eastern company which operates in the railway stations of some of the principal Eastern railways.

MOVING PICTURE MACHINES

A moving picture service is exceedingly valuable as a traffic inducer, especially as the cost to install and maintain the necessary equipment is only nominal. It is possible to announce through the daily newspapers, folders distributed from racks on the cars and bulletins in stations that a free moving picture service is being conducted for the special benefit of women and children so as to induce traffic by day, and also to lay stress upon the point that conductors will see to the safety and comfort of both the women and children en route. Week-day evening travel can be worked up in the same way by arranging an attractive program. This is especially true in the case of men, for whom from time to time special concerts could be arranged to include athletic games, boxing bouts, etc., and other subjects that appeal especially to the masculine mind. It must be remembered, too, that the pictures can be shown out of doors. Of course, where the pictures are shown indoors a small admission can be charged, which of itself would result in making the picture entertainment self-supporting and give a small profit besides. Miles Brothers, of New York and San Francisco, conduct a film rental bureau which makes available to subscribers at a small rental practically any subject. In addition, they originate films themselves for the exclusive use of their circuit.

A new automatic shutter is being placed on the Edison exhibition moving picture machine by Harston & Company, New York. This automatic shutter is very simple, and it is claimed that it is an absolute preventive of fire. Every one conversant with moving pictures understands that fires are caused primarily by the operator stopping his film and letting the light rest on it too long. As long as the film is moving, it will not ignite.

The minute the operator releases the handle of a machine equipped with the new shutter, the shutter immediately falls down and covers the aperture through which the film is passing. There is an air space of about an inch between the shutter and the film which makes it absolutely impossible for the film to become heated. The first turn of the handle raises the shutter, as shown in the accompanying illustration. Harston & Company's film rental service this coming season for parks will be very complete. They are sending at the present time to every park manager lists of the latest films as fast as they are issued, from which selection can be made.


PICTURE MACHINE WITH SHUTTER OPEN

ELECTRIC SIGNS AND LAMPS

For directing attention to amusement enterprises the electric sign is a most effective medium, its value in this line probably exceeding its effectiveness as an advertising medium for exploiting commercial articles, because of the opportunities which are afforded in parks for cooperation and harmonious use of lighting effects. For instance, signs may be standardized, a distinctive color scheme being adopted for the park and others for individual exhibitors, where concessions are granted. That a striking sign impresses people who ordinarily are given to discounting the personal appeal of a representative of an attraction there is no doubt. Another advantage that it possesses is that it is constantly in service, a most important consideration. A company that has made a specialty of signs for this class of work is the Haller Machine Company, of Chicago, which announces this year new attractions in the shape of two 5-cent theater signs, one with a lightning flash and the other with a fire-wheel revolving around the 5-cent panel. This sign, which can be modified to suit any conditions, is especially advantageous, because it performs the double service of calling attention to the attraction and making plain the price of admission.

A THEATER SIGN

Effective illumination, however, is dependent very largely on lamp efficiency. Efficient lamps mean small renewals and low operating cost. Where dependence is had upon street railway circuits for power, fluctuations are violent, and the life of the lamps likely to be seriously lessened unless precautions are taken in selecting the type of lamp. A company that caters especially to the street railway trade is the Buckeye Electric Company, of Cleveland, which has designed a special 4-watt 16-cp series railway lamp expressly for street railway work, and which is in service on the largest street railway systems in the United States, among them the Lehigh Valley Traction Company, the United Railroads of San Francisco, the Memphis Street Railway and many others. The company also gives special attention to the summer park business, its lamps being in use at Pittsburg Luna Park, Cleveland Luna Park, the Ingersoll Parks, American Amusement Company's enterprises and many others.

The A. & W. Electric Sign Company, of Cleveland, is a firm that has supplied a large number of amusement parks with up-to-date and attractive display signs. All of its work is guaranteed for a term of two years. The company says its special method of groove construction makes it possible to operate with about 50 per cent less current than ordinarily, and with better results than when projecting lamp letters are used. Among other things the company says that its method makes possible especially soft and pretty effects which do not confuse or tire the eye; that the confining of the light to the groove sharpens the outline of the letter; that the prettiest colored letters imaginable are produced by its lamps with frosted capping. The company also has special facilities for reproducing any trade mark.

THE DISTINCTLY SPECTACULAR SCENE

Purely spectacular amusements which have for their basis legend some notable public occurrence, some impressive scene from nature or some catastrophe have a peculiar fascination, as strikingly instanced in the phenomenal successes typifying the extremes in this feature, "Creation," or the story of the beginning of the world, and the "Johnstown Flood," a distressing calamity, both of which after their introduction at great expositions had several successful seasons at Coney Island. For the coming season a distinctly new departure in this line is announced by the Cascade Amusement Company, to be presented at the new Electric Park in Kansas City, Mo. It is to be a reproduction of the spectacle of Niagara. The bluffs on either side will be fashioned after famous caves, mines, etc., and will have other entertaining features. The falls will be 50 ft. long and 25 ft. high, and have a discharge of from 5000 to 8000 gals. of water per minute. On either side in crevices in bluffs automatic colored lights will play on the falling water in the evening, and will add attractiveness to the apparatus with other electrical effects. The walks will extend through a tunnel on a lower rocky ledge under or back of the falling water, through the caves, etc., on the far side and back through the other bluff and caves and exit. There is no limit to the capacity of this device, and the outer attractiveness will no doubt draw the crowds, as the electrical effects on the falling water can be easily imagined.

An amusement that will be both attractive and educational is proposed by the Daniels Scenic Studios, of Chicago, which offers an electrical wonder house. The exterior of the building will be strikingly illuminated in about fifteen different ways, flaming arc, Nernst, Moore and other lamps all being used to attain striking effects. In addition there will be a slate rigged for high-tension discharges to attract and hold attention. As the amusement features there will be offered demonstrations of the wireless telegraph, the wireless telephone, the electric furnace and a number of other purely commercial applications of electricity, to which there attaches among the general public the feeling of something peculiarly mysterious. These processes it is proposed briefly to explain. As a finale there will be introduced a dueling scene in which electricity will be made to play an important part.

A GENERAL AMUSEMENT SIGN

The White & Langever "Steamboat Tours of the World" is another scenic amusement. It is essentially a gigantic marine illusion apparatus, covering a space 75 ft. x 200 ft. and costing about $6,000 to construct. The front is a full-size reproduction of a steamboat, with pilot house, smoke-stacks, bells, searchlight and caliope or band. The boat

floats through a cement tank, forming a canal, to its destination, where the passengers are invited into the cabin and so onto the rear boat (enclosed in a large building). This rear boat also sets in a tank of water and rocks sideways and endways. Paddles beat the water underneath, breezes are made to blow, and the illusion completed with the aid of moving pictures. The "exits" are on the sides. One of the devices is now being erected by H. A. Dorsey at the Dominion Park Company's Park at Toronto, Can., and White & Langever, of Ft. Worth, Tex., the patentees, are building another at Pine Beach, Va., to be a leading feature there during the exposition at Jamestown.

BANDS

On tour this season under the management of Harry C. Head, of New York, are Restorff and his band. Mr. Restorff has filled engagements at the principal theaters in Kiel, Munich, Hamburg, Cologne and other large European cities. In 1880 Mr. Restorff was appointed oboe player in Gilmore's famous band, and since then he has been associated with such bands as Theodore Thomas' Orchestra, Innes' Band, Liberati's and Brooks' Chicago Marine Band. He is a soloist on different instruments, an excellent conductor, and has composed many stirring marches and other characteristic pieces. Before the opening of the Louisiana Purchase Exposition at St. Louis, Mo., Mr. Restorff was elected bandmaster of the Transvaal State Concert Band, connected with the great Boer War spectacle. This band, under the leadership of Prof. Henry Restorff, was one of the few bands that played the entire season—May to December, 1904—at the Fair.

The Pythian Concert Band, of Indianapolis, Ind., is another musical organization open to engagements. It is under the direction of John W. Sleight. As an added attraction Mr. Sleight has engaged Lillian May Monroe as soprano soloist.

A NEW RESORT FOR JERSEY

The Frank Melville Amusement Company, of New York, has in course of construction Melville Park, Boulevard and Fifty-First Street, Bayonne, N. J., spending $150,000 on improvements. There will be a fine park hotel, with 400 ft. of bathing beach; bath houses, large dancing pavilion, scenic railway, carrousel, figure-eight toboggan, a Traver circle swing, and large open-air vaudeville platform. There will also be a large picnic ground. The property takes up about two blocks frontage and is about 750 ft. deep. The resort will draw upon Jersey City, Newark, Bayonne and Staten Island points. The Public Service Corporation will build a loop direct to the park and will build a pier. There will also be facilities for landing boats from Newark. A unique feature of the plan is to keep the park open all year. The opening day is set for May 25. Twenty-five picnics have already been booked.

THE STREET RAILWAY AND PUBLICITY AS INSTANCED IN THE CASE OF THE BOSTON COMPANY

In his address at the recent meeting of the Massachusetts Street Railway Association, held at Young's Hotel, Boston, Mr. Thomas F. Anderson, manager of the Boston Publicity and Information Bureau, in discussing the general subject of publicity, gave some very interesting facts about the publicity bureau of the Boston Elevated Railway Company, under the management of J. Harvey White. However, before dealing with this specific case and the results obtained, Mr. Anderson made some terse remarks about publicity work in general. He said briefly that it is a mistake for any transportation company or public service corporation to try to keep the newspapers and the public in the dark concerning its doings. Mr. Anderson, who for twenty years was a reporter and editorial writer, said that conditions were improving, and that a vast change was taking place at the present time in publicity work, which promised materially to benefit companies in the future. He said he wished distinctly to be understood as speaking of those roads that have established publicity bureaus for the purpose of serving as an official medium of news and new suggestions between the public and the newspapers, and not departments established for the special purpose of advertising the facilities and attractions of roads, such as the bureaus conducted by the steam roads. Referring specifically to the work of the Boston Elevated, Mr. Anderson said:

"The Elevated Company's publicity department was established in 1897, and it grew out of President Gaston's conviction that the public, which furnished the patronage and the dividends of the company, really had some rights in addition to that of riding a certain distance for 5 cents.

"Another important consideration was that the time of the president was too valuable to be infringed upon very extensively even by newspaper men, and this was probably the determining reason for establishing the bureau.

"At first, Mr. White devoted only a part of his time to this work, but, with the growth of the system and the increasing popularity of the bureau itself with the newspapers, he was soon obliged to give all his time to the duties. Just now that comes pretty nearly meaning twenty-four hours a day, for he is practically 'on call' at all hours.

"Mr. White has an office of his own in the Elevated Company's building, and has a stenographer and an assistant. His mission in life is not to advertise the company, except as that may come in incidentally to his regular work, but to save the time of President Bancroft—one of the busiest men in New England—and to aid the newspapers in getting authentic news reports about the company, be it changes in policy, accidents, appointments of officials, additions of new rolling stock, or what not.

"His time is given up largely to receiving and talking with reporters who come with every conceivable sort of inquiry, all of which Mr. White is supposed to be in a position to answer off-hand, and when he is not doing this he is preparing special matter to be sent out by himself in the shape of news items or 'special articles.'

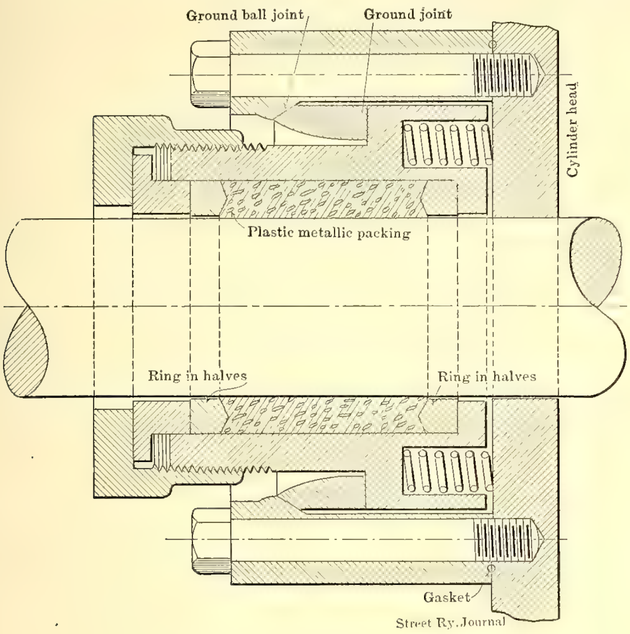
"It is the policy of the Elevated Company—in contrast to the secretive methods of many of the old-time street railways—to give out everything of a news nature that can possibly be construed as legitimate public property, and in the case of accidents everything except the names of those who are injured or claim to be injured.

"This latter reservation is made for the protection of the company, and to circumvent the enterprising 'ambulance attorneys,' who are always around in times of such trouble, and some of whom do not scruple to engineer legal conspiracies against the company. The Elevated Company, like most others, also has a rule forbidding its employees to give to reporters or others any information as to accidents.

"From the results of his ten years' experience as head of the publicity department, Mr. White is fully satisfied that the idea has worked splendidly for both the company and the newspapers, and incidentally for the public. It certainly has saved a great deal of the president's time, which is one of its most important functions."

AN AUTOMATIC VIBRATING STUFFING BOX

A vibrating stuffing box which automatically adjusts itself to any out-of-line movement of the piston rod or stem has recently been perfected by the Steel Mill Packing Company, of Detroit, and is illustrated in the accompanying engraving. It will be observed that the stuffing box is arranged with a casing, and is held against the ground ball joint ring by means of springs, assisted by the steam pressure from the cylinder, keeping the joints tight and preventing leakage. A clearance is provided between the stuffing box and in-



SECTION OF STUFFING BOX

terior of the casing, and between the rear surface of the stuffing box and the cylinder head. This permits the stuffing box to move laterally relative to the casing, to compensate for out-of-line movement of the rod or stem, and to rock on the curved face, or ball joint, to adapt itself to any angular movement of the rod. The spacing rings at each end of the packing work in connection with the packing, holding the stuffing box out of contact with the moving parts, thus preventing wear.

On Dec. 1, 1906, one of these stuffing boxes was placed on the main piston rod of a 100-hp engine in the Butterfield Power Building, Detroit. When the stuffing box was applied the piston rod was placed out of line so as to have an angular, as well as a lateral, movement of more than 1-16 in., and it has been found that the stuffing box "floats with the rod" without resistance, performing perfect work. In this instance the stuffing box is packed with the Steel Mill Company's "Safety" plastic metallic packing, but any suitable packing can be used. The company is now equipping its factory with special machinery for manufacturing these vibrating stuffing boxes under the supervision of its home force.

The Cincinnati Traction Company is preparing to equip its cars with closed and heated vestibules.

NEW ROLLING STOCK IN OTTUMWA, IOWA

A year ago the Ottumwa Railway & Light Company, of Ottumwa, Ia., was reorganized and the reconstruction of the entire property put in charge of H. M. Byllesby & Company, of Chicago, who are now the engineers and managers. Under their supervision a new power house has been built, equipped with the latest type of machinery; new car houses have been erected and the tracks have been relaid. Other improvements consisted in the reconstruction of the overhead system and light system. The office building now

INTERIOR OF OTTUMWA CAR

occupied by the company has been an added convenience. In the early spring it is probable that extensions and improvements will be made in South Ottumwa, which lies across the Des Moines River. Extensions lately completed total 2 miles of track, and in the way of rolling stock five open cars built by the American Car Company were among the new cars added to the lines last summer. The same builders have just shipped three cars of the Brill grooveless-post semi-convertible type to Ottumwa for operation on the Court Hill and Jefferson lines. These routes have exceedingly steep grades, and for this reason the cars have special safety brakes in addition to the regular hand brakes. The chief dimensions of the new semi-convertibles are as follows: Length over end panels, 20 ft. 8 ins.; over vestibules,

EXTERIOR OF OTTUMWA CAR

30 ft. 8 ins.; width over sills, including sheathing, 7 ft. 9½ ins.; over posts at belt, 8 ft. 2 ins.; size of side sills, 5 ins. x 3⅜ ins.; center sills, 3¼ ins. x 4¾ ins.; end sills, 3½ ins. x 8⅝ ins. Interiors are of cherry; ceilings of birch. Push buttons are provided. The truck employed is the No. 21-E.

FINANCIAL INTELLIGENCE

WALL STREET, Feb. 20, 1907.

The Money Market

There has been no material improvement in the monetary situation during the past week. The demand for money in connection with stock speculation has been less urgent, despite the advancing prices in the securities market, but the borrowings by corporations have been rather heavy, and have served to maintain rates for practically all classes of accommodation at last week's level. Money on call has been in good supply, at from 6 per cent to 3 per cent, while money for sixty days commanded 5¼ per cent. For the longer maturities, extending from ninety days to six months, lenders generally maintained the market at 5½ per cent, while in some instances 5¾ per cent was paid. It is not expected, however, that any material change in rates will be made in the near future. It is pointed out that any decided hardening in interest charges would doubtless be followed by the importation of gold from Europe. For several weeks past the rates of exchange have been at a point which permits the importation of the yellow metal, but so far our bankers have succeeded in securing only $1,000,000 gold in the open market at London. These small engagements are accounted for by the fact that the gold is not needed at this center at present, and there is no disposition on the part of local bankers to needlessly disturb the European money market. Should the local situation become such as to require relief from outside sources our bankers would doubtless be able to secure substantial amounts of gold in Europe for import to New York. In the meantime the Bank of England continues to strengthen its position by absorbing practically all of the gold arriving from South Africa in the London market, but so long as New York bankers continue in the market for gold the governors of the Bank of England are not likely to make any change in the official discount rate.

An important feature of the week has been the heavy demands for new capital by the railroads and other corporations. The New York, New Haven & Hartford Railroad has placed an issue of $29,000,000 4 per cent fifteen-year debentures in Paris, while the Interborough Rapid Transit Company and the Lackawanna Steel Company have placed $10,000,000 and $5,000,000 respectively in short-time notes. While the two latter loans were negotiated here it is understood that a considerable part of both issues will be placed in London and on the Continent. In addition to the above transactions the Pennsylvania Railroad will soon be in the market for $60,000,000, practically all of which will be used for refunding purposes. It is expected that a large part of it will be placed abroad, while the balance will be provided for in such a way as not to cause any serious disturbance in the local money market. So far as known the offer of Secretary Shaw to purchase $25,000,000 of Government 4 per cent bonds maturing this year has not met with much success, there being a general disposition on the part of the holders of those bonds to await their maturity on July 1 next. The national banks have about completed the repayment of the $12,000,000 special deposits made by the Secretary of the Treasury during the closing months of 1906, to relieve the stringency prevailing in the local market at that time. The bank statement published on last Saturday was about as expected. Loans decreased $7,295,400. The loss in cash amounted to $918,900, but as deposits decreased $8,016,300, the reserve required was smaller by $2,004,075. The surplus, therefore, was increased $1,085,175, to $4,431,050, which compares with a surplus of $3,345,875 in the previous week, and $5,789,925 in the corresponding week of last year.

The Stock Market

There has been a further decided improvement in the securities market during the past week. Trading was in smaller volume, but it was accompanied by a general rise in values. The market was entirely professional, and while London bought moderately there were no indications of a growing interest in the speculation on the part of the outside public. There was, however, several developments which served to impart a more cheerful sentiment. Chief of these was the growing belief that the proposed amendment to the currency laws would be passed at this session of Congress. Less concern was felt regarding the immediate future of the money market, and while flurries in call money are to be expected from time to time, there is nothing in the situation to warrant any material hardening of interest charges. The depository banks have about completed the repayment of the $12,000,000 special deposits into the Federal Treasury and barring the usual demands for money at the interior in connection with spring trade, the local institutions are not likely to be called upon to meet any extraordinary demand for funds. Several of the leading railroads who were understood to be contemplating the raising of new capital have abandoned their plans, and have announced a policy of retrenchment. While other railroad loans may be announced from time to time, it is believed that the bulk of corporate borrowings have been completed, at least for the present. Another important factor has been the eagerness on the part of foreign investors to invest in American securities, especially in the short-time notes now being offered by railroads and other corporations. In fact, a very considerable part of the loans announced during the week have been placed in Europe, and it is probable that local bankers will succeed in placing substantial amounts of the contemplated issues abroad. The placing of these issues in European markets not only relieves the local money market but opens up new markets for American securities and greatly increases our credit abroad. More than ordinary interest centered in the meetings of the Union and Southern Pacific directors, at which the semi-annual dividends of 5 per cent on the first-named stock, and 2½ per cent on the latter stock were declared. In some quarters it was believed that the distribution on Southern Pacific would be increased. However, as the company is earning considerably more than the present rate of dividends it is considered only a short question of time when the dividend on the stock will be enlarged. At the close of the week there were general recessions in prices as the result of profit-taking sales, but the undertone of the market was very firm.

The local traction stocks moved in sympathy with the general market. Interborough rapid transit ran off on the announcement that the company had sold an issue of $10,000,000 5 per cent notes, maturing in three years from March 1 next. This increases the total note issue of the company to $25,000,000. It is understood that the proceeds of the new loan will be used for further construction of the Brooklyn extension and for the development of trolley lines on Long Island already owned by the company.

Philadelphia

Trading in the local market for traction shares was extremely quiet during the week, but prices generally displayed firmness. Philadelphia Rapid Transit was about the only issue to develop any degree of activity, upwards of 8000 shares changing hands at from 21⅛ to 22. Philadelphia Company common held all of last week's gain, all sales taking place at 47. Philadelphia Traction was somewhat easier, the price declining ⅜ to 94. Other sales included American Railways at 50⅞ and 51, Philadelphia Company preferred at 46⅜, Union Traction at 57½ and 57¾, United Companies of New Jersey at 253½, and Consolidated Traction of New Jersey at 75.

Baltimore

Extreme dullness prevailed in the traction issues at Baltimore, but prices generally ruled firm. United Railway issues, which have been the active features of the trading for weeks past, were practically at a standstill. The 4 per cent bonds sold at 89⅞ and 90, while the incomes brought 57 for small amounts. United Railway free stock was an exception to the general rule, transactions in it aggregating nearly 900 shares, all at 13. City & Suburban 5s sold at 108⅛ and 108¼, and Knoxville Traction 5s brought 107.

Other Traction Securities

The market for traction stocks in Boston was quiet and very irregular. Boston & Worcester common, after selling at 27, broke to 25½. The preferred stock was steady at 76. Boston & Suburban declined a full point to 14 in the early dealings, but later recovered all the loss. Massachusetts Electric common declined from 19½ to 18, but subsequently recovered a point, but the preferred on light transactions declined from 69 to 67. Boston Elevated sold at 149, West End common 93½ and 93 and the preferred at 109. In the Chicago market dealings in street railway issues were practically at a standstill, the only transactions reported consisting of small lots of Chicago & Oak Park Elevated common and preferred at 4 and 13, respectively, and South Side Elevated at 85.

Aurora, Elgin & Chicago and Cleveland & Southwestern common were the factors on the Cleveland Stock Exchange the past week. Brokers were rather surprised at the turn of events, as these securities were not especially prominent until a little over a week ago, when a demand sprang up for Aurora, Elgin & Chicago. In all, about 1200 shares of Cleveland & Southwestern changed hands. Cleveland Electric has been steady, and of late there has been some demand for Cincinnati, Dayton & Toledo stock.

Security Quotations

The following table shows the present bid quotations for the leading traction stocks, and the active bonds, as compared with last week:

	Feb. 14	Feb. 20
American Railways	50¾	50¾
Boston Elevated	149	148
Brooklyn Rapid Transit	75	73¾
Chicago City	150	160
Chicago Union Traction (common)	5¼	5
Chicago Union Traction (preferred)	16¾	15½
Cleveland Electric	62	62
Consolidated Traction of New Jersey	75¼	75
Detroit United	80¼	78
Interborough-Metropolitan	35¾	34
Interborough-Metropolitan (preferred)	71½	70⅞
International Traction (common)	56	55
International Traction (preferred), 4s	80	80
Manhattan Railway	145	143½
Massachusetts Electric Cos. (common)	19	19
Massachusetts Electric Cos. (preferred)	69	68
Metropolitan Elevated, Chicago (common)	25	25
Metropolitan Elevated, Chicago (preferred)	68	68
Metropolitan Street	—	104
North American	82	81
North Jersey Street Railway	40	40
Philadelphia Company (common)	46¼	46½
Philadelphia Rapid Transit	21½	21½
Philadelphia Traction	94½	94
Public Service Corporation certificates	68	68
Public Service Corporation 5 per cent notes	96½	96½
South Side Elevated (Chicago)	84½	83
Third Avenue	119	117½
Twin City, Minneapolis (common)	103	103
Union Traction (Philadelphia)	57¾	57¾

Metals

The "Iron Age" says that the pig iron markets throughout the country have been quiet, and in some quarters show some easing off. Basic iron has been offered, but not pressed, in Eastern Pennsylvania by Shenango and Mahoning Valley furnaces, and some calls have been made, there being quite a demand for prompt basic. Reports from the finished iron and steel trade are uniformly cheerful, and in some branches, notably in bars and in plates, the pressure for deliveries is enormous. Cast iron pipe manufacturers report a continuance of heavy business at a comparatively early period of the year.

Copper metal continues strong but without change in price. Quotations follow: Lake, 25 and 25¼ c.; electrolytic, 24× and 25c.; Castings, at 24¼ and 24¾c.

DATE SET FOR SOUTHWESTERN ASSOCIATION MEETING

It has been decided by the executive committee of the Southwestern Electrical and Gas Association to hold the next annual convention at San Antonio, Tex., May 14, 15 and 16. The details have not as yet been arranged.

INDIANA LEGISLATURE PASSES A 2-CENT RAILWAY FARE LAW

The bill providing for a 2-cent rate on Indiana railroads awaits the Governor's signature to become a law. The Legislature, however, added a penalty of ½ cent on passengers who neglect to purchase tickets before entering the train. The conductor, however, must give a rebate voucher for the excess fare which will be cashed by any agent. It was shown by Ohio conductors who appeared before the committee, that designing passengers in groups of three or five would board a train, and each individual tender a large bill in payment of a small fare.

BRITISH TRAMWAY STATISTICS

The annual volume issued by the railway department of the Board of Trade, giving the statistics of the tramways in Great Britain, has just been published. They are for the year ending March 31, 1906, and include the following: Capital stock issued, £16,447,845; bonded indebtedness issued, including municipal tramway loans, £41,490,572; length of route, 2240 miles; number of cars, electric, 9276; number of cars, non-electric, 1614; passengers carried, 2,236,012,777; kilowatt-hours output, 316,134,816; gross receipts, £10,643,178; operating expenses, £6,835,763; net receipts, £3,807,415.

The division of operating expenses is as follows: Maintenance of permanent way, £377,527; maintenance of electrical equipment, £112,226; maintenance of engines or horses, £66,344; maintenance of cars and other rolling stock, £573,997; maintenance of buildings, fixtures, tools and miscellaneous equipment, £87,769; cost of tractive power, £1,747,509; traffic expenses, £2,775,754; rent of offices, etc., £93 695; rates and taxes, £384,288; injuries and damages, £164,342; miscellaneous, £452,312; total, £6,835,763..

Of the total 312 undertakings, 175 belong to local authorities and 137 to companies or private individuals. The municipal plants represent 1491 miles of total route, or 2499 miles measured as single-track line; the private systems have a route mileage of 748, or a total mileage measured as single track of 1092. Of the entire 2240 miles, 1993 were operated by electricity, 72 miles by steam, 26 miles by cable, 4 miles by gas engines and 145 miles by horses at the time the figures were compiled.

NEW YORK CITY RAILWAY REPORT

The New York City Railway Company's report for the quarter and twelve months ended Dec. 31, 1906, compare as follows:

	1906	1905
Oct. 1 to Dec. 31—		
Gross	$4,552,656	$4,453,875
Expenses	2,559,657	2,471,462
Net	$1,992 999	$1,982,413
Other income	271,086	313,956
Total income	$2,264,085	$2,296,369
Charges	2,871,807	2,812,000
Deficit	$607,722	$515,631
Jan. 1 to Dec. 31—		
Gross	$17,636,707	$17,020,033
Expenses	9,558,287	9,651,324
Net	$8,078,420	$7,368,709
Other income	1,172,264	1,261,681
Total income	$9,250,684	$8,630,390
Charges	11,347,788	11,185,658
Deficit	$2,097,104	$2,555,268

The gross earnings and operating expenses for 1906 include the operations over the tracks of the Thirty-Fourth Street Crosstown Railroad Company, Fulton Street Railroad Company and Twenty-Eighth and Twenty-Ninth Streets Crosstown Railroad Company, and the interest on funded debt, and taxes include the accrued interest and taxes of these companies. These amounts in 1905 were shown net as income from other sources. The income for 1906 also includes the operations over the tracks of the Kingsbridge Railway Company.

ANNUAL REPORT OF THE CHICAGO CITY COMPANY

The Chicago City Railway Company has issued its annual report for the year ended Dec. 31, 1906. The income account compares as follows:

	1906	1905
Gross	$7,871,126	$7,322,080
Expenses, taxes, depreciation and int.	6,146,304	5,642,606
Net	*$1,724,822	1,679,474
Dividends	1,620,000	1,620,000
Surplus	$104,822	$59,474

* Equal to 9.50 per cent on the $18,000,000 capital stock.

The percentage of expenses to gross earnings was 78.08 per cent. Passenger receipts per day amounted to $21,297. Fare passengers for the year aggregated 156,177,363. Transfer passengers 94,623,106. The percentage of transfer to fare passengers was 60.59 per cent.

President Mitten says: "With an increase of 7.34 per cent in the passengers paying fare, there was but 60.59 per cent of fare-paying passengers taking transfers as against figures of 60.42 per cent for the preceding year. The average fare being same as last year, 3.1 cents.

"The increase of 8.92 per cent in expenses was due largely to increased volume of business, necessitating more cars and labor to handle the same, to which must be added heavy truck repair account and increased interest charges on borrowed money, due to large sums being expended for new cars and construction of power plants and other buildings.

"The 200 cars purchased during 1905 having proved satisfactory, 100 additional cars of same type were purchased and placed in service. The use of cable lines and horse cars has been discontinued and all lines are now operated electrically.

"To meet the demand for increased power, marked additions have been made to sub-station power plants, the rated capacity of generating plants and sub-stations combined now being approximately 35,000 hp, an increase of 10,000 hp.

"A new paint shop with a capacity of 150 cars has been completed at Seventy-Seventh Street, adjacent to general repair shops. A modern office building for use as divisional headquarters has also been completed at same location. Two new car stations of large capacity and modern equipment are in course of erection. Portions of track on Twenty-Sixth Street, Thirty-First Street, Forty-Third Street, Forty-Seventh Street, Fifty-First Street, Sixty-Third Street, Ashland Avenue, Halsted Street and Center Avenue have been reconstructed.

"The elimination of grade crossings still continues. The expense to company during year as result of track elevation approximated $100,000. This expenditure will be reflected later in decreased operating expenses, as faster schedules can be maintained and abolition of grade crossing accidents will result.

"Material improvements in fire risk at power houses and other buildings materially decreased rate of insurance for current year."

QUARTERLY STATEMENTS OF MANHATTAN ELEVATED AND SUBWAY DIVISIONS OF THE INTERBOROUGH COMPANY

The quarterly statement of earnings for the three months ended Dec. 31, 1906, of the Manhattan Elevated and Subway divisions, showing the amounts contributed by each to the total earnings of the Interborough Rapid Transit Company, follows:

MANHATTAN RAILWAY

Oct. 1 to Dec. 31—	1906	1905
Gross	$3,612,746	$3,294,284
Expenses	1,399,934	1,392,377
Net	$2,212,812	$1,901,907
Other income	98,128	114,717
Total income	$2,310,940	$2,016,624
Charges	1,860,241	1,857,022
Surplus	$450,699	$159,602

July 1 to Dec. 31—	1906	1905
Gross	$6,727,103	$6,097,760
Expenses	2,719,273	2,707,222
Net	$4,007,830	$3,390,538
Other income	189,280	186,017
Total income	$4,197,110	$3,576,555
Charges	3,557,941	3,534,694
Surplus	$639,169	$41,861

SUBWAY DIVISION

Oct. 1 to Dec. 31—	1906	1905
Gross	$2,202,485	$1,887,317
Expenses	965,231	744,977
Net	$1,237,254	$1,142,340
Other income	96,529	111,075
Total income	$1,333,783	$1,253,415
Charges	612,665	449,737
Surplus	$721,118	$803,678
July 1 to Dec. 31—		
Gross	$3,580,148	$2,988,937
Expenses	1,778,190	1,397,579
Net	$1,801,958	$1,591,358
Other income	154,449	199,616
Total income	$1,956,407	$1,790,974
Charges	1,146,174	759,736
Surplus	$810,233	$1,031,238

The total of both divisions for the quarter and six months ended Dec. 31, 1906, is as follows:

Oct. 1 to Dec. 31, 1906—	Manhattan Division	Subway Division
Gross	$3,612,746	$2,202,485
Expenses	1,399,934	965,231
Net	$2,122,812	$1,237,254
Other income	98,128	96,529
Total income	$2,310,940	$1,333,783
Charges	1,860,241	612,665
Surplus	$450,699	$721,118
July 1 to Dec. 31, 1906—		
Gross	$6,927,103	$3,580,148
Expenses	2,719,273	1,778,190
Net	$4,007,830	$1,801,958
Other income	189,280	154,449
Total income	$4,197,110	$1,956,407
Charges	3,557,941	1,146,174
Surplus	$630,169	$810,233

The earnings of the Interborough for the entire twelve months of 1906 and of 1905 with actual and percentage increases compare as follows:

	1906	1905
Gross earnings	$20,916,145	$18,218,265
Expenses	8,793,486	8,245,006
Net earnings	$12,122,659	$9,973,259
Other income	673,597	701,662
Total income	$12,796,256	$10,674,921
Charges	*9,251,066	*8,170,780
Surplus	$3,545,190	$2,504,141

* Includes dividend on Manhattan Railway Company stock.

THE SITUATION IN CLEVELAND

The presidents of the two street railway companies at Cleveland, Ohio, have been patiently considering the figures that have been gathered for them and are still some distance from the point at which a conclusion may be expected. The appraisal work is being done in a very thorough manner, and in some cases where figures have been turned in by city employees Mr. Du Pont has returned them and asked that expert appraisers be employed to give their opinions. It is said that this has been done several times. Mr. Du Pont seems to be eminently fair in the manner in which he is going at this work, and President Andrews, of the Cleveland Electric, is equally fair in getting at figures that will represent actual values.

J. G. W. Cowles, an expert on city real estate values, has been employed several times by the city to fix the worth of certain real estate. The two presidents feel that when they make their report they should have figures that will be satisfactory to both sides, and if they are not, they want to be fortified with the reasons. In other words, they will leave nothing to guess work, but will have appraised values and careful estimates for everything. Then, if there is a disagreement or dissatisfaction, the proof of the whole thing will be on paper.

Following the announcement that they had agreed upon the manner in which depreciation should be estimated, it is now stated that the depreciation in some of the lines has been arrived at. This work will be carried along as well as possible with the other things that come up from time to time.

Impatience has been shown over the length of time being taken in the work. Mr. Du Pont has stated several times that the work is formidable and filled with detail, requiring much time, and both he and Mr. Andrews may issue a joint statement, giving an outline of what is being done, in order to satisfy those who are in a hurry. Again, it has been charged that the Mayor is delaying the work, so that he may be able to make political capital out of it for his next campaign, but this is probably not true. In the past he has used the 3-cent issue for all it is worth, but the matter has now gone so far that it will hardly help him to have it delayed.

President Springborn, of the board of public service, is making complaints to the effect that the Cleveland Electric is not using all its cars during the rush hours morning and evening, and has threatened to appeal to the City Council. Manager Stanley denies that the company is holding up any of its cars that can be used.

THE TREND OF AFFAIRS AT HARRISBURG

Legislative circles are considerably mystified concerning the real parties behind the four bills introduced at Harrisburg by Senator Campbell, who refuses to take his fellow legislators into his confidence. These bills were introduced in the shape of amendments to the street passenger railway act of 1889 and 1905. The railroad merger provides that "any street railway company, incorporated under the act, may acquire any or all of the stock of any railroad company, purchase the property of such railroad company and the right to purchase or lease the property, or by operating agreement, operate its cars over the property, right of way or tracks of any such railroad company." The operation of cars over the acquired property of such railroad company shall be under the laws applicable to street railway companies.

Any street railway company, under the laws relating to the merger of railroads, may merge itself into any railroad company, but the operation of the consolidated company shall also be subject to the laws applicable to street railway companies.

The right of eminent domain granted in the same bill to street railway companies authorizes them to take any interest of abutting owners in the highways or land necessary for the construction and operation of their roads, not exceeding, however, 60 ft. in width. Provision is made for just compensation for all property taken or injured. No place of worship or dwelling house or cemetery shall be taken.

Every street railway company may carry freight under such rules as to the kind of freight, the time and method of transportation, and the rate of payment therefor, as the board of directors may adopt. Such company shall carry freight within any city or borough without the consent of municipal authorities and under such regulations as they may prescribe.

The same bill permits the president and directors of a street railway company to borrow as much money as they please, to issue bonds for any amount and to pay any rate of interest, and pay the principal when they get ready.

The act of 1889 provides that the president and directors of any railway company shall have power to borrow money, "not exceeding the amount of capital stock subscribed," and issue bonds in such amounts as "shall not exceed double the amount actually paid up of the capital stock subscribed, the proceeds whereof shall be actually expended in the construction and equipment of the roads; these bonds to be payable at such times not exceeding thirty years after the date thereof at such rate of interest not exceeding 7 per centum."

The amended bill eliminates the parts quoted above. The object is to remove all restrictions in the amount they can borrow so that they may extend their branches to a distance proportionate to their borrowing capacity.

The second Campbell bill further amends the act of 1889 by authorizing a railway company to construct any branch or extension by resolution of its board of directors, instead of by resolution of its stockholders, and the proposed branch or extension need not be within "the general scope of its original charter."

Roads started after obtaining consent of municipal authorities must be completed within five years and used every day for the transportation of passengers. Otherwise the company shall be deemed to have abandoned the right to occupy and use streets, highways and bridges.

A section is stricken out of the act of 1889 which forbids street passenger railway companies to connect their tracks with the tracks of a railroad company.

The two bills amending the act of 1895 remove provisions that prevented any traction or motor power company or any street passenger railway company from leasing or acquiring any line or part of a line occupying any township, borough or country road.

This proviso, however, was inserted in the section allowing traction or motor companies to sell or lease their lines or passenger railway lines leased or controlled by them to each other.

"Provided, That nothing herein contained shall be construed as authorizing any traction or motor power company to acquire, lease or operate so much of the line of any other motor power company as occupies any township, borough or country road."

This is stricken out of the amended bill just introduced by Senator Campbell, as is also a similar provision in the 1905 act permitting street passenger railway companies to lease or sell their lines to traction or motor power companies, "not operating a line or lines of railway on township or country roads."

REVIVAL OF OHIO AND INDIANA CONSOLIDATION RUMORS

Owing to a revival of the talk concerning the combination of all the traction properties of the Philadelphia syndicate under the control of W. Kelsey Schoepf and Hugh J. McGowan in Ohio and Indiana, a report was sent out that the merger had been completed. While this is not true in Ohio, it is known that the managers have been working to that end ever since they began to secure properties in the State, and if their plans come out right they will have an immense trunk line system in this territory within the next few years. The Indiana, Columbus & Eastern controls the old Appleyard lines, the roads between Columbus and Zanesville, the Lima & Toledo and the Columbus & Lake Michigan. When the gaps are filled in the company will have through lines from Dayton to Zanesville and Toledo, with connections for Cincinnati and Indianapolis and other Indiana cities. The other Ohio interests are the Ohio Traction Company, consisting of the Cincinnati Traction Company and the Cincinnati Car Company; the old Millcreek Valley lines, the Cincinnati, Dayton & Toledo and the Cincinnati Northern. The merger of the Indianapolis & Northwestern, Indianapolis & Western, Indianapolis Coal Traction, Indianapolis & Martinsville, Indianapolis & Eastern and the Richmond Street & Interurban Railway into one large system is a step toward the final consolidation. At this time the groups of properties in Ohio are not in shape for even such consolidation, but as soon as the various gaps are filled in and financial conditions are right the merger will no doubt be perfected.

TROLLEY FREIGHT RIGHTS FOR BOSTON SUBURBAN LINES

The Massachusetts Railroad Commission has issued an order granting the privilege of carrying trolley freight and express matter to the street railways operating in Waltham, Newton and Lexington. Explosives and all other articles which may hereafter be prohibited by the Board are excluded in the order. Press reports state that there is a prospect that the Boston Elevated Railway Company may take up the freight handling problem, with a view toward facilitating the exchange of light freight and express packages between Boston and its environs. Baggage and freight rights have also been granted to the Westboro & Hopkinton Street Railway.

NEW YORK TRANSIT MATTERS

The New York Rapid Transit Commission has given out the form of contract for the proposed subway loop connecting the Brooklyn and Williamsburg Bridges. There will be five separate contracts for the construction of the loop. The first will cover the portion between Pearl and Canal Streets, which, in the opinion of the engineers, will be the most difficult part of the work. The Commission expects that it will take at least twenty-one months to construct the Manhattan loop, and that is the time limit fixed in the contract. The consruction of the Brooklyn loop also will take a considerable time; so it is probable that cars will not be running within three years. A public hearing on the contract will be given on Feb. 28.

In conference with representatives of the Pennsylvania Railroad, committees of the Rapid Transit Board and the Board of Estimate agreed upon the terms of a franchise for the New York Connecting Railroad, and the decision was submitted to the Transit Board for approval last week.

The final compensation which it is agreed that the company is to pay the city for the franchise is as follows: An annual sum of $27,000 a year, the payments to begin when the company begins to operate the road. This is to be paid for the first ten years, and $55,000 a year is to be paid for the next ten years. At the end of each twenty-five years the terms are to be readjusted by the Supreme Court.

ACCIDENT ON THE ELECTRIFIED DIVISION OF THE NEW YORK CENTRAL

A serious accident occurred Feb. 16 at a curve near 205th Street, New York, on the Harlem division of the New York Central Railroad, with the White Plains and Brewster express, which left the Grand Central Station at 6:13 p. m. The train was made up of five wooden cars drawn by two standard electric locomotives of the New York Central Railroad. The last four cars were derailed while passing the curve at that point, turned over and were smashed. The casualty list totalized about twenty killed and 150 injured.

The Railroad Commissioners and the railroad company are now making an investigation to determine the cause of the accident. The evidence so far presented indicates that the rails became spread through a movement of the outer rail, but the exact speed of the train at the time of the accident had not been determined at the time of going to press. The official statement of the company, issued Feb. 18, follows:

The investigation carried on by officials of the company has not, thus far, disclosed the exact cause of the accident. There is evidence that a break in one of the wheels of the engine occurred at the point of derailment, as pieces of the broken wheel were found at that point. In almost the same place a rail broke, but it is impossible to say which of these caused the derailment or which resulted from it.

The rail was 100 lbs. to the yard, and the records show that it had been on the track less than a year. This is the heaviest weight of rail in general use in the country. The track was also well ballasted with stone, and was in perfect alignment and surface. The ties were in excellent condition, and the gage of the track was secured by the most approved form of tie-plates.

The electric motor was new, and had been thoroughly tested on an experimental track before being permitted to operate in service, and all wheels under the motor and equipment were of the standard steel-tire construction. In a matter of such grave importance it is not possible to determine definitely the cause of the accident in such a short period of time. Every effort, however, is being made to locate the cause.

TERMS FIXED FOR THE SALE OF THE LANCASTER PROPERTIES

The committee recently appointed by the stockholders of the Lancaster County Railway & Light Company to arrange the terms of sale of the property to Bertron, Storrs & Griscom, of New York, reported at a meeting last week that the stockholders will receive $100 per share in cash, and that 25 per cent will be paid on March 1 and 25 per cent each sixty days thereafter until it is all paid. All stockholders are requested to deposit their stock before March 1 with the Lancaster Trust Company or the People's Trust Company, as trustees for the stockholders.

The purchasers of this property have taken out incorporation papers under the name of the Susquehanna Railway, Light & Power Company, in New Jersey, with a capital stock of $20,000,000, divided as follows: Preferred stock, cumulative, 5 to 7 per cent, authorized, $10,000,000; to be issued, $3,650,000. Common stock, full paid, authorized, $10,000,000; to be issued, $3,650,000. The stock to be issued at once is for the purchase of the common stock of the Lancaster County Railway & Light Company and of the United Gas & Electric Company. The stock reserved in the treasury is for extensions and improvements and for the purchase of additional properties. The preferred stock will be 5 per cent cumulative, but after 5 per cent has been paid on the common stock, the preferred stock will share equally with the common stock in non-cumulative dividends up to 7 per cent, all other dividends accruing to the common stock.

The Lancaster County Railway & Light Company was incorporated June 15, 1901, under the New Jersey laws, and owns practically all of the stock of the Conestoga Traction Company, the Edison Electric Illuminating Company, Lancaster Gas Light & Fuel Company, and Columbia Electric Light, Heat & Power Company; it operates all of the electric railways entering the city of Lancaster, and practically all in Lancaster County. It also does all the gas and electric lighting in the city of Lancaster and the electric lighting in Columbia. On this company there are: Collateral trust 5 per cent bonds, due 1901, $1,000,000; preferred stock, 5 per cent cumulative, $1,000,000; common stock, $1,000,000. The collateral trust bonds are secured by all the stock in the above named companies which are owned by the Lancaster County Railway & Light Company.

The United Gas & Electric Company owns, controls and operates eleven gas and electric properties in different cities of the United States, as follows: Altoona, Pa. (gas company); Chicopee, Mass. (gas company); Colorado Springs, Col. (gas company); Terre Haute, Ind. (gas company); Hyde Park, Mass. (gas company); Elmira, N. Y. (gas, electric light, water and street railways; Hartford, Conn. (gas company); Leavenworth, Kan. (gas and electric); Lockport, N. Y. (gas and electric); Richmond, Ind. (gas and electric). The company has been in operation for five years, and is capitalized as follows: First mortgage 5 per cent bonds outstanding, due 1922, $1,543,500; preferred stock, 5 per cent, $1,022,170; common stock, $1,649,320.

Several extensions and connections are intended to be made as soon as practicable to the Lancaster County Railway & Light Company's electric railway lines. Some of the extensions contemplated are: From Christiana to Parkesburg, connecting with the Philadelphia, Coatesville & Lancaster Railway, giving through connection with Philadelphia. From Mt. Joy to Middletown, providing for through service between Lancaster and Harrisburg, 40 miles. From Manheim to Lebanon, giving through service for the 30 miles between Lancaster and Lebanon. The present connection with Reading will be taken advantage of by a through and improved car service. The cost of these lines will be approximately $1,500,000.

After setting forth the present and prospective earnings of the company, the prospectus, which is issued by Bertron, Storrs & Griscom, says that within the next eighteen months about 75,000 hp will be generated and available from the water-power electric generating plant at McCall's Ferry. It is estimated that at least 45,000 hp can be used in Lancaster and surrounding territory reached by the Lancaster County Railway & Light Company. It is intended that this amount of power shall be used for the benefit not only of the traction and electric lighting and power properties owned by this company, but shall be used also for the benefit of the manufacturing and other industries of the whole section. The Lancaster County Railway & Light Company is the natural distributing agent in Lancaster County for McCall's Ferry power.

BOSTON AND NORTHERN BUYS POWER AT HAVERHILL

The Boston & Northern Street Railway Company has made arrangements with the Haverhill Electric Company for the supply of 250 kw at its Bradford sub-station, which is on the opposite side of the Merrimack River from Haverhill. A 2300-volt, 60-cycle three-phase armored cable 700 ft. long was laid on the river bottom last week in 5 hours, by cutting a slot 8 ins. wide across the river through 14 ins. of ice. The cable has an ultimate capacity of 600 kw, and was laid by being allowed to fall through the slot to the bottom by its own weight.

COMMITTEE ON MUNICIPAL OWNERSHIP

The personnel of the committee on municipal ownership of the American Street and Interurban Railway Association was announced last week by President Beggs. It consists of the following:

C. D. Wyman (chairman), general manager, Stone & Webster, Boston, Mass.

John A. Beeler, general manager, Denver City Tramway Company, Denver, Col.

George F. Chapman, general manager, United Railroads of San Francisco, San Francisco, Cal.

H. M. Sloan, general manager, Calumet Electric Street Railway Company, Chicago, Ill.

J. J. Stanley, general manager, Cleveland Electric Railway Company, Cleveland, Ohio.

MOTOR BUS LINE IN PHILADELPHIA

The Auto Transit Company, of Philadelphia, has asked City Councils for permission to operate electric omnibus lines. This concern proposes to install a service, starting June 1, on North Broad Street, the coaches to run on a regular schedule. The fare is to be 5 cents, and no passengers are to be taken on unless there are vacant seats for them. The company was incorporated last spring by local financiers and two Pittsburg capitalists, and applied to the Bureau of Highways for licenses to run its vehicles on the streets. Another company asked for an exclusive right from Councils. The matter has been pending for several months, but the favorable action taken by the highway sub-committee on a bill permitting any company to take out licenses for this class of vehicles is regarded as the virtual end of the controversy. The bill is said to be certain of passage in Councils.

SAN FRANCISCO BOARD OF ARBITRATION DECISION

While no formal report has been made, the board of arbitration selected to adjust the differences between the carmen and the United Railroads of San Francisco is said to have arrived at a decision, that the United Railroads pay its employees an increase of 20 per cent in wages and that the hours of labor shall remain as at present—10 hours constituting a day's work. The question of "open shop" or "closed shop" did not enter into the controversy upon which the arbitrators passed. The board of arbitration, which is composed of Chief Justice of the Supreme Court William H. Beatty, Major Frank McLaughlin and Rev. Peter C. Yorke, was unanimous in its decision, so that the third member was not required to umpire a difference between the other two.

Says the San Francisco News Bureau: "The great victory for the people lies in the fact that the 'closed shop' is not insisted upon. This feature of unionism is abhorent to every true American, and it is with the greatest satisfaction that the people of San Francisco note that no action was taken in this matter. Now that the labor question is settled, it behooves the United Railroads to see that arrangements are made at once to render a transportation service to this city in keeping with the privileges it enjoys."

TROLLEY SLEEPER PLACED IN SERVICE

The first trolley car sleeper ever run in the State of Illinois left East St. Louis for Decatur, Ill., via Springfield, at midnight, Thursday, Feb. 14, with seven passengers on board. The car resembles very much a Pullman sleeper. It is nearly 72 ft. long and is divided into ten compartments, including a smoker. The car will pass only one coach on its way to Springfield, and that will be the sleeper eastbound.

BOSTON TERMINUS OF CAMBRIDGE SUBWAY FIXED

The Boston Transit Commission has decided to terminate the Boston end of the new subway from Cambridge at Park Street. The decision involves the construction of a tunnel for two tracks adapted to the operation of elevated trains from a point near the Boston end of the new Cambridge Bridge under Beacon Hill to the present Park Street station. The tunnel is to be constructed and paid for under the same terms as the Washington Street subway, and the present entrances and exits from Park Street station may be enlarged by a maximum of one-third. The Boston Elevated Railway Company has the right of appeal from the decision for thirty days if it desires, but it is not anticipated that the company will raise objections to the Park Street route.

NEW DEVELOPMENTS IN ORGANIZATION OF THE OHIO BRASS COMPANY

In order better to serve its rapidly increasing trade the Ohio Brass Company has recently made arrangements for the establishment of two new branch offices and has made several additions to the personnel of its home office. These new branch offices will be located at St. Louis, Mo., and Atlanta, Ga., and they will carry ample stock of standard materials for quick shipments, which will be selected to fulfil the requirements peculiar to their respective territories. The establishment of these offices will enable the company to take care of its trade in the Southwestern and Southeastern territories more efficiently than ever, and will greatly facilitate prompt filling of orders.

The St. Louis office will be located at No. 10 North Fourth Street, and will be ready for business on March 1. This date will mark the termination of the Ohio Brass Company's arrangements with the Watts & Uthoff Supply Company, who have acted as its sales agents in that territory for several years past. The new office will be under the management of E. C. Brown, who, for many years, has been actively identified with the electric railway trade and will be assisted in the office by N. W. Biggart, who has been transferred from the home office for that purpose. Traveling salesmen will be added to this office as soon as its organization has been completed, and customers in the St. Louis territory will now be even better served than heretofore.

The new branch office at Atlanta, Ga., will be ready for business March 15, and will be under the management of J. E. Slimp. R. I. Courtney will assist Mr. Slimp in the office and a staff of traveling salesmen will start to call upon the trade as soon as the office is formally opened. The Atlanta office will be located in room 308, Peters Building, corner of Wall and Peachtree Streets. The warerooms will be in the same building, and sufficient stock will be carried to fill all rush orders.

Several new acquisitions have recently been made to the home office force at Mansfield. These additions are made necessary by the rapidly increasing volume of business, consequent to the completion of the Ohio Brass Company's new factory buildings. These additions are as follows: J. F. Little is assistant in the line material division of the railway sales department. He was formerly connected with the sales department of the Western Electric Company, in Chicago. C. C. Beck has assumed the position of commercial engineer, having been previously assistant superintendent of the Ideal Electric Company. C. V. Marks is personal assistant to the secretary. H. C. Moran is assistant in the rail-bond department, having been previously connected with the Western Electric Company. A. W. Campbell is assistant in the office of the vice-president. H. W. Young, formerly with the Cutler-Hammer Manufacturing Company, of Milwaukee, Wis., is assistant in the advertising department.

AMERICAN STREET AND INTERURBAN RAILWAY ACCOUNTANTS' ASSOCIATION

As announced in the Street Railway Journal for Feb. 2, a sub-committee on interurban accounts has been appointed by President Tingley, of the American Street and Interurban Railway Accountants' Association, and consists of the following: William H. Forse, Jr., assistant treasurer, Indiana Union Traction Company, Anderson, Ind.; A. B. Bierck, auditor, Long Island Electric Companies, New York; A. C. Henry, auditor, Lake Shore Railway Company, Norwalk, Ohio. It will be supplemental to the committee on standard classification of accounts, the purpose of the supplemental committee being to formulate a classification of accounts suitable for the use of interurban electric railways. The committee is desirous of securing an expression from each member, and suggestions, gleaned from past experience, that will enable them to provide a classification which will meet the requirements of interurban construction and operation, and requests that the following questions be answered, supplemented with any criticisms or suggestions that will enable the committee to understand clearly the position of each member company on this proposition:

1. Do you use the standard system of electric railway accounting approved by this association?
2. In what respect do you modify same, if at all?
3. Do you think it advisable to add new accounts and what ones do you recommend?
4. Do you recommend any change in the position of accounts under the general headings?
5. Do you use subsidiary accounts?
6. Have you made any use of the classification prescribed by the Interstate Commerce Commission for the use of steam railways?
7. What is your interurban mileage?

It is requested that the questions be answered with respect to construction as well as operating accounts. If a printed or written classification is used the committee will appreciate a copy. Replies should be sent to William H. Forse, Jr., assistant treasurer, Indiana Union Traction Company, Anderson, Ind., not later than Feb. 25.

MR. SHONTS ON THE SITUATION IN NEW YORK—PRESIDENT McCARTER ON NEW JERSEY

Theodore P. Shonts, president of the Interborough-Metropolitan Company, at the banquet of the Iowa Society in New York, Thursday evening, Feb. 14, said that some of the railroads of the country were largely responsible for part of the troubles that had been brought upon them by the attitude of some of the managements, that the roads were run for their own particular benefit. Speaking of the Interborough, he said: "The owners of New York's transit facilities have followed the rule which has governed transportation companies generally throughout the country, namely, enlarging their facilities by piecemeal, with the result that before one set of improvements has been finished the volume of traffic has exceeded its capacity. The first problem is to devise ways and means even though necessarily of a temporary character, which will give relief from the aggravations of the existing congestion. To this problem we shall give our instant and best attention. The second and broader problem is to prepare plans looking to the future, comprehensive enough to provide adequate facilities for the next fifty years of the city's growth, and a scale liberal enough to give it better transportation than is furnished the people of any other city in the world. The plans should safeguard the rights of the traveling public, the rights of the city and the rights of the stockholders. I hope within a reasonable time to submit to the proper authorities, for a free and fair and frank discussion, a proposition drawn on the lines I have indicated with the conviction that an agreement will be reached which will be satisfactory to the municipal authorities, to ourselves and to every fair-minded and thoughtful citizen."

Along similar lines were the remarks of President McCarter, of the Public Service Corporation of New Jersey, in Plainfield a few evenings ago. He said in part:

"The few years prior to 1903 had been formative or constructive years of the underlying companies. It was a strenuous undertaking, and undoubtedly shortened the lives of Vice-President Hobart and the late B. M. Shanley, of Newark. But from the present standpoint, it is clear that they made mistakes, in that they over-discounted the future and over-capitalized some of the great properties they constructed. In the course of a short period these securities became widely scattered in the hands of the investing public. While we all, I think, disapprove now of the extent to which this over-capitalization was carried on, we must remember that the theory on which it was based was justified at the time, both by law and public sentiment.

"By the winter of 1902-1903 it was evident that without new capital for necessary improvements and for the restoration of impaired credit, the railroads could not go on. Something had to be done, and that quickly, or a great financial panic stared New Jersey in the face. The railroads could not meet their accruing obligations. This was becoming generally known, and I knew it professionally. The policy of the constituent companies was shaped by a comparatively small number of men. To these gentlemen I suggested the formation of a new company, with a large cash capital, which should acquire, upon fair terms, all the constituent properties, good and bad, represented by them, the theory being that during the critical period the strong and prosperous should carry the financially and physically weak properties.

"Thus the Public Service was formed, with a cash capital of $10,000,000, fully paid up, without one dollar of water. It shortly acquired all of its gas and many of its electric properties by lease. The stocks of the financially embarrassed railroads and of the United Electric Company of New Jersey, which was also in a struggling condition, were exchanged for the obligations—not the cash—of the new company, but in the doing of it approximately $60,000,000 of stock obligation was transformed into approximately $20,000,000 of new obligations. This transaction was certainly free from the injection of water."

A NEW ENGINEERING FIRM

The firm of Mudge & Neefus has recently been organized by Chas. A. Mudge and H. VH. Neefus, with headquarters at No. 20 Broad Street, New York City, as railway and electrical engineers. Mr. Mudge has been connected in an engineering capacity with a number of manufacturing firms, among them the Westinghouse, Bullock and Sprague Electric Companies. In 1900 he was engaged by the Allgemeine Elektricitäts-Gesellschaft, of Berlin, Germany, to design a line of railway apparatus which was put on the market with great success by the company. He was also in charge of the engineering work of the 1903 Zossen high-speed tests, and has contributed several articles on the subject of this work to this journal and to technical societies. Since Mr. Mudge's return to this country he has been engineer of the railway department of the Electro-Dynamic Company, of New York City. Mr. Neefus, the other member of the firm, has been connected with general engineering and contracting work in different parts of the United States, and has been instrumental in the development and introduction of a number of mechanical devices. He was also identified with the Electro-Dynamic Company during the early years of that company. He was later appointed manager of the Von Zweigbergk Controller Company, and was recently elected secretary of the Suergard Sanitary Engineering Company.

In addition to the regular business of consulting railway and electrical engineers the firm is prepared to give advice on the design and construction of motors, generators, brakes, systems of control, etc., for railway service. It expects to devote special attention to engineering work in reference to consulting and superintending the installation of electric conveying machinery for railway and steamship terminals, also the installation of material conveying plants for factories, gas works and industrial plants, and also for coaling machinery. This field has grown to such enormous proportions that the services of independent consulting engineers along this line will be of great value to users of this class of apparatus.

The question of heavy electric railway traction in connection with trunk lines will also be a branch of the engineering work of this firm.

REPORT OF TWIN CITY RAPID TRANSIT COMPANY FOR YEAR—REFERENCE TO AMUSEMENT EXPENDITURES BY PRESIDENT LOWRY

The gross earnings of the Twin City Rapid Transit Company for the year ended Dec. 31, 1906, amount to $5,644,988, as compared with $4,759,263 for 1905, an increase of 18.61 per cent, and net earnings of $3,019,609, as compared with $2,640,117 for 1905, an increase of 14.37 per cent. The difference between the gross and net increase is largely due to an increase of 10 per cent in employees' wages and the increased cost of all raw materials. The income account for the year ended Dec. 31, 1906, shows the following, with comparison with the two previous years:

	1906	1905
Gross earnings	$5,644,988	$4,759,262
Expenses	2,625,379	2,119,145
Net earnings	$3,019,609	$2,640,117
Interest and taxes	1,137,427	1,050,797
Surplus	*$1,882,182	$1,589,320
Dividends	1,162,500	1,091,387
Surplus	$719,682	$497,933
Appropriation for renewal funds	482,000	340,000
Surplus	$237,682	$157,933

* After deducting the full 7 per cent on the $3,000,000 preferred stock, the balance, $1,672,182, available for common stock, shows 8.32 per cent on the $20,100,000 outstanding.

In his report President Lowry says: "During the year the management has paid particular attention to the matter of amusements along its lines, and more especially to its parks at the terminus at Excelsior, Lake Minnetonka. It has developed a large business in this connection by judicious advertising. The expenses incurred thereby largely account for the increase in the general expenses. During the year there were issued and sold $1,000,000 consolidated 5 per cent bonds, due 1928, and $2,100,000 common stock. The interest and dividends accruing on these issues, after deducting premiums received on the sale thereof, amounted to $63,500. This amount was charged against income as in previous years, although these issues were made to defray the cost of new construction. During the boom of 1902 there was started outside of the city limits two villages for manufacturing purposes, St. Louis Park on the southwest, a distance of 6.1 miles from the city limits, and Robbinsdale on the northwest, a distance of 2.2 miles. Great pressure was brought to bear on our company to make extensions to these suburbs, but instead of doing so we secured the Minneapolis rights to connect with both villages. We then leased these rights to parties desiring to build, reserving the privilege to purchase whenever we saw fit. We recently concluded that the time had arrived when it would be to our advantage to take them over. We accordingly purchased the St. Louis Park Line for $40,000 and the Robbinsdale Line for $30,000. These lines will pay their operating expenses and interest on the investment. From the surplus of $257,932 earned in 1905, your directors have appropriated $100,000 to the renewal fund. During 1906 the fund was further increased by the addition of interest on the investments. We estimate the depreciation on the properties of the company for the past year to be $482,000. During the year there was expended for car replacement and track construction $480,783. The balance of the credit of the renewal fund now stands at $590,449, of which $363,500 is invested in bonds.

"A statement of extensions and improvements made during the year shows a total distribution of $2,648,518, of which $1,034,514 was for new power.

"On May 1, 1906, $20,000 of the 7 per cent bonds of the Minneapolis Street Railway Company were redeemed. An equivalent amount of first mortgage consolidated bonds may be issued in place of them. They will be used as an investment for a corresponding amount of the renewal funds, as will also be the amount similarly redeemed in 1905, in all $40,000."

THE SITUATION IN NEW ENGLAND

In commenting on the general situation in New England as concerns the New York, New Haven & Hartford Railroad, the Boston News Bureau has this to say: People who think that the New York, New Haven & Hartford Railroad is to remain a Connecticut toll-gate rail line between Boston and New York have not adequately measured the western training, breadth of view or the ambitions of President Mellen. It ought to be perfectly obvious to men who view a situation in a broad way that Mr. Mellen is not buying Maine steamers and Philadelphia steamers for the purpose of going into the ocean steamship business. He must be buying these lines with broader plans. Neither is Mr. Mellen buying trolley lines in Connecticut and Rhode Island without understanding that the Massachusetts Electric, surrounding Boston and covering the whole of Eastern Massachusetts between Rhode Island and New Hampshire, is the greatest trolley field in New England, and the key to several transportation situations. But Mr. Mellen's trolley and steamship policy is carrying him north, and the millions he has recently accumulated may yet mean the absorption of the Massachusetts Electric or the Boston & Maine, or both, and may have some direct relation to the Boston & Albany. Mr. Mellen has his eye on both Massachusetts Electric and the Boston & Maine, and it is on the map and in logical sequence that the New Haven quit the water and become the great railroad power of New England, with the best traffic area in the country to offer in interchange for business. Under a broadgage policy, President Mellen can do for the New England seaports and for New England, greater good than can come to these interests from any other business or transportation factor in the United States.

STREET RAILWAY PATENTS

[This department is conducted by Rosenbaum & Stockbridge, patent attorneys, 140 Nassau Street, New York.]

UNITED STATES PATENTS ISSUED FEB. 5, 1907.

842,852. Electrical Contact Apparatus; James C. Boyd, New York, N. Y. App. filed Dec. 16, 1905. A spring-impelled contact shoe or blade for the third rail of electric trains. Adapted to be used with two or more third rails at different levels with respect to the running rails.

842,915. Rail-Joint; Archibald W. Shaw, Drew, Miss. App. filed Sept. 25, 1906. Comprises a chair which is in two separate interlocking sections provided with rail-engaging means.

842,930. Railway Switch; Thomas K. Wilson, Chillicothe, Ohio. App. filed Nov. 18, 1905. Means for operating a switch which is arranged to permit manual closing or opening of the switch or automatically closing of the switch by the movement of the train; has a mechanically arranged tappet depressed by the wheels in passing which closes a circuit.

842,957. Electric Car and Locomotive; Coloman De Kando, Buda-Pest, Austria-Hungary. App. filed May 12, 1904. Relates to motors having cranks with pitman connections to the driven mechanism. The journal boxes are made with a special bearing to receive the driving thrusts communicated by the crank shaft.

843,039. Train Dispatching System; Charles E. Scribner, Jericho, Vt. App. filed July 9, 1906. Comprising a signal circuit extending from a principal to an outlying station and having at the principal station means for setting a signal at the outlying station at safety or danger position, as desired, and at the same time placing a test signal at the principal station under the control of said signal at the outlying station.

843,119. Railway Joint; Reuben B. Swank, Dayton, Ohio. App. filed Jan. 8, 1906. Comprising a supporting chair, an interlocking side plate bolted to the rails and an inclined key to be locked with a spike.

843,135. Rail Joint; Joseph J. Cousins, New York, N. Y. App. filed Oct. 31, 1905 Comprises a key-bolt engaging the fishplates and the webs of the abutting rails.

843,182. Circuit Closing Mechanism for Indicators on Cars; Thomas W. Small, Cleveland, Ohio. App. filed May 17, 1905. The trucks have depending arms with rollers which are impelled

upward by projections adjacent to the track rails so as to close a signal or indicating circuit on the train.

843,232. Anti-Creeping Attachment for Rails; Tracy L. Paine, Milwaukee, Wis. App. filed April 30, 1906. Comprising a pair of clamping jaws having rail-gripping faces and depending opposing feet having horizontal-supporting engagement one with the other, to prevent their separation in a vertical direction, a tie-bolt engageable with the jaws and a nut engageable with the bolt.

843,261. Electric Tram Car; George J. Conaty, Smethwick, England. App. filed July 6, 1904. A single-truck car in which the two axles have a radial movement to the track or curve. The driving motors also have the same radial movement as the axles, and therefore drive equally well in whatever positions the axles may be.

843,262. Brake Mechanism for Tram Cars; George J. Conaty, Kings Heath, England. App. filed May 22, 1906. Relates to improvements on the preceding invention.

843,308. Railway Tie; Herman G. Staab, Milwaukee, Wis. App. filed Aug. 23, 1906. An I-beam tie having U-shaped cuts in the top thereof, the tongue formed thereby being bent up into rail-engaging clips.

843,351. Metallic Tie and Rail Fastener; Hubert W. Mulvey, Glassport, Pa. App. filed Aug. 14, 1906. A yoke engages one side of the base flange of the rail, said yoke being keyed in a recess in the tie.

843,373. Trolley; John Struth and Conrad Holzapfel, Primrose, Pa. App. filed June 23, 1906. A pair of guard arms spring-pressed together above the trolley wheel to confine the wire thereon.

843,409. Rail-Joint; John L. Mertins, Wolfe City, Tex. App. filed June 19, 1906. The abutting rails have a slot and tongue connection with each other.

843,418. Single Rail Electric Overhead Railway with Suspended Vehicle; Hippolyte Romanoff, St. Petersburg, Russia. App. filed June 1, 1905. Relates to the construction of the wheel frame and the manner in which the cars are suspended.

843,445. Trolley Controlling Device; Jonathan Dale, Kinston, N. C. App. filed July 9, 1906. Details of a spring drum and ratchet device.

843,455. Derailer; Stanley W. Hayes, Geneva, N. Y. App. filed Aug. 16, 1906. Comprises a wheel-derailing member, a rocking link supporting the derail block end of said member and adapted to impart a lifting movement thereto, means for slidingly supporting the other end of said member and an operating connection attached directly to said derailing member.

843,473. Switching Device; John N. Marley, Edward F. Manett and Frank M. Dannelly, Dallas, Tex. App. filed July 17, 1906. An electrically operated switch-tongue-throwing mechanism including a special construction of motor having a vertical shaft and an annular gear with a pitman connection to the switch point.

843,475. Metallic Rail Tie; William G. Martin, Otter Creek, Florida. App. filed Sept. 20, 1906. A hollow metallic tie having spaced bearers therein located beneath the rails mounted on the tie, one side of the tie having an opening under the rail to permit access to the rail-engaging bolts.

843,492. Metal Railway Tie; Arthur O. Ridgway, Denver, Col. App. filed June 11, 1906. A metal tie composed of inverted arch-shaped end members and a central member approximately rectangular in cross-section.

PERSONAL MENTION

COL. GEORGE W. DUNN has sent to Gov. Hughes, of New York, his resignation as State Railroad Commissioner.

MR. CARL W. WILCOXEN, for some years superintendent of the Western Ohio Railway Company, with headquarters at Lima, Ohio, on his departure for Pittsburg to take up his new duties as general superintendent of the Pittsburg & Butler Street Railway Company, was presented with a diamond stud by the employees of the operating department as a token of esteem.

MR. W. C. SMITH, for a number of years general manager of the lines of the Mahoning & Shenango, at Youngstown, who is now in Pittsburg, will succeed Mr. T. C. Armstrong, of New Castle, as division superintendent, who is to be appointed to a more important position with the company, of which announcement is to be made in the future.

MR. ERNEST GONZENBACH, in addition to his duties as vice-president and general manager of the Sheboygan Light, Power & Railway Company, has since Jan. 1 held the position of general manager of the Greensboro Electric Company, which operates the street railway system, electric light plant, gas plant and city pumping station of Greensboro, N. C. Mr. Gonzenbach will divide his time between the two properties, probably spending the greater portion of the winter season at Greensboro and of the summer period at Sheboygan.

MR. A. G. MAISH, superintendent of the Des Moines City Railway Company, of Des Moines, Ia., has been appointed to the newly created position of assistant general manager of the company, under Mr. G. B. Hippee, who is general manager of the Des Moines Company, and vice-president of the Interurban Company. Mr. W. G. Owens, former superintendent of way and structure, has been elected superintendent to succeed Mr. Maish. Mr. Owens has been with the City Railway Company fifteen years, coming to Des Moines from Newport.

MR. JAMES BLAKE CAHOON, vice-president and consulting engineer of the Eldenhel Construction Company, of New York, who has been prominent in engineering and street railway circles for a number of years, died at New Rochelle, Sunday, Feb. 17. Mr. Cahoon was born at Lynden, Vt., in 1859, and entered the United States Naval Academy as a cadet-midshipman in 1875. Soon after his graduation in 1879, Ensign Cahoon was detailed to electrical work at the Newport (R. I.) naval station, where in experimental work he injured his sight, and was placed on the retired list. Then he became connected with the General Electric Company, and as chairman of the local companies committee at different times supervised the thirty-nine lighting and street railway companies owned by the company. In 1895 he resigned from the General Electric Company to become general manager of the Elmira Improvement Company, of Elmira, N. Y., controlling the electric light, railway, gas and water plants of that city. Leaving that company in 1899 his interests since then have been largely with the electric light industry.

MR. ALBERT H. STANLEY, whose appointment to the position of general manager of the railway department of the Public Service Corporation of New Jersey was announced in the STREET RAILWAY JOURNAL for Jan. 12, 1907, has resigned from the company to become connected in a similar capacity with the Underground Electric Railway Company, of London, England. Although Mr. Stanley acted under the title of general superintendent from the time of his becoming connected with the Public Service Corporation up to the date of his appointment as general manager, he has shared the duties of manager for the past two years with Col. Edwin W. Hine, the vice-president. Contemporary with the formation of the Public Service Corporation and the appointment of Mr. Stanley to the company, the rehabilitation of the street railway properties entering into the merger began. Mr. Stanley more than any one else has been charged with the responsibility for the new work of the railway department, the excellent results of which are beginning to manifest themselves. Mr. Stanley was born in England, and has an experience of seventeen years in street railway work, for the most part in Detroit. During this time his record has been one of constantly being given added responsibilities. He expects to sail for London about April 1. A biographical sketch of the new manager of the Underground Electric Railways Company, of London, was published in the STREET RAILWAY JOURNAL for Jan. 12.

ALBERT H. STANLEY

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BACK COPIES.—No copies of issues prior to September, 1904, are kept on sale, except in bound volumes.

DATE ON WRAPPER shows the month at the end of which the subscription expires. The sending of remittances for renewal prior to that date will be much appreciated by the publishers.

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Changes of advertising copy should reach this office by 10 a. m. Monday preceding the date of publication, except the first issue of the month, for which changes of copy should be received two weeks prior to publication date. New advertisements for any issue will be accepted up to noon of Tuesday for the paper dated the following Saturday.

Of this issue of the Street Railway Journal 8250 copies are printed. Total circulation for 1907 to date, 73,650 copies, an average of 8183 copies per week.

Making Drawings of Shop "Kinks"

The great majority of electric railways are constantly using home-made contrivances in their repair shops, but in very few instances are there kept any drawings or dimensional sketches of these "kinks" and appliances. Local conditions create the demand for various handy contrivances, and often the man responsible for a clever idea in the shop has neither the time nor the drafting ability to prepare even a simple sketch of the device. It would seem that some one connected with the company, however, ought to be charged with the duty of making at least a rough sketch for the sake of having a complete equipment record if nothing more. Sometimes a photograph is even better for the purpose.

Master mechanics come and go, and so do the foremen of shop departments. Handy devices are usually rugged in character, but they wear out sooner or later and their replacement or improvement is much easier if a workable sketch of the device when new is on file. A contrivance full of merit—possibly some testing device with more or less complicated wiring—may give out some day long after the man responsible for it has left the company, and if a simple drawing of its essential parts is on file, there is less danger that a good idea will be lost. The saving of time when patterns and castings are required is well worth the trouble of making the sketch. A note book full of such drawings would be a mechanical treasure, and the exchange of small blue prints by visiting officials a source of mutual profit and lasting benefit.

Team Work in the Power House

The cost of labor per kilowatt-hour of output is an important division of power-house expenses, and its reduction to the minimum consistent with good service is admittedly desirable. Sometimes this means the payment of exceedingly moderate wages and the operation of long shifts; in other cases it signifies the encouragement of initiative on the part of employees in the plant, a genuine interest in the operating man's welfare and a desire to reward good work by the payment of bonuses for records in fuel economy, speedy repairs and minimum interruptions to service. Without attempting to specify desirable and undesirable wages—and the conditions of few plants are alike in this respect—it is none the less profitable to consider how team work in the power house can be insured.

The discussion of personal relationships is naturally a delicate matter, but it is certainly true that the men at work on different shifts must work in harmony with one another and with the wishes of the engineer in charge of the plant if the best results are to be secured. The chief engineer of a plant should have considerable executive ability and breadth of mind; he should be freed from the petty jealousies so common in shops where a low standard of esprit-de-corps prevails. Whenever it is possible, promotions should be made from within the plant, and when it is necessary to employ a new engineer from without, the advent of the new man should not be a pretext for letting all his friends come in and replace the old force, provided the latter is doing its work squarely. Men cannot always work together in perfect harmony; in such cases it is better to make a change in the shifts than to perpetuate discord.

Relatively to the whole number of employees, the forces in the power plants and sub-stations of an operating road are few in numbers, and it should therefore be much easier to watch their records and adjust their difficulties than in the case of car service men. Power plant operators are

thrown closely together in their work, and the personal equation makes more difference than in some other branches of the transportation industry. Given a management which is interested in the individual power house employee, which encourages him to become more valuable and better his condition, which listens patiently to his suggestions, and which endeavors to put itself in the place of the man behind the switchboard, stoker and throttle, the seed of co-operation is sown and team work becomes a direct probability. Of course, the power house attendant on his part must "make good"; poor material must either be strengthened or weeded out, and lack of interest in the company's welfare must be suitably condemned. Welfare work must not have a charitable aspect; it is better to begin at the pay envelope than to put the same money into a power house roof garden. On the other hand, uncomfortable lavatories, the absence of hot water for washing and pure cold water for drinking, the omission of lockers and other plain, every-day conveniences are negligences which ought not to be perpetuated. The root of the whole matter lies in the mutual appreciation of management and employees, in liberality on the one side and loyalty on the other.

The Ventilation of Repair Shops

The relation between the productive efficiency of a set of repair shop employees and the ventilation of the premises where they work cannot be expressed in other than general terms, but it is clear enough that a shop with a well-designed system of fresh air supply will make a better record in volume of work turned out than one in which no special attention has been given to ventilation. The best quality of work needs comfortable conditions for its execution, and fresh air is quite as desirable in the long run as good lighting.

Fortunately in street railway shops the employees are seldom crowded together to a degree which makes for unhealthy conditions. The character of the work is such that a large area is required for its proper conduct; trucks, motors, car bodies and the heavier equipment of electric railway service are all relatively bulky. At the same time there is a tendency for the air in the paint shop to become impregnated with volatile odors which should be carried outside the building, for the air in the machine and erecting shops to become saturated with the oily distillate which marks the continued use of machinery, and for the air of the blacksmith shop and brass foundry to hang heavy with smoke from the forges and the dust of the anvil. Although none of these conditions may be actively injurious to health, they all tend to vitiate the exhilarating effect of the air, and to slow down production in much the same way that a slight drop in voltage reduces the schedule speed on a line with insufficient feeder capacity.

The ventilation and the heating problems are tied so closely together in the modern repair shop that one cannot well be considered without the other. In climates where considerable artificial heating is needed to offset the cold weather outside the building the scheme of passing the air through a set of steam coils and delivering it to the various parts of the shop under the power of a motor or engine-driven fan is a thoroughly effective means of combined heating and ventilating. The cost of suitable ducts is not serious, and the control of the air supply is flexible and simple. A fair average allowance is 100 to 150 cu. ft. of space per linear foot of steam coil, according as exhaust or live steam is used in the latter, provided all the air is taken from out of doors. If practically all the air is returned from the building the amount of space per linear foot of pipe may run as high as 190 to 200 cu. ft. The larger the shop the smaller will be the radiation from the wall surface in proportion to the total contents. For figuring the size of fans, three or four changes per hour are about as many as are needed, even in a shop with a large number of employees.

It is seldom necessary to install a general system of exhaust ventilation in a railway machine shop if provision is made for the influx of plenty of out-of-door air. In the blacksmith shop and brass foundry special exhaust fans are well worth their cost. Recent wood-working shops for railway service have been quite generally equipped with fans and ducts for exhausting shavings and chips, sawdust and dirt from the machinery and carrying the debris away to be burned. The cost of power is so low on any well-managed street railway that no one should hesitate to experiment with improved ventilation facilities if the present conditions are inferior.

Fenders and Brakes

An attempt is made in the March number of one of the most sensational of the 15-cent popular monthlies to pillory all of the street railway companies of the country for an alleged disregard of safety appliances in the equipment of their cars. Foreign street railway companies are held up as exhibiting examples of what American companies should copy in this particular, especially so far as fenders and brakes are concerned. Statistics of the larger payments for accident claims in this country than abroad are quoted in defense of this claim. The article of course bears its own refutation on its face because the very much larger damage payments made by American companies and the far stricter accountability to which the courts hold American companies for accidents, to which we have frequently referred in these columns, make the question of the proper safety devices a very much more important one, both in theory and practice, in this country than abroad.

Now we believe thoroughly in the idea that in many respects American street railway companies can gain valuable hints on electric railway practice from what their confréres are accomplishing across the water, and for this reason we have given a great deal of space to describing foreign methods; but we believe that less can be learned from European practice in connection with fenders and brakes than in almost any other direction. The principal considerations in the selection of a proper fender are the average speed and weight of the car to be equipped, the condition of the pavement between the rails, the type of car and the traffic congestion on the street. The first determines the distance traveled by the car after braking and also the impact with which the fender strikes the person to be picked up; the second fixes the height at which the fender can be carried over the pavement; and the type of car, whether single or double-truck, settles to a large extent the type of fender, because with a teetering single-truck car the platform fender is obviously at much greater disadvantage than on a double-truck car. Finally, the congestion on the

street obviously also has a great deal to do with the possibility of using a platform fender which requires a clear space in front of the car of several feet instead of a wheel guard which is protected under the front platform from damage.

Now, in all of the points mentioned European street railway practice differs radically from that followed here. Considering first, speed, the rates in general use are very much lower than in this country. In Great Britain speeds are fixed by the Board of Trade upon the recommendation of its respective officers, and have regard to the circumstances affecting the several routes, such as grades, density of traffic, etc. Unless such circumstances are especially favorable a speed not exceeding 8 miles an hour is generally prescribed. Irrespective of the wishes of the inhabitants of any city, the street railway is bound to these rates of speed and managers of municipally owned systems are liable to prosecution upon the complaint of any citizen, if they exceed these rates, even if the excess is approved by the mayor and entire common council. A great deal is said in the article about the tremendous merits of the Liverpool fender. We do not wish to disparage this device, but in connection with this question of speed think it only fair to point out that up to within a comparatively short time the average speed of the electric cars in Liverpool was limited by the Board of Trade rules to 5.8 miles per hour.

Taking up the second point mentioned in connection with fenders, the pavements in European cities are kept in a much more level condition as a rule than in this country. This is due partly to the better municipal governments, partly to the lower price of ordinary labor and partly, no doubt, to the fact that, in the older cities especially, the sidewalks are so narrow that people habitually walk in the streets. Owing also to the narrow and crooked streets single-truck cars are the rule, not the exception as in this country.

We see, therefore, first, that each of the four considerations cited drives the European company to the use of a wheel guard rather than to a platform fender, and second, that the conditions so far as speed, weight and type of car employed, are so entirely different from those in this country as to afford no guide for the use of either appliance here. As a rule the European wheel guard is rather a crude affair, somewhat similar to that formerly used on cable cars in this country, though ample probably for the speeds and conditions under which it is used. The low accident records on the British roads are certainly not due, therefore, to the use of the Liverpool fender, as would be inferred from the article mentioned. In fact this fender is by no means accepted as essential or even desirable in its home, and the British Board of Trade, while not specifying any particular type of fender or life guard, says in its rules that it "prefers one of the trigger type," a form which in the magazine article is condemned as inadequate. In Germany practically all of the companies use simply the old cable wheel guard or track scraper, as it is called there, with the addition in some cases of a spring buffer on the front dash to cushion the shock of a blow.

The question of brakes is based largely upon the same conditions as those cited for fenders. With single-truck cars the rule, and traveling at speeds but slightly in excess of those used by horse cars, a very different type of brake is possible than under American conditions. It is somewhat of a coincidence, however, that the particular type of brake recommended in the magazine article was the one with which the car involved in the Highgate accident in London on June 25, 1906, was equipped, and in the official inquiry on that accident by Lieut. Col. Yorke, of the Board of Trade, the use of a brake whose operation depended upon the rotation of the wheels was practically condemned. The German types of electric brake, which are also commended in the article, are not unknown here. They have been tried extensively, particularly in the form of the disc brake, but have been abandoned, principally because of the load put upon the motors.

A great deal of stress is laid in the magazine article upon the alleged smaller percentage of accidents abroad both on a car-mile and passenger basis. But comparisons of the number of reported accidents are deceitful unless compiled upon the same basis. It is said, for instance, that in 1903 the number of fatal street railway casualties in London was only 10, but unless we know what accidents were attributed to the cars and what to contributory negligence on the part of the injured person, the comparison is valueless. The tendency abroad is to hold the individual much more strictly accountable than here. An instance is afforded in a case which we reported some time ago from Australia, where a man attempting to drive across an unprotected grade crossing was struck by a train and narrowly escaped with his life, but was haled to court and fined 20 shillings for obstructing travel. Many American accidents are undoubtedly due to the practice, common among passengers here but forbidden by law in most European countries, of getting off and on cars while they are in motion. Thus the New York State records show that during the year ending June 30, 1904, or that corresponding to the London year quoted above, this cause accounted for 23 of the 24 total number of fatalities to passengers in the State. Our laws do not hold the companies liable for accidents occurring from this cause but the number goes to swell the total. In the same way, of the entire fatalities that year to passengers, employees and others, only three, according to the Commissioners' report, were not caused by the individual's own misconduct or incaution. Yet the roads in New York State carried over four times the number of passengers transported by those in London during the corresponding period.

The concluding claim in the article, that street railway managers pay no regard to the safety of the public in the operation of their cars, is a gratuitous insult to the industry as a whole, and to the Boston, New York and Brooklyn companies which are mentioned in particular. There are none whose standing is higher in this country for broad-minded administration and lack of parsimonious dealing. American managers through State and national associations, as well as individually, are working in every way to better their service, and no subject attracts more attention at a convention than one on methods to reduce accidents. It necessarily must be so in a country where the negligence law is construed so strictly against the railway company as here, and any statement to the contrary is a perversion of facts. We prophecy that the attack will fall as flat as the others in which the same magazine has engaged in the past.

THE ELEVATED SHOPS AND TERMINALS OF THE BROOKLYN RAPID TRANSIT COMPANY—MANUFACTURING METHODS, STORAGE, EMPLOYEES AND ACCOUNTING AT EAST NEW YORK *

THE MACHINE TOOL DEPARTMENT

The machine tool department occupies the east bay or Gillen Place side of the lower floor of the main shop building, running parallel with the west bay taken up by the truck-overhauling shop. To take full advantage of the natural illumination, there are no partitions of any kind between the two shops. As the side of this building facing Gillen Place is made up almost entirely of windows, no better location could have been found for a department where so much machine tool work must be done. Along the full length of this side, facing the windows, there is a 3-in. hard maple work bench for the performance of minor machine work.

Form N. S. 185 — 250 Pads 10-5-6 O—85000

BROOKLYN RAPID TRANSIT SYSTEM

ORIGINAL

MACHINE SHOP ORDER NO.

........................190

This work should be completed by........................190

Signed: .... Charge to........................

Approved: ....

Head of Dept. Requiring Work Done

Foregoing described work to be done at........................Shop

Do not write in this space) .... *Superintendent of Equipment.*

Order sent to Shop........................

Sent to V. P. and G. M. for Approval........................

Sent to Comptroller for Approval........................

DIRECTIONS

This order must give a brief description of the work desired and should give enough information to enable one to promptly and properly furnish what is required. All four copies are to be sent to the Supt. of Equipment after approval of Head of Dept. requiring work done and the quadruplicate (pink sheet) will be returned with the number of order thereon when same is sent to the shop

FIG. 35.—MACHINE SHOP ORDER MADE OUT IN QUADRUPLICATE FOR MANUFACTURING WORK TO BE DONE AT THE EAST NEW YORK SHOPS FOR OTHER DEPARTMENTS

In this shop considerable manufacturing is done for other departments of the company besides that required in connection with the maintenance of the elevated rolling stock.

When another department of the company desires to have a job done by the machine shop, an order of the type shown in Fig. 35 is made out in quadruplicate on different colored sheets and sent to the superintendent of equipment's office where it is assigned a machine-shop order number. The original is retained in this office, the duplicate sent to the shop doing the work, the triplicate to the comptroller's office and the quadruplicate to the department ordering the work. For instance, the track department may desire to have tools sharpened, plates drilled and other work performed for which it has no machinery. If the work is of such a character that the proper charge account cannot be assigned in the shop, the comptroller's office is asked to decide that point. When the job is completed the same office also checks up the time spent as shown by the employees' time card. This procedure is the usual one, except for rush orders, in which case the work may be started on a telephone order as soon as the superintendent of equipment's office has assigned the proper number. This telephone order is followed by the regular written forms as confirmation.

All orders received by the machine shop are entered in a book containing columns for the order number, date, date received, signer, charge, foreman, material to be made up,

THE BROOKLYN HEIGHTS RAILROAD COMPANY. ELEVATED DIVISION .... SHOP

REPORT OF PRESSING ON OF NEW WHEELS OR RENEWAL OF STEEL TIRES

Wheel No .... Tire No ....

Make of Wheel .... Make of Tire ....

Wheel Fitted By .... Tire Fitted By ....

Pressed On By .... Outside Diameter ....

Tons Pressure ....

Axle No. ....

Make of Axle ....

Diameter of Axle ....

Fitted By .... Date 190

Inspected By .... Foreman

FIG. 36.—REPORT OF PRESSING ON OF NEW WHEELS OR THE RENEWAL OF STEEL TIRES

THE BROOKLYN HEIGHTS RAILROAD COMPANY. ELEVATED DIVISION .... SHOP

REPORT OF TURNING STEEL TIRED WHEELS

Wheel No ....

Received From .... Shop 190

Reason For Turning ....

Measurement (Circumference) Before Turning ....

Measurement (Circumference) After Turning ....

Tire Loss (Calipered) ....

Work Done by .... Date 190

Inspected by .... Foreman

No of Wheel Scrapped	No of Axle scrapped	No of tire Scrapped	Reason for Scrapping
Date 190	Date 190	Date 190	

FIG. 37.—REPORT COVERING THE TURNING OF STEEL-TIRED WHEELS AND THE NUMBER OF WHEELS AND AXLES SCRAPPED

date completed and date delivered. The orders themselves are kept on two files, one for the completed jobs and the other for those still under way. If a requisition calls for work that must be divided among several foremen, copies of their part of the order are given to each so the order can be filled without loss of time.

The amount of wheel work done in this shop for this and other traffic divisions is very extensive so that careful records are essential. The two wheel forms shown in Figs. 36 and 37 are both for the elevated division. Fig. 36 is made out for pressing on new wheels or the renewal of steel tires, and Fig. 37 covers the turning of steel-tired wheels. It will be seen by examining these reports that they are capable of being developed into elaborate records of the cost, life and maintenance of wheels and axles. Such detail work is not done in the shops, however, but in the office of the superintendent of equipment. In connection with this outside work, the machine shop has a thrice-a-week

* See STREET RAILWAY JOURNAL, Feb. 2 and 9, 1907.

delivery to other departments. Delivery cars are used on both surface and elevated divisions. All cars are specially constructed for this work and are fitted with derricks and other means for handling heavy materials.

The machinery installed in this shop, although very extensive in its scope, is new only in part, as many of the tools were formerly employed as belt-driven machines in older elevated railway shops. Some of these have been remodeled for motor-drive, while others are still running as belt-driven machines where the latter method of operation is better. This condition applies also to the tools in the mill room, as described elsewhere in this article.

The arrangement and driving of such a collection of tools as used in this installation required much preliminary study and a few changes after the plans were put into practice. For the sake of convenience all tool combinations driven from one countershaft are identified by a group letter, such as A, B, C, etc., and all the tools, whether group-driven or not, are assigned certain numbers. Records of all of these shop tools and motors are kept in the office of the superintendent of equipment. In the accompanying plan, Fig. 40, there are two groups, A and B, in this shop besides the independent driven tools. All of the motors throughout the shops are of Northern Electric manufacture unless otherwise mentioned.

The following tools were changed over from belt to independent motor drive: No. 1, Pond wheel lathe with a 15-hp motor; No. 3 and No. 4 Bement-Miles wheel lathes with 10-hp motors each; No. 11, L. W. Pond iron planer, 30-in. bed, and 12 ft. long, with a 7½-hp motor; No. 12, Perkins 22-in. engine lathe with a 2½-hp motor; No. 14, New Haven 36-in. lathe with a 5-hp motor; No. 15, McCabe double-spindle 26-in.-48-in. lathe with a 5-hp motor; No. 16, Bement-Miles 5-ft. radial drill with a 2½-hp motor. Of the tools in this group, the neat, compact method of installing the motor above the bed of the planer, as shown in Fig. 39, is of particular interest.

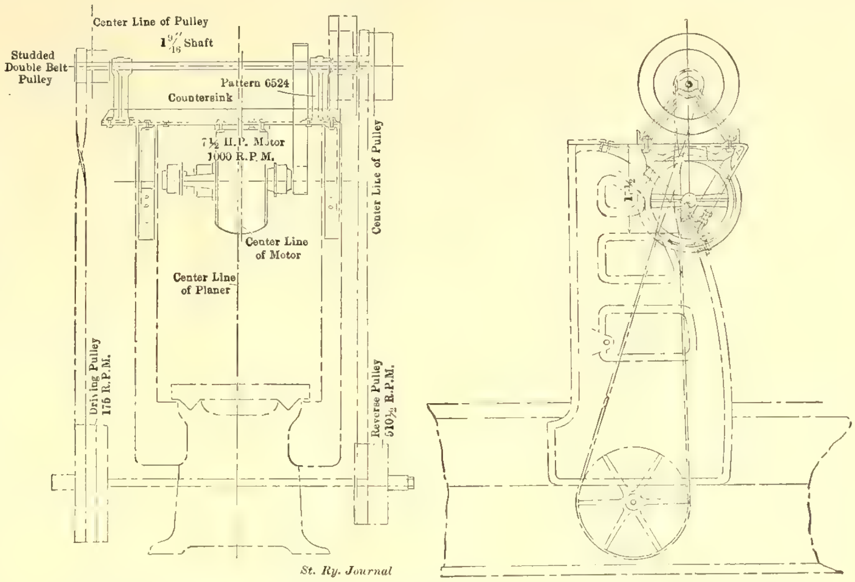


FIG. 39.—FRONT AND SIDE ELEVATIONS OF PLANER WITH REVISED DRIVE, ILLUSTRATING PARTICULARLY THE MANNER OF MOUNTING THE MOTOR OVER THE BED OF THE MACHINE

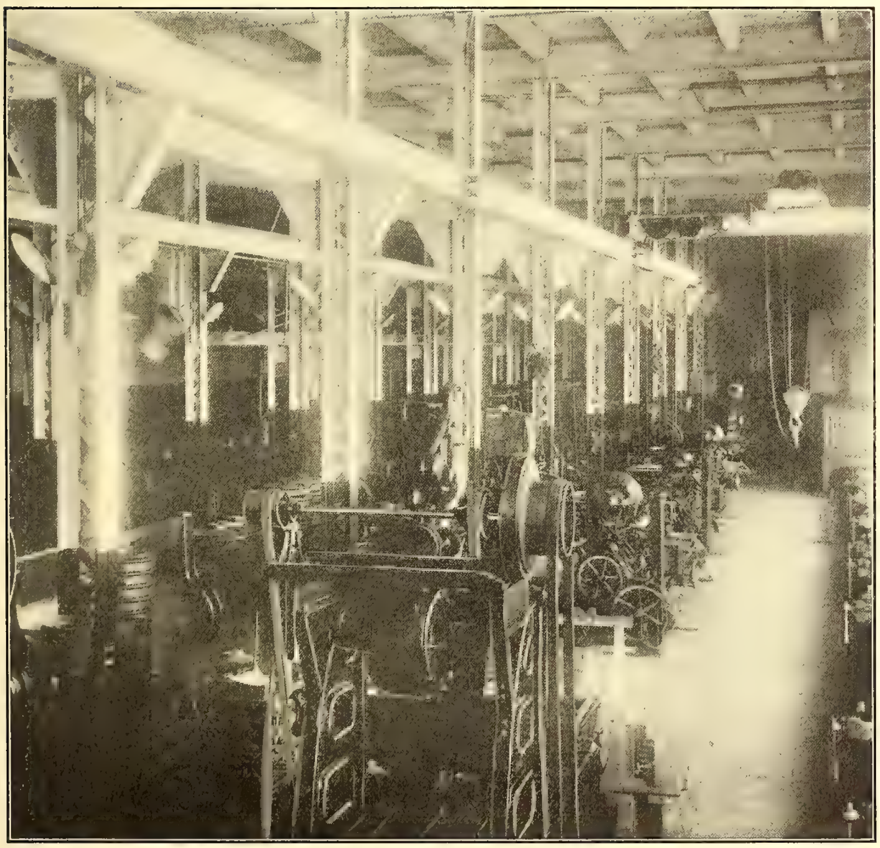


FIG. 38.—LOOKING DOWN ONE OF THE MACHINE SHOP BAYS ON THE GILLEN PLACE SIDE

The other motor-driven tools consist of the following new machines: No. 2, Pond wheel lathe, driven by a 15-hp motor, which allows a greater clearance for an axle with the gear on than the older type; No. 5, a wheel grinder with 10-hp motor; No. 7, Putnam axle lathe with a 10-hp motor; No. 8, milling machines with a 2-hp motor; No. 9, 300-ton Putnam wheel press with a 7½-hp motor; No. 10, Putnam wheel borer with a 7½-hp motor; No. 13, Cincinnati shaper with a 3-hp motor.

Group A is located between the last of the stub tracks of the truck shop and the stock room. It comprises the following tools, all driven from one 20-hp, 800-r.-p.-m. motor: No. 6, Bement-Miles slotting machine; No. 17, Pond iron planer; No. 18, Niles 16-in. screw cutting lathe; No. 22, iron shaper; Nos. 25 and 26, Lodge & Davis 16 and 18-in. screw cutting lathes; No. 27, Lodge & Davis 16-in. screw-cutting lathe; No. 29, Place 32-in. drill press; No. 34, E. W. Bliss, No. 18 stamping machine; No. 35, Whitcomb punching machine; No. 40, Dwight slate 12-in. drill press; No. 41, Le Blond 16-in. engine lathe; and No. 42, American Tool & Machine Company's monitor lathe. To this group the following tools are being added: No. 43, Lodge & Shipley

20-in. combination engine and turret lathe; No. 44, Betts No. 2 horizontal boring mill for boring out air-brake cylinders; and No. 45, Bridgeford single-axle lathe.

Group B starts at a line coinciding with the southern end of the tool storage room and the Gillen Place side of the shop. It is driven by one 20-hp, 950-r.-p.-m. motor, and includes the following tools: No. 19, Garvin milling ma-

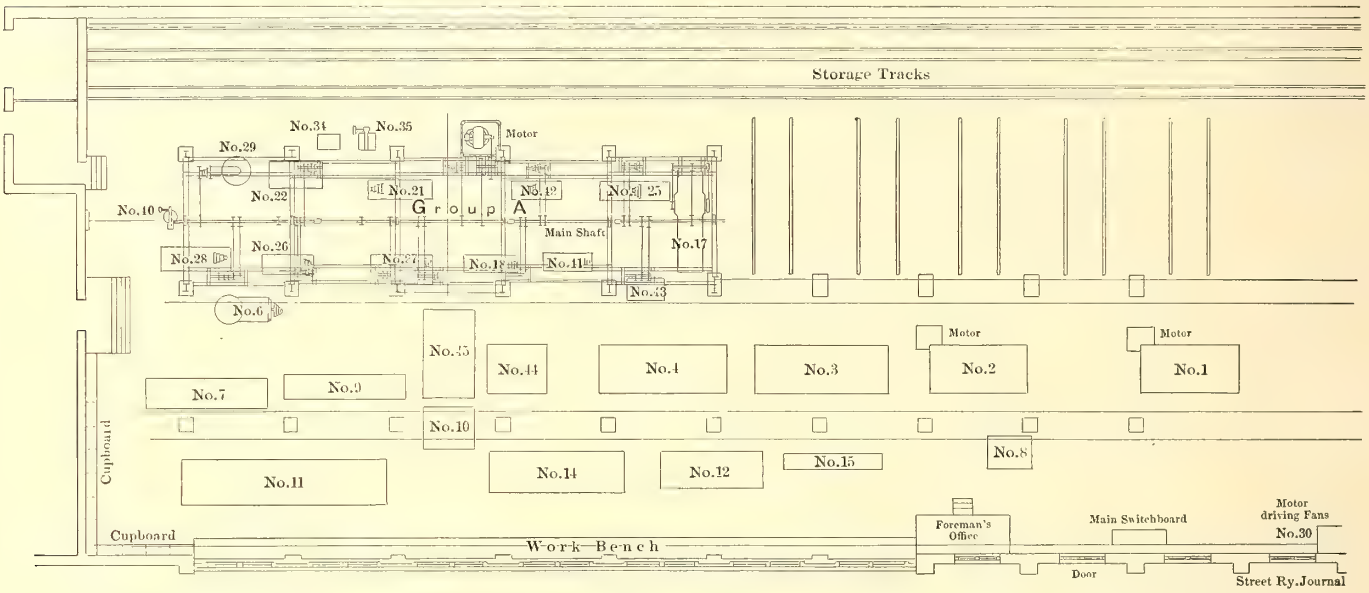
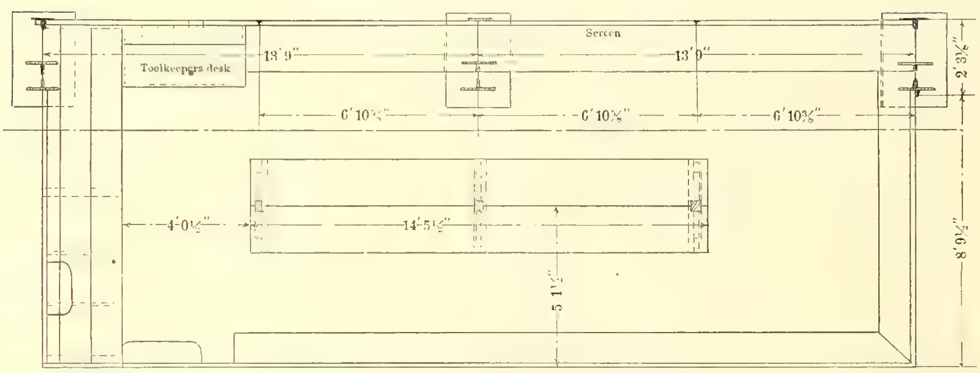


FIG. 40.—PLAN OF FIRST PART OF MACHINE AND TRUCK OVERHAULING SHOP, SHOWING ARRANGEMENTS FOR GROUP AND INDEPENDENT MACHINE DRIVE, STORAGE TRACKS, ETC.

For conveying wheels or other heavy material to the machines two Cleveland cranes of two tons capacity each have been installed with a travel covering the east bay or machine shop and the bay adjoining the workshop. In addition to these, there is an I-beam trolley and a two-ton air hoist for transporting surface car wheels and other parts from the surface track running parallel with the Gillen Place side of the shop building. No provision is made in this shop for overhauling surface cars other than turning their wheels. At the present time 400 pairs of wheels and axles are being fitted up for the 100 new surface cars being equipped at the Thirty-Ninth Street elevated and surface shops. As the East New York shops now have the best facilities for this work it is not being done in the Fifty-Second Street shops as heretofore.



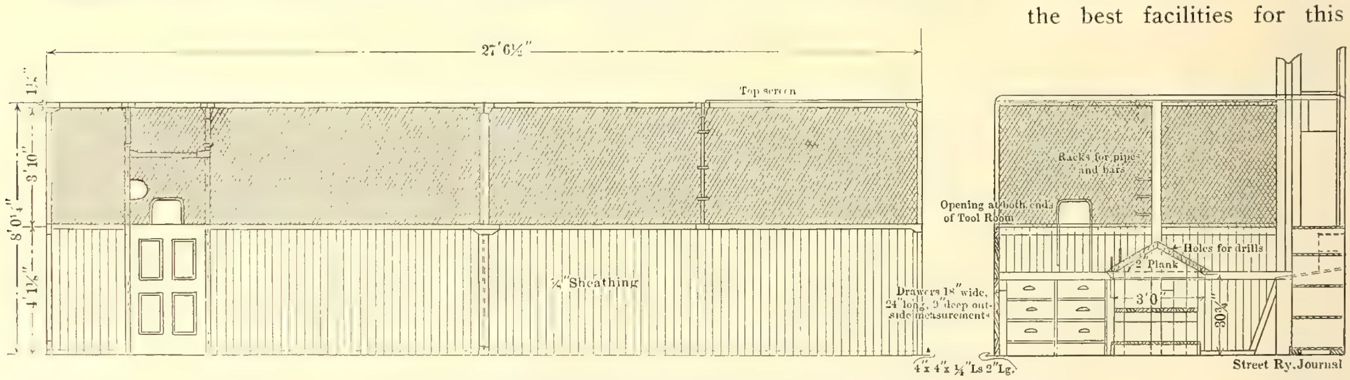


FIG. 41.—PLAN, ELEVATION AND PART SECTION OF THE TOOL ROOM

chine; No. 20, Greenfield universal grinding machine placed in the tool room; No. 23, L. & C. shop saw; No. 24, National double-head bolt-threading machine ⅜ in. to 1½ ins.; No. 30, Place 26-in. drill press; No. 31, Dwight slate 12-in. single spindle sensitive drill; No. 32, diamond double emery grinder; No. 36, Geo. L. Cumming 6-in. x 36-in. grindstone; No. 37, Barnes 25-in. drill press; No. 38, Snyder 20-in. drill press, and No. 39, Foote, Burt & Company three-spindle sensitive drill.

The main switchboard has been erected in the northeastern portion of the machine tool bay, made up of three black slate panels. On the middle panel are mounted in line the main switch, a 3000-amp. Cutter circuit breaker and a switch for the circuit-carrying current to all the first-floor motors.

Below these in another row are the switches for the second-floor motors, the inspection shed, the second-floor lights

and the first-floor lights. All of these switches except the main switch have Noark fuses. The other panels are composed almost entirely of small switches for the smaller lighting circuits leading to different parts of the building, fire-alarm system, etc.

THE TOOL ROOM

The tool room for storing all tools belonging to the company is located in the center of the lower shop floor between the overhauling and machine shops. It is 27 ft. 6½ ins. long and 8 ft. 9½ ins. wide. As noted in Fig. 41, the division walls are 4 ft. 1⅛ ins. high, but have in addition an expanded metal screen which makes the total height 8 ft. ¼ in. The room is furnished with the appropriate drawers, bins and pigeon holes; a center table 14 ft. 5½ ins. long, on which are receptacles for holding drills and the like in a vertical position; and the tool-keeper's desk, which is placed opposite the single entrance.

Every shop employee secures tools from this room through five small brass checks which carry the number assigned to him. Should he desire a sixth tool he must give up one of the five previously taken. The tool room is in charge of a machinist who is furnished with a universal grinder and vise to grind drills and keep other tools in repair. If there is not enough work of this kind to keep him busy, outside employment is given him. Hence the tool room is always in the charge of a reliable man without incurring the expense of employing some one with a lot of idle time on his hands. In addition to keeping the tools, this room is also used for storing jigs, templets and other standards of the company.

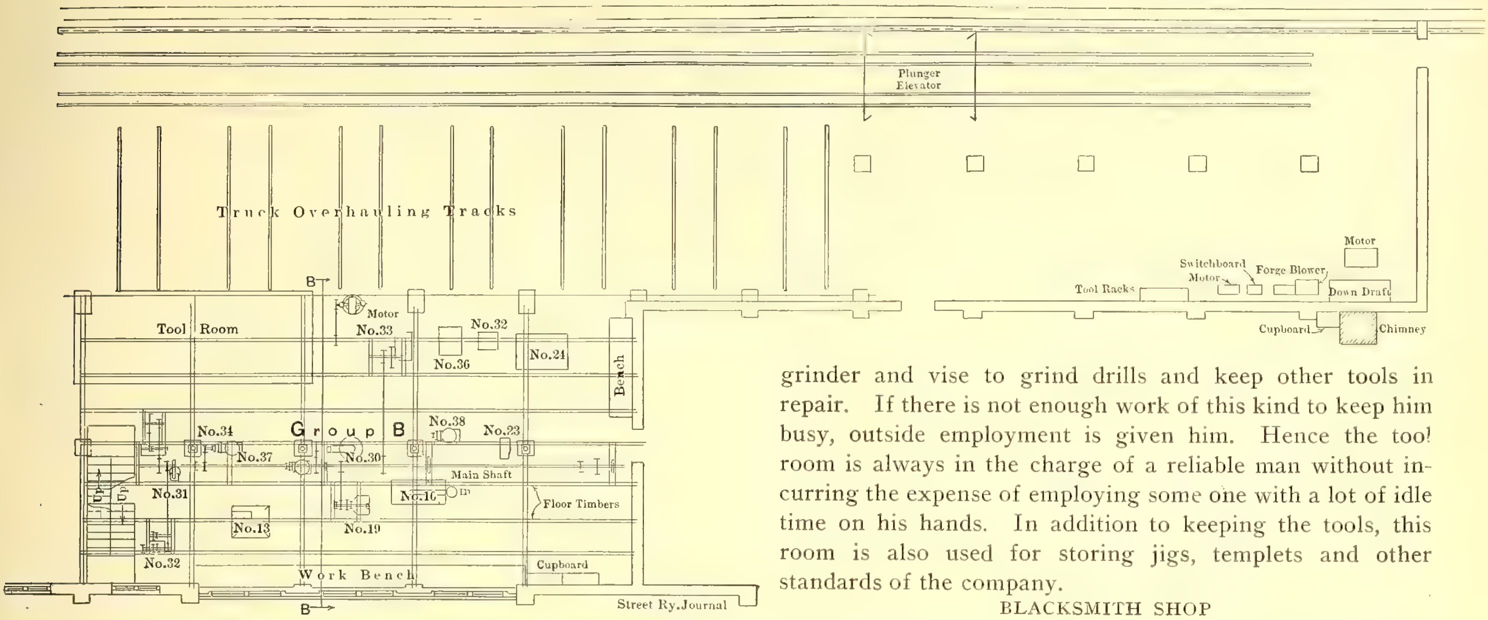


FIG. 40 (CONTINUED).—PLAN OF SECOND PART OF MACHINE AND TRUCK OVERHAULING SHOPS, SHOWING GROUP-DRIVEN TOOLS, TRUCK-OVERHAULING TRACKS, ELEVATOR, TOOL ROOM, ETC.

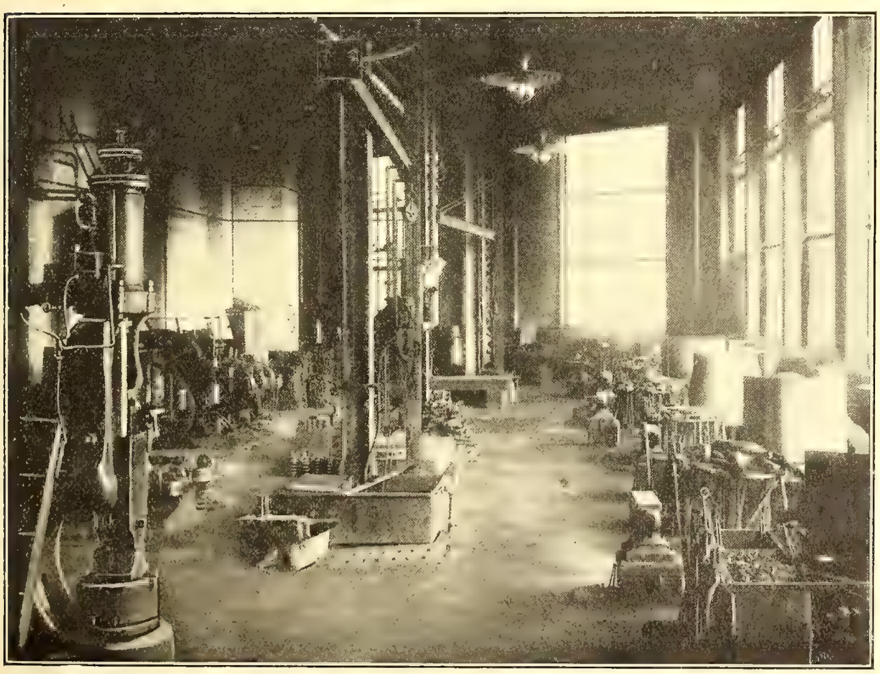


FIG. 42.—VIEW OF THE BLACKSMITH SHOP, SHOWING FORGES, TOOL TURRETS, ETC.

BLACKSMITH SHOP

The nature of the work done in the blacksmith shop covers all kinds of small forgings and bolts for the building, track, electrical and power house departments, as well as forgings for the repair and maintenance of elevated and surface cars.

The blacksmith shop forms a continuation of the bay occupied by the machine shop and extends to the end of the building, with a floor of a special New Jersey clay. It is separated from the other departments on this level by a brick fire wall.

The equipment of this shop embraces the following: Fourteen down-draft forges; 9-in. McDougal-Pond steam hammer (No. 78) and one 7-in. American steam hammer (No. 79), both operated by steam received from the rubbish incinerator plant; a Williams & White bulldozer (No. 77) driven by a 10-hp motor; a Hillis & Jones No. 3 punch and shear (No. 75) with 22-in. throat, driven by a 10-hp motor conveniently located on the top of the machine; a Hillis & Jones iron clamp (No. 80); and a 2-in. Acme bolt-heading and forging machine (No. 76). This last machine mentioned is fitted for several types of dies, which enables the operator to make any kind of forging up to 2 ins. diameter. Bolts can be made on this machine much cheaper than they could be bought. For heating the iron and steel in this machine the two oil furnaces mentioned later are used.

The exhaust fan in this shop is driven by a 12-hp Sprague direct-connected motor, and the blast fan is belt-driven by a 7½-hp Sprague motor. Both motors are operated from one switchboard having two starting boxes and one circuit

breaker. The pipes for this blower system are led through clay conduits under the floor. The fans and forges were installed by the New York Blower Company, of Bucyrus Ohio.

Two interesting features in connection with the forges are the separate coke boxes and revolving tool-rack turrets which were built in the company's shops. There are also two oil furnaces in the blacksmith shop; one of these is of the double-burner Buckeye type, 24-in. x 48-in.; the other

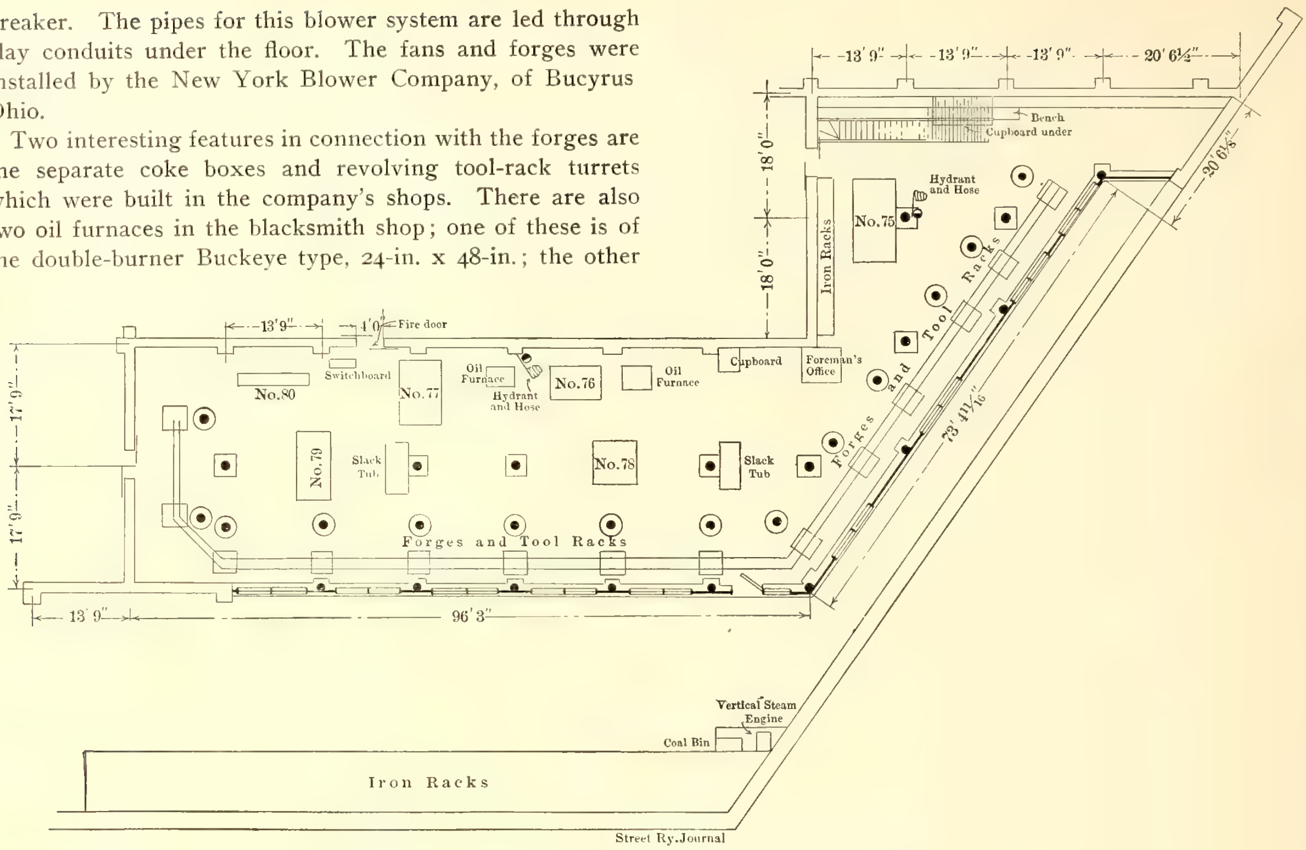


FIG. 43.—PLAN OF BLACKSMITH SHOP AND ADJACENT STORAGE YARD AT EAST NEW YORK

is a bolt furnace, also with double burners, constructed of fire brick and angle iron in the company's shops.

THE MILL ROOM

The mill room is located in the northeast part of the shop directly over the blacksmith room, and, like the latter, is separated from the rest of the shops on the same level by a brick wall. The principal work of the mill room is to manufacture car framing, carlines, window frames, doors and other classes of car woodwork. Considerable cabinet work, such as office furniture, etc., is also manufactured in this shop.

The mill machinery consists of several belt-driven machines divided into two groups, C and D. Group C is made up of the following tools: No. 49, Rogers 42-in. band saw; No. 54, Levi Houston 8-in. molding machine; No. 55, Fay & Egan post-boring machine; No. 57, a Greenley hollow chisel mortiser. There is also one emery wheel (No. 63) in this group directly outside of the mill room for grinding or facing snow brushes. Group D consists of the following:

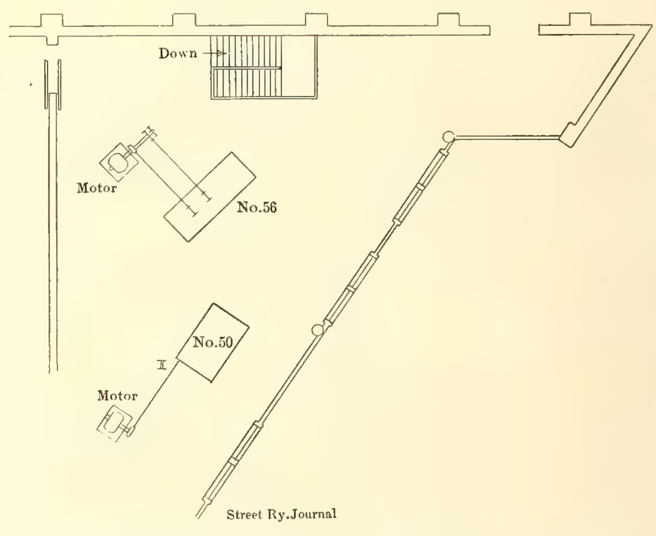


FIG. 44 (CONTINUED).—PLAN OF UPPER END OF MILL ROOM

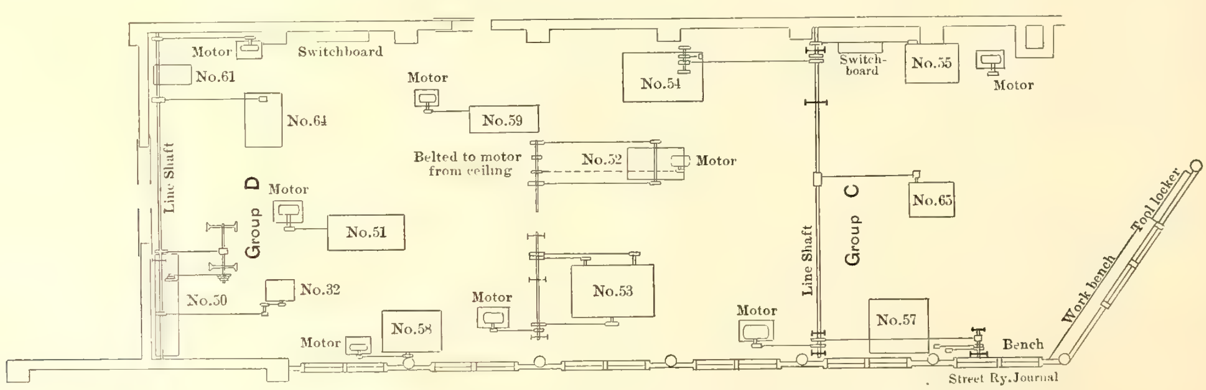


FIG. 44.—PLAN OF MILL ROOM, SHOWING LOCATION AND DRIVE OF WOODWORKING TOOLS

No. 48, an Atlantic 32-in. band saw; No. 60, an H. B. Smith wood-turning lathe; No. 61, Norton 30-in. grindstone; and No. 32, a small emery wheel grinder. This group is driven by a 7½-hp motor.

The independent motor-driven machines include: No. 50, Jos. Colladay 26-in. rip saw, belt-driven from 15-hp motor; No. 51, one Oliver rip and cross saw with 7½-hp belt-driven motor; No. 52, one Baxter & Whitney 26-in. planer driven by a 20-hp motor which is suspended from the ceiling to save space; No. 53, one Berlin Machine Works "Royal Invincible" sanding machine belt-driven by a 20-hp motor; No. 56, one double-spindle Prentice molding machine belt-driven by a 7½-hp motor; No. 58, one Levi Houston 7-in. tenoning machine belt-driven by a 3½-hp motor, and No. 59, one Prentice jointer belt-driven by a 3½-hp motor.

All of the motors are of Northern Electric manufacture and are furnished with dust-excluding shields. The exhauster system is operated by a 20-hp Crocker-Wheeler motor supported on wall brackets. This machine runs without intermission from 7. a. m. to 5:30 p. m., and at times up to 9:30 p. m. without the slightest trouble.

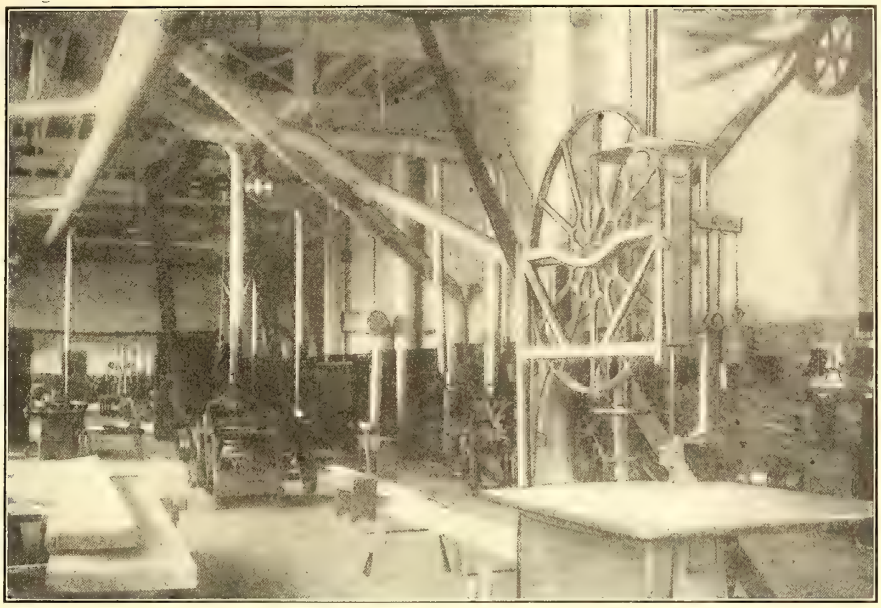


FIG. 45.—SCENE IN THE MILL ROOM, SHOWING EXHAUST PIPES FOR CARRYING OFF SHAVINGS

There are two 5-panel black slate switchboards in this room. Panel 1 of the first board contains the circuit breaker, switch and starting box for group C; panels 2, 3 and 4 the same apparatus for the planer, rip saw and molder; panel 5 a magnetic blow-out, circuit breaker, switch and starting box for a fan motor. On the second board, panel 1 contains a circuit-breaker switch and starting box for group D, and the remaining panels are similarly squipped for the saw, sander, tenoner and jointer.

FIG. 46.—GENERAL VIEW OF THE CARPENTER SHOP

A notable feature of the equipment of this department is the exhaust system connected to each machine for drawing off all shavings, chips, dust, etc. This refuse is carried to a receptacle on the roof, from which it enters a chute leading to the yard, where the material is discharged into two covered carts holding 35 bushels each. These carts when full are pushed by hand across the street, where their contents are transferred to the incinerator.

CARPENTER SHOP

The carpenter shop is located on the second floor of the main shop building between the Gillen Place side and the two inspection tracks. In connection with the mill-room machinery this shop is capable of carrying out all kinds of repairs to car finish and miscellaneous cabinet work.

Through the center of this shop are placed seven cabinet-makers' benches, and along the entire length of the Gillen Place wall as far as the mill-room similar working benches are installed. These are made with hard maple tops 3 ins. thick, provided with through bolts which can be tightened from time to time to allow for shrinkage of the wood. All the benches have drawers for holding the carpenter tools, most of which belong to the men, and each of these drawers is furnished with a 1½-in. Yale padlock. Construction details of these benches will be found in Fig. 47.

BATTERY-CHARGING OUTFIT

Adjacent to the carpenter shop and just behind the elevators there is located a charging outfit for the batteries used in connection with the Westinghouse unit switch group train control, which is used on the elevated lines of the Brooklyn Rapid Transit Company. This consists of a lamp rack of one hundred 10-cp lamps arranged in groups with switches for cutting in 25, 50, 75 or 100 lamps, as different amperages are required. The cells of the storage batteries are of various Westinghouse types and are arranged in sets of seven to deliver 14 volts.

STORAGE BUILDINGS

A shop plant so extensive as the one in East New York naturally requires a large and varied assortment of supplies

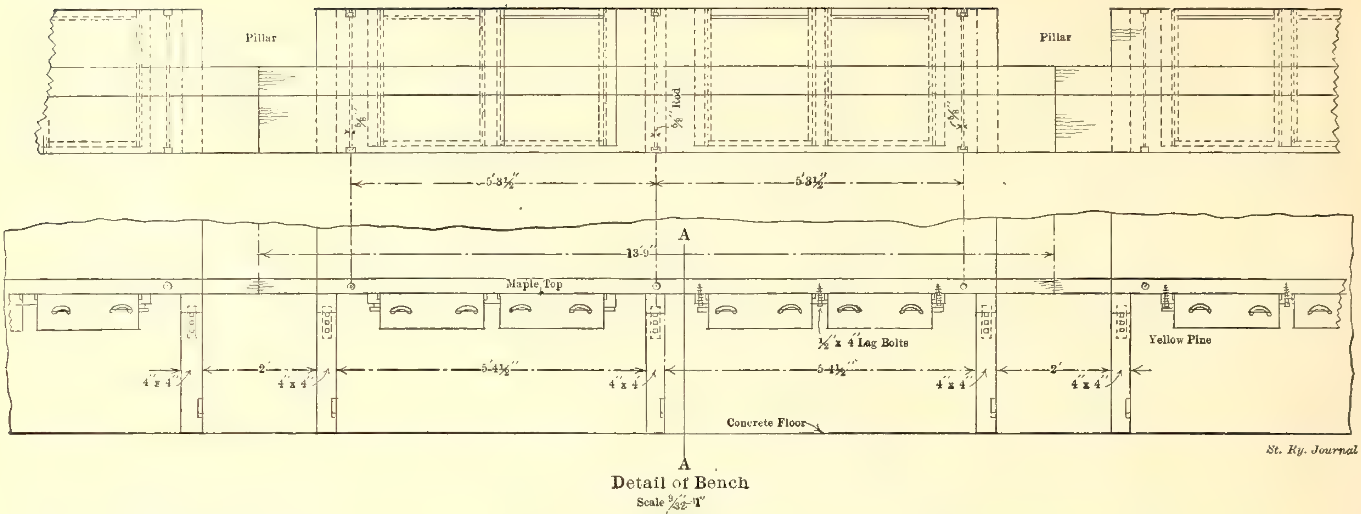


FIG. 47.—CONSTRUCTION DETAILS OF THE WORK BENCHES USED AT THE EAST NEW YORK SHOPS. A NOTEWORTHY FEATURE IS THE USE OF THE ⅝-IN. RODS TO ALLOW FOR SHRINKAGE OR SWELLING

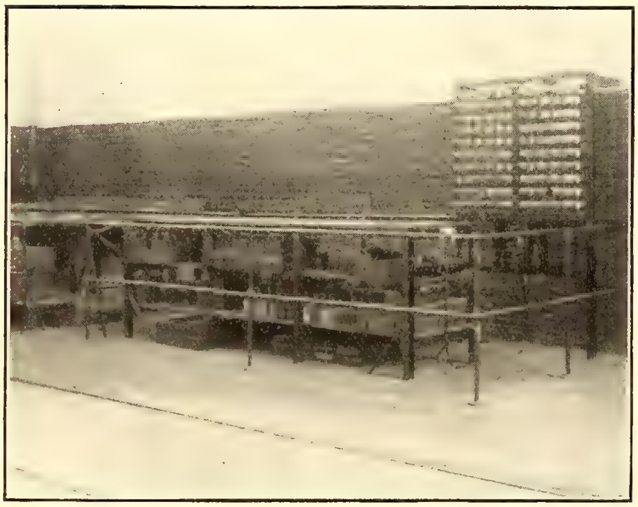


FIG. 48.—LAMP RACK FOR BATTERY TESTING

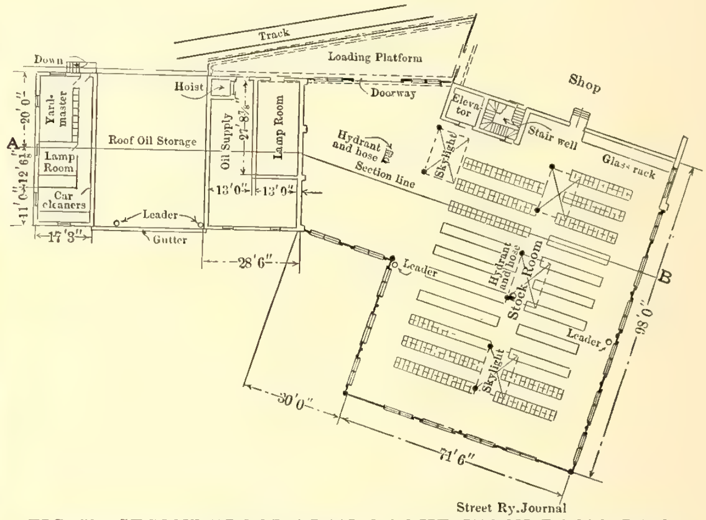


FIG. 50.—SECOND-FLOOR PLAN OF THE STOCK ROOM, LAMP ROOM, OIL STORAGE, YARD-MASTER'S OFFICE, ETC.

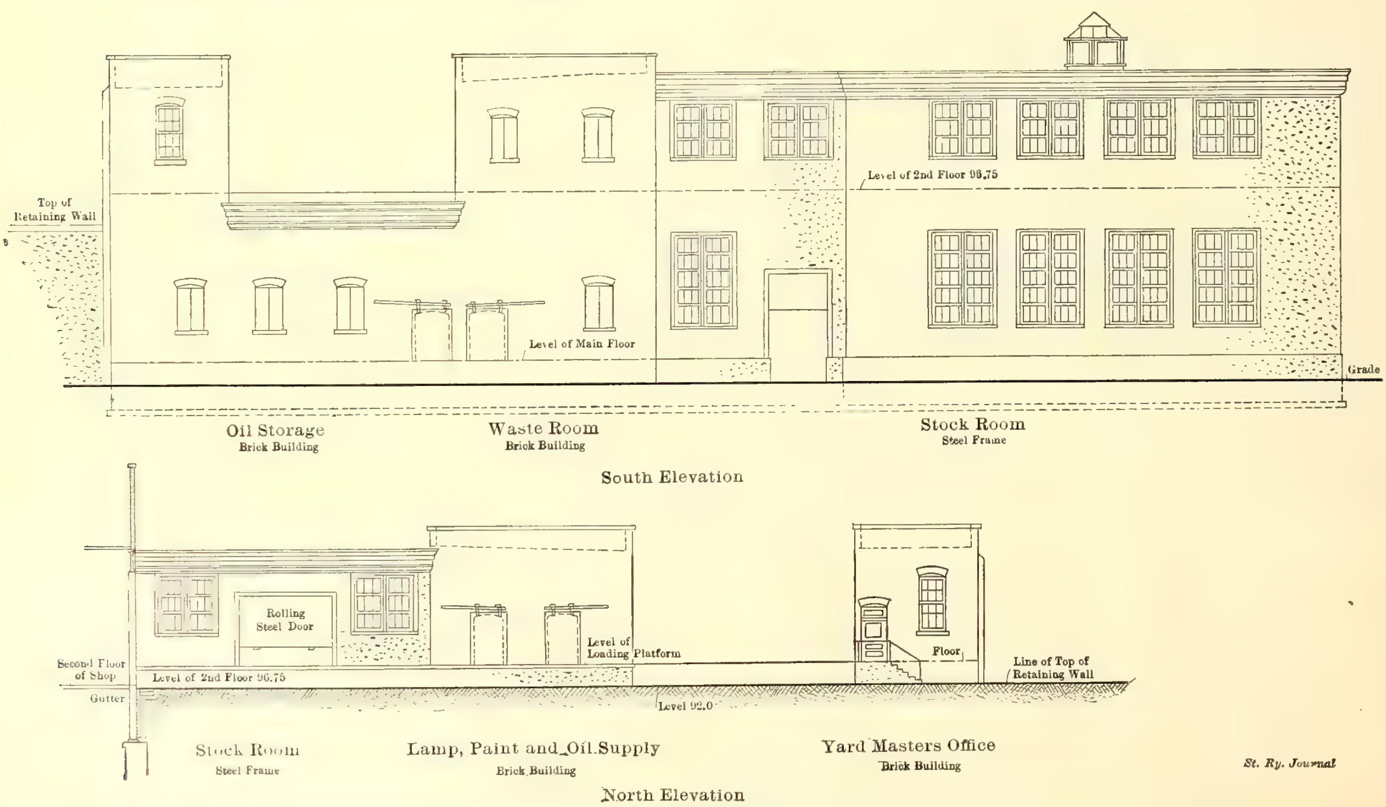


FIG. 49.—NORTH AND SOUTH ELEVATIONS OF THE STORAGE BUILDINGS AND YARD-MASTER'S OFFICE

both for manufacturing and because it is a distributing center. Hence a study of the best means for bringing material into the yards and distributing it afterward with the least labor is of considerable importance. Particular attention was given to two things, to have a stock room nearest to the shop using all or the greater part of its contents, and to isolate structures containing combustibles from other buildings as much as the conditions permitted.

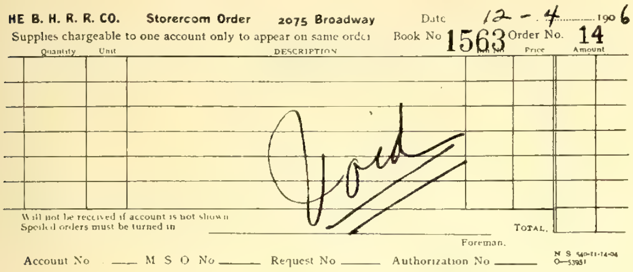

HE B. H. R. R. CO. Storercom Order 2075 Broadway Date 12-4-1906
Supplies chargeable to one account only to appear on same order Book No 1563 Order No. 14
Quantity | Unit | DESCRIPTION | Price | Amount
Void
Will not be received if account is not shown
Special orders must be turned in
TOTAL
Foreman.
Account No ___ M S O No ___ Request No ___ Authorization No ___

FIG. 52.—STOREROOM ORDER WHICH MUST CONTAIN THE NUMBER OF THE ACCOUNT TO WHICH MATERIAL SHOULD BE CHARGED

The main stock building which carries supplies for the elevated division, the track department and the signal department is located at the southern end of the shop forming a continuation of the building proper. It has two floors with offices for the storekeeper and his assistants. The floors of this building are raised about 3 ft. above the corresponding floors of the rest of the shop building, this arrangement making it easier to handle material to or from the surface and elevated tracks serving this part of the yard. The elevated track is a right-hand branch of the double Y entering the storage yard, and runs alongside a large platform just outside of the stock room. There are elevators in both this stock room and in the nearby paint and oil supply and lamp storage building. The surface track leads into a pocket on the lower floor, extending through the rolling doors of the stock room proper, the floor, as above

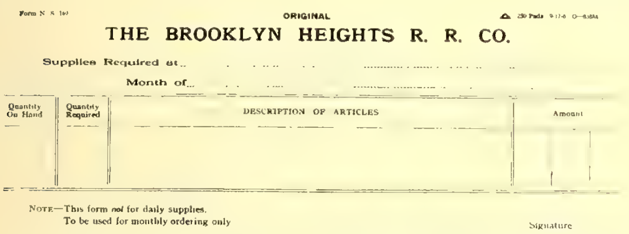

ORIGINAL
THE BROOKLYN HEIGHTS R. R. CO.
Supplies Required at ___
Month of ___
Quantity On Hand | Quantity Required | DESCRIPTION OF ARTICLES | Amount
NOTE—This form not for daily supplies.
To be used for monthly ordering only
Signature

FIG. 53.—PART OF REGULAR TWICE-A-MONTH GENERAL REQUISITION SENT TO THE HEADQUARTERS OF THE COMPANY

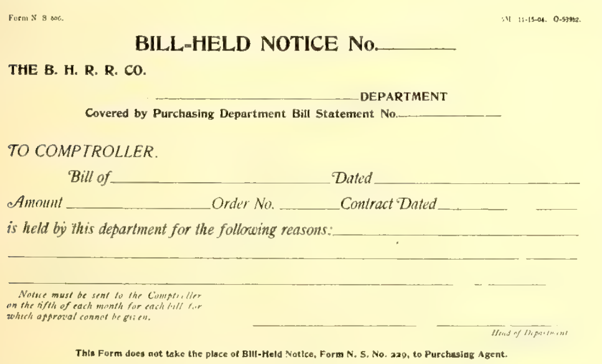

BILL-HELD NOTICE No. ___
THE B. H. R. R. CO.
___ DEPARTMENT
Covered by Purchasing Department Bill Statement No. ___
TO COMPTROLLER.
Bill of ___ Dated ___
Amount ___ Order No. ___ Contract Dated ___
is held by this department for the following reasons: ___
Notice must be sent to the Comptroller on the fifth of each month for each bill for which approval cannot be given.
Head of Department
This Form does not take the place of Bill-Held Notice, Form N. S. No. 229, to Purchasing Agent.

FIG. 54.—EXPLANATORY NOTICE SENT TO THE ACCOUNTING DEPARTMENT FROM SHOP USING PURCHASED MATERIAL WHEN INVOICES ARE NOT APPROVED IN THE USUAL TIME

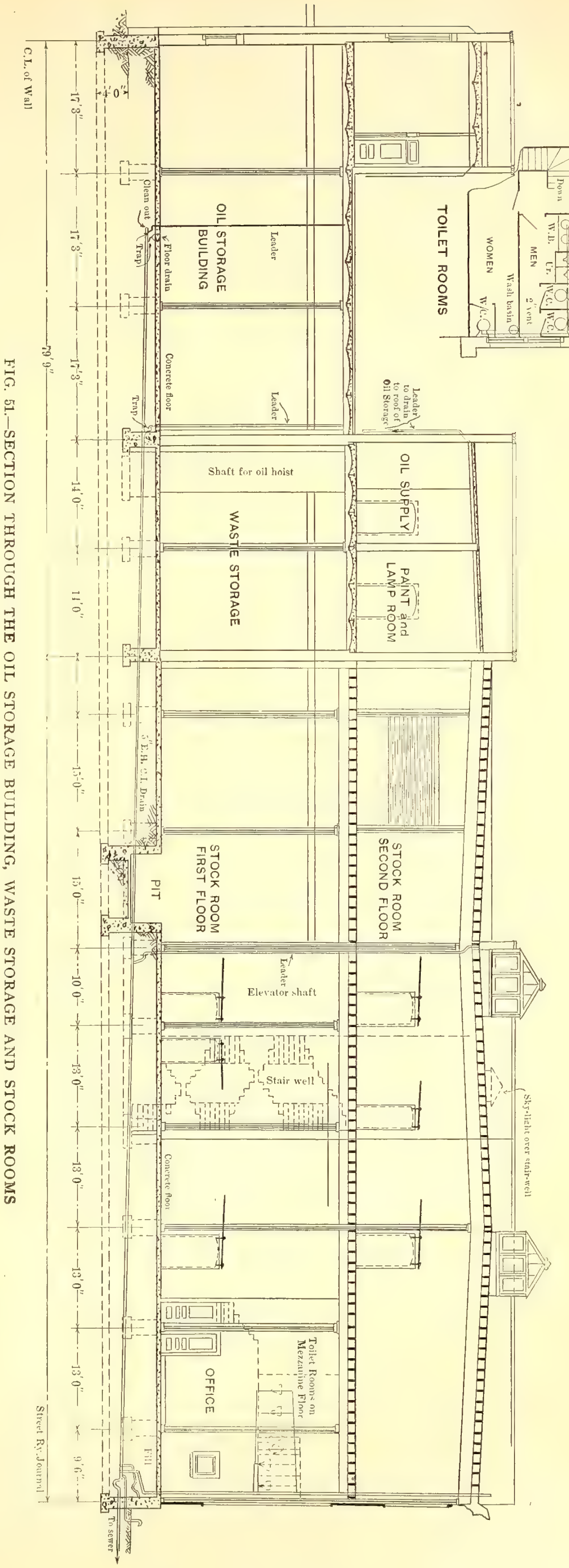
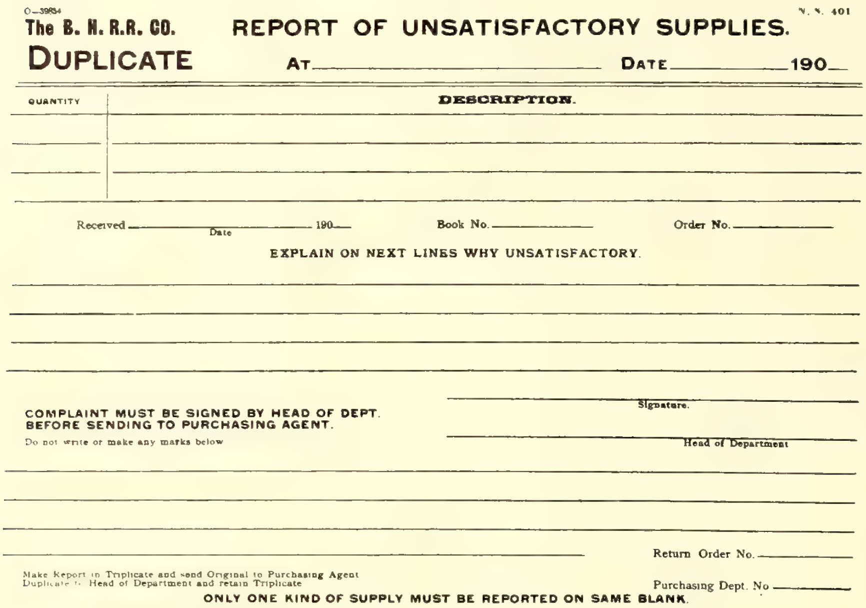


FIG. 51.—SECTION THROUGH THE OIL STORAGE BUILDING, WASTE STORAGE AND STOCK ROOMS

noted, being raised to the level of the platform of the supply cars.

The same surface track used for supplies to the main stock room is continued through the yard along Gillen Place, parallel with the shop building, terminating in front of the blacksmith shop. At this place are stored most of the supplies required for that shop. The iron racks are in a shed directly opposite this shop adjoining the coal bin. The latter contains a 3-hp steam engine which operates the crusher supplying pulverized coal for the forges. Steam for this engine is taken from the pipe supplying the steam hammers.


O—39834 N. S. 401

The B. H. R.R. CO. REPORT OF UNSATISFACTORY SUPPLIES.

DUPLICATE AT ______ DATE ______ 190__

QUANTITY	DESCRIPTION.

Received ______ 190__ Book No. ______ Order No. ______
Date

EXPLAIN ON NEXT LINES WHY UNSATISFACTORY.

COMPLAINT MUST BE SIGNED BY HEAD OF DEPT. BEFORE SENDING TO PURCHASING AGENT. ______ Signature.

Do not write or make any marks below ______ Head of Department

Return Order No. ______

Make Report in Triplicate and send Original to Purchasing Agent
Duplicate to Head of Department and retain Triplicate

Purchasing Dept. No ______

ONLY ONE KIND OF SUPPLY MUST BE REPORTED ON SAME BLANK.

FIG. 55.—REPORT OF UNSATISFACTORY SUPPLIES SENT TO THE PURCHASING AGENT BY SHOP FOREMAN

The fuel oil required for the furnaces in the blacksmith shop is stored in a 100-gallon tank buried at this point. Oil is supplied to this tank from barrels with the aid of a small chain hoist and crane which raises the barrel slightly to allow the oil to run into the pipes below the ground.

In connection with the storage methods in general it is interesting to note here that numerous metal lockers have been installed in different parts of the shop where small finished products can be kept. This avoids littering up the floors with loose pieces, besides making it much easier to keep record of manufactured material on hand.

Supplies from the stock rooms are ordered on the form reproduced in Fig. 52. An important feature of this form, which simplifies the accounting, is that it must be used only for supplies chargeable to one account. The order must be signed by the foreman of the department requiring the material.

The storekeeper orders his supplies about the 15th and 30th day of the month, using the

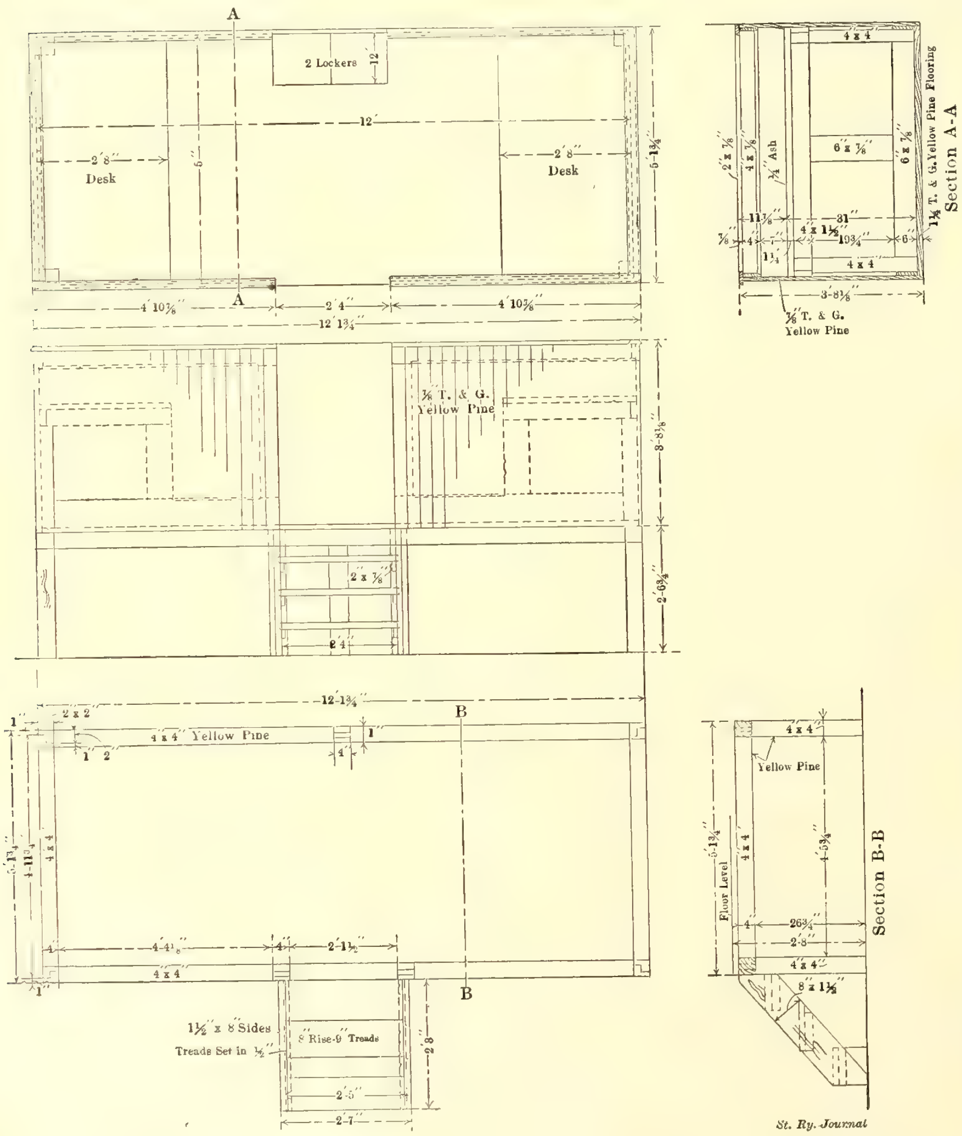
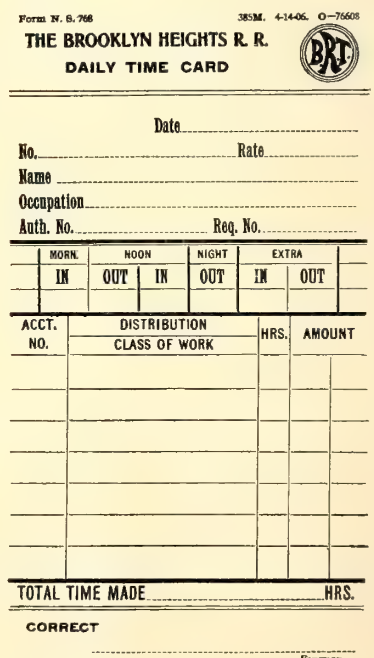


FIG. 60.—CONSTRUCTION DETAILS OF FOREMAN'S OBSERVATION OFFICES, PLACED IN THE SHOPS


Form N. S. 768 385M. 4-14-06. O—76608

THE BROOKLYN HEIGHTS R. R.
DAILY TIME CARD

Date ______
No. ______ Rate ______
Name ______
Occupation ______
Auth. No. ______ Req. No. ______

MORN.	NOON		NIGHT	EXTRA	
IN	OUT	IN	OUT	IN	OUT

ACCT. NO.	DISTRIBUTION CLASS OF WORK	HRS.	AMOUNT

TOTAL TIME MADE ______ HRS.

CORRECT

______ Foreman.

FIG. 58.—EMPLOYEE'S TIME CARD, INCLUDING DATA REGARDING CLASS OF WORK

form illustrated in Fig. 53. If ordered at any other time, he may use the same form but must mark it "Special."

Two interesting forms are those shown in Figs. 54 and 55. The latter is a report made out by the department foreman explaining to the purchasing agent why certain material is considered unsatisfactory; and the former is a "bill-held" notice sent to the comptroller on the 5th of each month explaining that specific bills have remained unapproved by the department ordering the material on account of high price, unsatisfactory supplies, etc.

In case the material needed to fill a certain order is found excessive, the surplus is turned in to the storekeeper with the

Form N. S. 45 — 50 Pads 9-18-06-O-8908

DUPLICATE

The Brooklyn Heights Railroad Company

Department No ______ Date ______ 190__

OLD MATERIAL

Taken from ______ has this day been turned into Stock and Stored at ______

Numbered from ______ to ______ inclusive

FULL DESCRIPTION	Item Number	Price	VALUE
	(Do	Not Write in	These Columns)

By ______ *Employe.*

Received and charged to "Old Material Account" for the month of ______ 190__

Statement No ______

Date ______ 190__ ______ *General Storekeeper*

TO BE MADE IN QUADRUPLICATE. Original, Duplicate and Triplicate to be sent to the General Storekeeper and Quadruplicate to be Retained by Department Reporting.

FIG. 57.—REPORT TURNED IN WHEN SENDING OLD MATERIAL TO THE GENERAL STOREKEEPER

L 225 — 20 M 2-3-06 O-73,382

ELEVATED LINES—B. H. R. R. CO.

Occupation ......
Name in full ......
Badge No. ......
Week ending ...... 1......

	Days	Hours	Rate	Amount $	c.
Friday					
Saturday					
Sunday					
Monday					
Tuesday					
Wednesday					
Thursday					
Total					

Fill in name and badge number (if any), the date and the amount earned each day, giving the total at end of week.

On pay day hand this card to paymaster, who will receive it and hold it as a receipt.

Each employee is required to show badge when presenting card for payment.

All employees, where possible, are required to receive their pay direct from the paymaster.

If the paymaster cannot be reached an entry must be made on the back of the card, stating to whom the pay shall be given; the reasons why the employee can not come in person, and the whole certified to by the immediate superior of the employee and receipted for by the person receiving the money.

FIG. 59.—DATA CONTAINED ON WEEKLY PAY CARD OF ELEVATED RAILWAY SHOP EMPLOYEES OF THE BROOKLYN RAPID TRANSIT COMPANY

B. R. T. UNUSED MATERIAL REPORT.

...... Dep't. Date ...... 190...

Material described below drawn from stock, or purchased, for work covered by respective Authorizations given below has been turned into stock at

DESCRIPTION:											
CREDIT											
Autho.	Account	Quantity	Price	Quantity	Price	Quantity	Price	Quantity	Price	Quantity	Price	AMOUNT
TOTAL VALUE												

ORIGINAL — By ...... *Foreman*

Received and Charged to Stock, Month of ...... 190....
Statement No. ...... *Storekeeper*

TO BE MADE IN QUADRUPLICATE Original and Duplicate sent to Storekeeper. Triplicate to be retained by Employee makng report. Original, when priced, to be forwarded to Comptroller. Quadruplicate to be forwarded to Head of Department.

FIG. 56.—DATA GIVEN ON BLANK FORM OF UNUSED MATERIAL REPORT

blank shown in Fig. 56, and the cost is credited to the proper account. Fig. 57 illustrates the form used for turning in and crediting old material such as scrap brass, copper, etc.

WASH ROOMS, TOILET, CLOTHES LOCKERS, ETC.

It is worth noting that in the East New York plant as much care has been taken for the comfort of the men as for the proper layout of the work that they are called upon to do. This fact is demonstrated by the lighting and heating of the buildings, as well as the commodious toilet and wash room, which in its comfortable arrangements is on par with the best work of manufacturing companies noted for their welfare work. This room is on the mezzanine floor directly above the machine shop, and is furnished with sixteen urinals, thirty-two toilets, sixty-four yellow porcelain wash basins with hot and cold water, and four shower baths,

sufficient for a total force of 400 men. There are also smaller toilets in the armature room, storehouse and offices.

Directly off the main toilet and wash room and under the office is a locker room which contains 480 expanded metal lockers for the shop men. The use of these fireproof metal lockers insures absolutely the privacy and safety of the employees' property; and as their contents can be observed from the outside it is difficult for any employees to store tools or other of the company's property.

This room is well lighted and has enough space outside the lockers to allow a considerable number of employees to use it as a lunch room. For the latter purpose, as well as to assist the men in dressing, benches are placed along the walls of the room.

EMPLOYEES AND SOCIAL FEATURES

For convenience of keeping cost of records all of the employees in this shop receive a number which indicates at once what class of work they perform. For instance, as an arbitrary illustration it may be assumed that all cabinet makers are numbered from 300 to 350, air-brake men 351 to 400, wire men 401 to 450, etc.

Every man is furnished with the company's standard time card as illustrated in Fig. 58, which must be placed in the time clock to be stamped when entering and leaving shops. This card is arranged for the account, authorization number, etc., under which the employee is working. The back of the card contains a line each for the employee's name and number. It is the rule for the shop men to receive ten hours' pay for eight hours work on holidays and for nine hours on Saturdays. The weekly pay card is illustrated in Fig. 59, together with the instructions regarding the collection of wages.

As noted in an earlier part of this article, the splendidly equipped clubhouse of the Brooklyn Rapid Transit Benefit Association is adjacent to the shops so that members can spend their free time in the reading room, gymnasium, pool parlor, etc. In addition to this, the Young Men's Christian Association provides some form of musical entertainment and religious discourse every Tuesday during the noon hour in the carpenter shop. The latter is best suited for the purpose on account of its large free area and its excellent lighting. This diversion is always interesting and is enjoyed by a large number of the men.

A novel practice for an electric railway shop is the installation of foreman's pulpits, that is placing his office on an elevated platform from which he can survey his shop to the best advantage. In this shop nearly all the department foremen are provided with platforms of the type shown in the drawing on page 360. The structure is about 3 ft. above the shop level and has three of its sides fully enclosed by walls 2 ft. 8 ins. high. As the pulpit is open at the top no extra ventilating means are required. The floor is 12 ft. long and 5 ft. wide, so there is sufficient room for a desk at each end, drawers, lockers and miscellaneous office material. The three steps leading to the platform are provided with Universal safety treads. These foreman's offices can, of course, be built for one desk only if desirable.

ACCOUNTING FOR LABOR AND MATERIAL

For the purpose of properly charging up all labor and material, every shop foreman is supplied with a schedule of operating expense accounts devised by Howard Abel, the comptroller of the company. Part of this schedule is shown herewith. It is tabulated in six columns covering the following points: The first column includes labor, material or both,

PART OF THE SCHEDULE OF OPERATING EXPENSES

	Schedule No. Surf.	Elev.	Bridge.	F. M. & E. A. R. T.	MAINTENANCE OF WAY AND STRUCTURE.
L.M.	288	588	888	1188	Motors—Miscellaneous.
L.M.	289	589	889	1189	Transfer of motors and equipment for other purposes than repairs.
L.M.	290	590	890	....	Electrical equipment of service cars and plows.
L.M.	291	591	891	1191	Air-brakes, including pumps and
..	292	592	892	1192	governors.
					Repairs and Renewals of Locomotives.
L.M.	...	593	..	1193	Boilers and fire-boxes.
L.M.	...	594	..	1194	Brake shoes.
L.M.	...	595	..	1195	Wheels, axles and journal brasses.
L.M.	...	596	..	1196	Springs.
L.M.	...	597		1197	Miscellaneous repairs.
L.M.	...	598	..	1198	Electric locomotives.
					Repairs and Renewals of Miscellaneous Equipment:
L.M.	299	599	899	1199	Plows, sweepers, sprinklers and
.	300	600	...	1200	brine cars.
					Repairs and Renewals of Track and Roadway:
M.	201	501	801	1101	Steel rails, girder or T.
M.	202	502	802	1102	Cross ties.
M.	203	503	803	1103	Guard rails.
M.	204	504	804	1104	Track-walk, slatting and rail filler.
M.	...	505	805	....	Frogs, switches and crossings.
M.	206	...	...	1106	Special work.
M.	207	507	807	1107	Spikes, bolts, splices and braces.
L.M.	208	508	808	1108	Paving and ballast.
L.M.	209	509	809	1109	Bridges and culverts.
M.	210	...	810	....	Sheaves and bearings.
L.M.	211	511	811	1111	Tools.
L.M.	212	512	812	1112	Foundations.
L.M.	213	513	813	1113	Structure repairs.
L.	214	514	814	1114	Hauling and distributing material.
L.M.	215	515	815	1115	Other expenses.
L.	216	516	816	1116	Labor.
L.M.	217	517	817	1117	Engineerng Dep't—Salaries and
..	218	518	818	1118	expenses.
					Repairs and Renewals of Electric Line:
M.	219	519	819	1119	Poles, span wires and fixtures.
M.	220	520	820	1120	Trolley wire.
M.	221	521	821	1121	Feeder and fixtures, overhead.
M.	222	522	822	1122	Feeder and fixtures, underground.
M.	223	...	...	....	Subways.
M.	224	524	824	1124	Bonding.
M.	...	525	825	....	Third rail and fixtures.
L.M.	226	...	...	1126	Stable expenses.
L.M.	227	527	827	1127	Tools and other expenses.
L.	228	528	828	1128	Labor.
L.	229	529	829	1129	Emergency crews.
L.M.	230	530	830	1130	Electric lighting—Repairs and renewals.
L.M.	231	531	831	1131	Repairs and renewals of telephone and telegraph lines, fixtures and instruments.
L.M.	232	532	832	1132	Engineering and superintendence—
..	233	533	833	1133	Salaries and expenses.
					Repairs and Renewals of Buildings and Fixtures:
L.M.	234	534	834	1134	Machine and car shops.
L.M.	235	535	835	1135	Depots.
L.M.	236	...	836	....	Power stations.
L.M.	237	537	837	1137	Switch towers, machinery and signals
L.M.	238	538	838	1138	Stations
L.M.	...	539	...	1139	Water and coaling stations.
L.M.	240	540	840	1140	Flag and track houses.
L.M.	241	541	841	1141	Miscellaneous buildings.
L.M.	242	...	...	1142	Docks and dock repairs.
L.M.	243	...	...	1143	Dredging.
L.M.	...	...	...	1144	Ash stations, cranes, derricks, bins and covers.
					MAINTENANCE OF EQUIPMENT.
					Repairs and Renewals of Steam Plant Electric Stations:
L.M.	245	...	845	....	Boilers.
L.M.	246	...	846	....	Piping.
L.M.	247	...	847	....	Economizers.
L.M.	248	...	848	....	Stokers.
L.M.	249	...	849	....	Forced draught apparatus.
L.M.	250	...	850	....	Engines and pumps.
L.M.	251	..	851	....	Condensers.
L.M.	252	...	852	....	Coal and ash handling machinery
L.M.	253	...	853	....	Other repairs.
L.M.	254	...	854	....	
					Repairs and Renewals of Electric Plant:
L.M.	255	...	855	....	High tension generators and exciters.
L.M.	256	...	856	....	Low tension generators.
L.M.	257	...	857	....	High tension switchboards and cables
L.M.	258	...	858	....	Low tension switchboards and cables.
L.M.	259	...	859	....	Rotary transformers.
L.M.	260	..	860	....	Static transformers and blowers.
L.M.	261	...	861	....	Boosters.
L.M.	262	...	862	....	Storage batteries
L.M.	263	...	863	....	Other repairs.
					Repairs and Renewals of Passenger Cars:
L.M.	268	568	868	1168	Bodies.
L.M.	269	569	869	1169	Painting and varnishing.
L.M.	270	570	870	1170	Trucks, hand brakes and brake rigging.

PART OF THE SCHEDULE OF OPERATING EXPENSES—Cont.

	Schedule No.				MAINTENANCE OF WAY AND STRUCTURE.
	Surf.	Elev.	Bridge.	F. M. & E. A. R. T.	
L.M.	271	571	871	1171	Wheels and axles.
L.M.	272	572	872	1172	Journal brasses.
L.M.	273	573	873	1173	Brake shoes.
L.M.	274	574	874	1174	Transfer of trucks for purposes other than repairs.
L.M.	275	575	875	1175	Fenders.
L.M.	276	576	876	....	Fare registers.
L.M.	277	577	877	....	Grips and grip fixtures.
..	278	578	878	1178	
					Repairs and Renewals of Electrical Equipment of Cars:
L.M.	279	579	879	1179	Trolley stands, poles, trolley contact shoes and beams.
L.M.	280	580	880	1180	Car-heaters and lights (switches, fuse-blocks and wiring).
L.M.	281	581	881	1181	Armatures.
L.M.	282	582	882	1182	Commutators.
L.M.	283	583	883	1183	Fields.
L.M.	284	584	884	1184	Electrical car control.
L.M.	285	585	885	1185	Gears, pinions and gear cases (car motors).
L.M.	286	586	886	1186	Motor bearings.
L.M.	287	587	887	1187	Brush holders.

as the case may be; the second for work in the surface department, numbered from 201 up; the third for work on the elevated division, numbered from 501 up; the fourth for work on the bridge division, from 801 up; the fifth for work on mail and express cars and for the American Railways Traffic Company, numbered from 1101 up; the sixth and last column gives a description of the labor performed. The simplicity of this system is such that there can be little hesitation regarding the proper account against which a charge should be made, but in case of doubt the right number is specified by the comptroller.

It will be noted that there are several blank squares under some of the headings. These omissions are due to the fact that certain kinds of charges do not come up in every department. For instance, no charges appear against No 1176, covering fare registers, because there are none in the service in the American Railways and Traffic Company's department. The figures "76" do appear, however, on all the passenger divisions.

INSTALLATION AND CONNECTION OF GRID RESISTANCES

BY HENRY SCHLEGEL

The article by the writer on "Grid Starting Coils" in the Street Railway Journal for Oct. 6 attracted such attention and comment that a few hints on the installation and connection of grid resistances may prove of value to some of the readers of this paper.

If we assume that we have a set of grid resistance frames well selected and correctly made, the next chance for fault and confusion is in their installation and connection—and faulty installation often begets faulty connection. The frames should be placed well away from the car floor, well away from the water and slush to be thrown by the car wheels, and well clear of all brake parts. By the latter I mean under all conditions, that is, whether the brakes are applied or released, whether the car is light or loaded, and whether it is in a curve or on straight rail or on no rail at all, and in all these cases allowance must be made for extreme travel of brake rods and chains due to neglect, slack and wear.

Secondary considerations in the location of the resistances are (a) that the frames shall be so placed that the heat of one frame shall not blow through the others when the car is in motion; (b) that the frames shall be located in the same order on all cars, and (c) that the individual placing of frames be such that the minimum length of jumper will connect the correct end of one frame to the correct end of the frame next to it. With conditions b and c observed, the right or wrong disposal of a frame can be judged at a glance.

The height above the rails and the space available under different car bodies varies so in amount and disposition that no rigid rule can apply to all. On modern grid frames the length of the legs is such that the resistance metal is held a safe distance from the asbestos lined car floor even when the legs are lagged or bolted directly to the car floor, provided a proper selection of grids prevents excessive heating; but this direct connection of frames to car floor, especially by through bolts, is to be avoided, because in event of defective grid-to-frame insulation or of a frame picking up wire in the street—and this often occurs—the through bolts become charged and create in the car floor above a charged area ready to shock a passenger making contact with it and a grounded area at the same time. The safest method of suspension is by means of the hangers supported at points where their fastening bolts will not be within reach of passengers' feet inside the car. A good method and place of suspension, where such is practicable, is to use hangers of L section which extend on either side of the short-circuit line of the car, the resistance frames being placed lengthwise along the shorter center line. This arrangement has the advantage that the sides of all frames are exposed to the direct windage due to motion and the hangers are supported from the sides where the liability to cause shock is the least. On cars with center-hung brake lever, the frames must be dropped as low as permissible and the brake rigging allowed to work between the top of the hanger and the bottom of the car. A wood or fiber guard should then be placed above the hangers on both ends to prevent any contact between the sway bar and the hanger.

Assuming that the frames have been so assembled and the sectioning so proportioned that all car wires must be brought down to the same side of the frames, care must be taken that all frames are installed with their connecting sides toward the same hanger iron. If this is not done, not only will some of the car wires have to cross over or under the frame, but a long jumper will have to be used instead of a short one, thereby making the connections appear confusing. Where the manner of assembling has not been thus standardized, it will in all cases pay to do so. The turning of a coil end for end would then become detectable at once, and this is a mighty good feature, especially on frames composed of two or more different kinds of grid. The effect of getting such a frame end for end is to put high-resistance grids of low current capacity where low-resistance grids of high current capacity should be, with the final result that the car will notch in jerks and the abused frame will give trouble. Measurement of the total resistance of the starting coil will not reveal this condition, because unless the jumpers are so run as to cut out some grids the total resistance will measure normal. The wiremen should be made to understand that jumpers between frames should be so run that current entering at one end of the starting coil must traverse every grid of every frame before leaving at the other.

The above points by no means include all of the irregularities encountered in the careless assembly, installation and connection of grid starting coils, but are sufficient to emphasize the importance of using a stand grid, assembled in a standard frame and installed and connected according to standard methods.

SHOP PRACTICE AND SHOP DEVICES AT MEMPHIS

When the Memphis Street Railway was acquired by its present owners, about two years ago, the shop department underwent a complete reorganization. New features of practice were introduced and many original devices for facilitating work were gotten up. The changes resulted in a great reduction in the maintenance expenses, and many of the devices developed might to advantage be introduced into other shops. Through the courtesy of President T. H. Tutwiler this publication is able to give an account of the work in the shop for the last two years.

On assuming charge, A. D. McWhorter, master mechanic of the shops, began at once to systematize the inspection of cars. This portion of the car-house work was regarded as having such influence on the cost of maintenance that Mr. McWhorter took personal charge of the inspection for a period in order to get the system into working order, and he now gives it a great deal of attention. Because of the limited number of extra cars it is necessary to do all of the inspection at night. About 33 men are employed in caring for 168 cars. The distinguishing feature of the system is that each man or squad of men is delegated to do a certain portion of the work on all of the cars. Each inspector is given an inspection card, a duplicate of which is reproduced. On this he is required to check the particular parts which he is required to inspect and the numbers of the cars inspected. This enables any faulty work on any car to be easily traced back to the man at fault. One squad of men inspects the trucks, brakes, wheels and motors. Another examines the brushes and lubricates the motors. One man is responsible for the condition of the fenders alone, while another has charge of the trolleys. The car body, including the grab handles and the signs, is cared for by a separate squad. One man inspects all of the controllers and one squad takes care of all of the air apparatus. The careful manner in which the inspection work is carried out is no doubt due in part to the fact that whenever faulty inspection is the cause of an accident or whenever faulty inspection is discovered, the man at fault may be ascertained by reference to the inspection cards. He is then either dismissed or dealt with in such a manner that he is not likely to repeat the offense. This is especially true with regard to armature clearance, and it is a very rare instance for an armature to get down on the pole pieces.

CAR CLEANING

In addition to the nightly cleaning of the interior and of the windows, the exterior of the car is washed off every third night with Phœnix car washer and cold water. The interior is washed thoroughly every two weeks. The floors and seats of the summer cars are blown out with air every night just before being run into the shop, air being obtained from the compressor plant in the shop. About one minute is required per car, and the adoption of air for this work has enabled the cleaning force to be cut to one-third its former number.

CARE OF HEADLIGHTS

Arc headlights are used on the cars and are turned out only when the cars are on Main Street. In order to care for the 140 arc lights used, a separate building measuring 25 ft. x 40 ft. has been constructed. In summer this building is also used to store the 600 pairs of vestibule doors which are removed from the cars during the summer season. The headlights are collected from most of the cars as they come in at night. Those from the other cars are set off at a central point down town and brought to the shop on a work car. Each day the reflectors of the headlights are cleaned, the globes wiped out, and new carbons are put in and the light is then tested. The work requires one man's time continuously.

FRONT VIEW OF SHOPS AND OFFICE OF THE MEMPHIS STREET RAILWAY

OVERHAULING MOTORS

The thorough nightly inspection to which the cars are subjected is regarded as the chief cause for the relatively small number of armatures lost. The method of overhauling motors, however, has its effect. The decrease in armature troubles may be judged from the fact that where seven winders were formerly employed, two men and a boy now do all the winding, including the manufacture of the armature and field coils for almost twice the former number of cars. Motors are overhauled by inspection rather than by mileage, and as much of the work as it is possible to do on the car-house floor is done there rather than under the car. Motors of the GE-800 type are removed from the truck bodily and are gone over on the car-house floor. With other types the lower half of the shells are set out.

It is considered that on the car-house floor there is better opportunity to get at the fields, and the better light makes it possible to see defects which would otherwise be overlooked. As a rule motors are given a thorough inspection every time bearings are renewed or armatures changed.

REPORT OF WINDING ROOM.

Month of October, 1906.

Number of men.......................................

	G. E. 800.	G. E. 1000.	G. E. 80.	G. E. 67.	G. E. 57.	AA–1 Comp.	AA–4 Comp.	Total.
Armatures brought into winding room	69	3	..	10	56	..	2	140
Armatures for mechanical trouble	58	3	..	10	56	..	2	129
Armatures for electrical trouble	5	..	..	..	..	..	..	5
Armatures for inspection	13	..	..	..	..	..	..	13
Armatures wound	3	..	..	..	1	..	..	4
Armatures O. K. in stock	18	47	..	4	3	1	1	31
Commutators renewed	5	..		..	..	..	..	5
Commutators turned	54	3	.	6	14	..	1	78
Field coils O. K. in stock	188	14	..	72	4	..	..	272
Field coils wound	84	..	..	..	..	..	..	84
Field coils repaired	..	9	..	..	4	..	4	17
Field coils used	26	..	..	..	4	..	4	34

REMARKS: Wound—34 K–2 controller magnets.
Repaired—8 K–2 controller magnets.
Wound—5 electric switch solenoids.

....Foreman.

The lower half of the shell is cleaned out thoroughly, the fields are examined and repainted, and the armatures are taken into the winding room, where they are blown out and inspected.

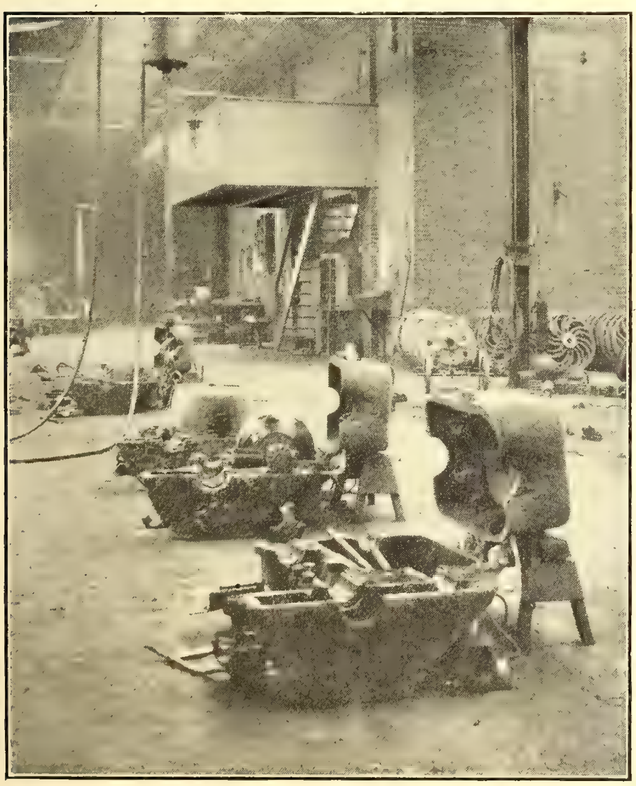
WINDING-ROOM METHODS

The small amount of trouble experienced with defective armatures may be observed by reference to the winding-room report for the month of October, 1906. This shows that only four armatures were rewound during the month. For one year, as has been stated, the record was 76 armatures rewound, and during this year, 1906, 1318 were inspected. The form of winding-room report is in itself worthy of a notice. It shows at a glance the work done in the winding room during the month, and also the number of armatures and field coils on hand. It is made out each month by the foreman of the winding room and is forwarded by him to the office of the master mechanic. This report also shows that the winding department is much ahead in its work. At the rate they were used during the month for which the report was made the 31 armatures and the 272 field coils on hand would enable the department to discontinue winding for several months. Coils are usually wound on shop orders for large numbers. The itemized cost on an order for 79 field coils is given to show the material entering into a field. This also shows a very small

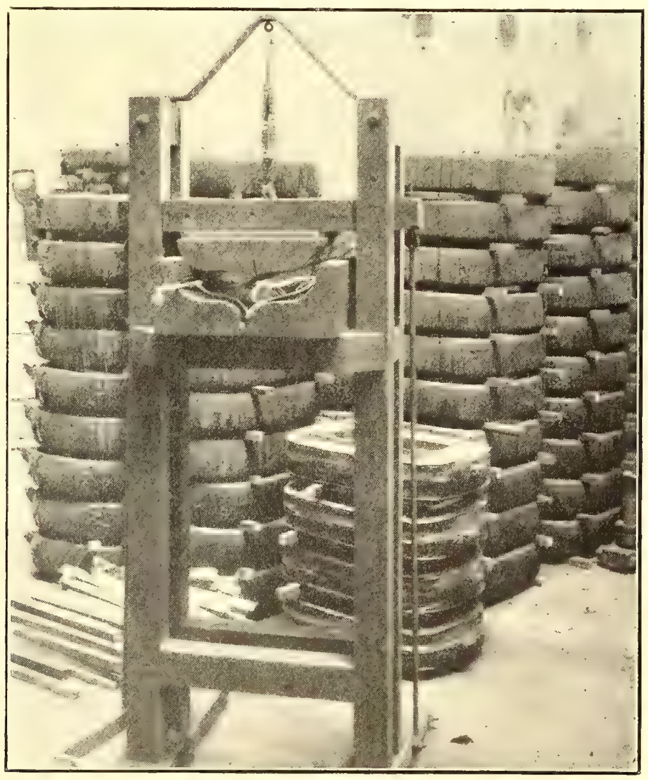
DRIP CAN WITH EXTENDING SPOUTS USED IN THE WINDING ROOM

labor cost per field. The fillers used in the fields are of asbestos and all splices are covered with mica.

All of the armature coils for the GE-800, GE-1000 and GE-67 motors are wound in the armature room. After being wound on the usual forms they are dipped in standard varnish and then taped with white linen tape. The operator of the taping machine tapes them at the rate of about twenty per hour. After being taped they are dipped in M. I. C. compound, and after drying and being baked they

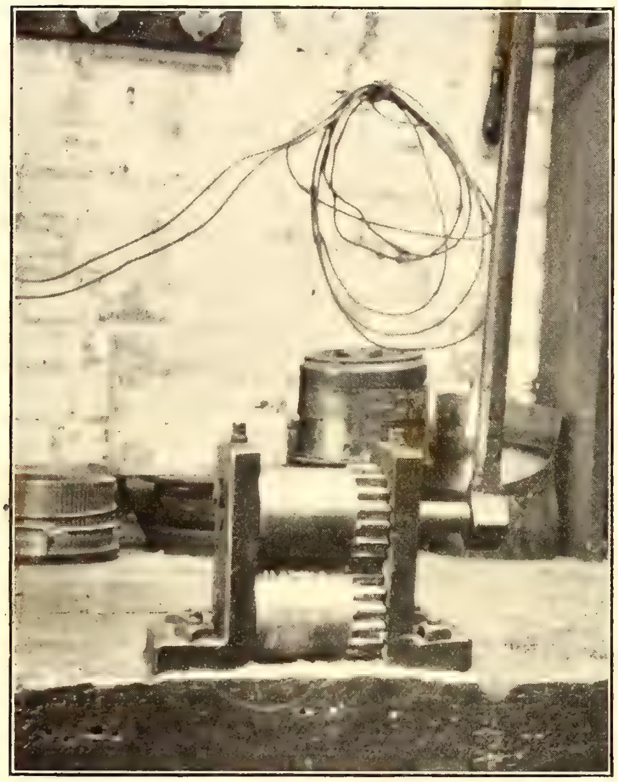


MOTORS LAID OUT FOR OVERHAULING

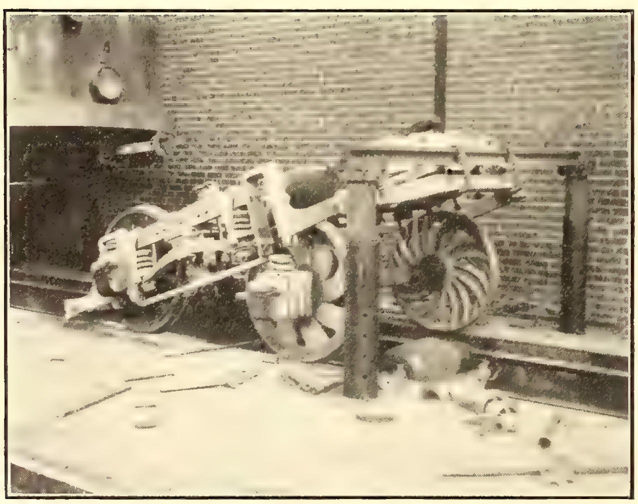


PRESS FOR SHAPING COILS; ALSO SHOWING THE MANNER OF STORING THEM

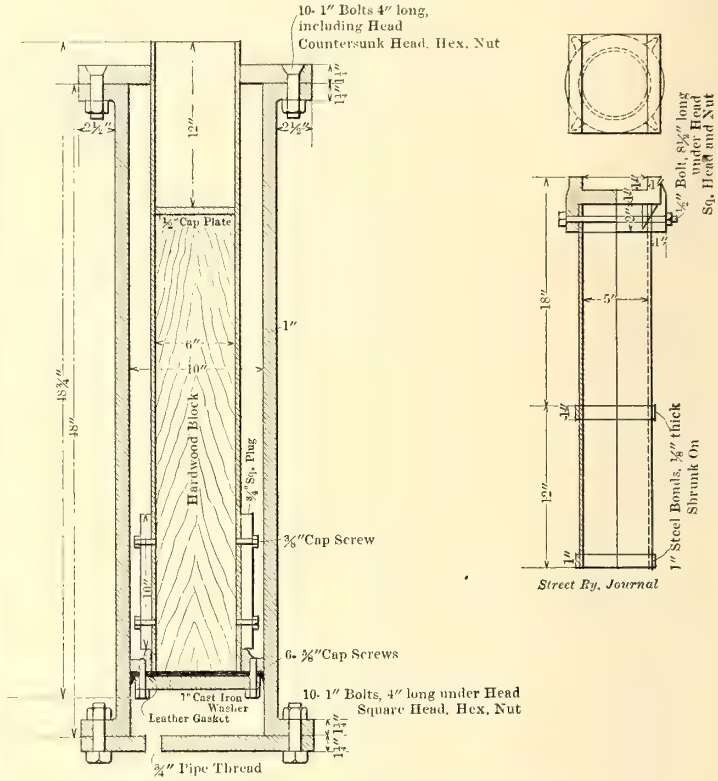
are pressed in shape in the press shown in an accompanying illustration. This press, which is operated by a foot lever so shapes the coils that very little pounding is necessary in winding the armatures. Incidentally, the reproduction of the press shows the manner of stacking fields in the winding room. Another reproduction shows a drip can which results in a considerable saving in dripping varnish. Field and armature coils while drying are suspended above the troughs on either side of the central can and all the drip runs into the can. The two cans of this type in use are made of No. 22 galvanized iron reinforced at the top of the troughs by small galvanized angle-irons measuring about 1 in. x 1 in. x ⅛ in. A special device for flattening the leads of GE-800 armature coils has been found to save considerable annoyance. The rolls which were made from two pieces of an old axle are placed at such a distance apart that when an armature lead is rolled between them it is flattened out to a thickness which causes them to fit snugly in the slots of the commutator bars. In winding GE-1000 coils, the coil is changed somewhat from the standard form. Instead of bringing one lead out in the center it is carried out directly from the slot as is customary with the coils of more modern machines. The throw of the leads is not changed, the short leads being brought up to the same segment. This results in a shortened lead on one end with a consequent saving in wire, and in addition the smaller amount of wire in the leads makes the head of the armature less bulky.



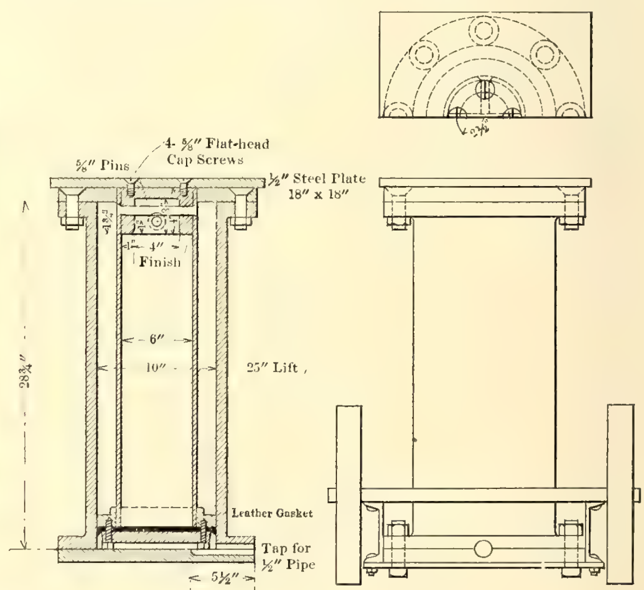
COIL FLATTENER USED IN THE WINDING ROOM



RAISING A TRUCK TO CHANGE THE WHEELS



CONSTRUCTION DETAILS OF AIR LIFT

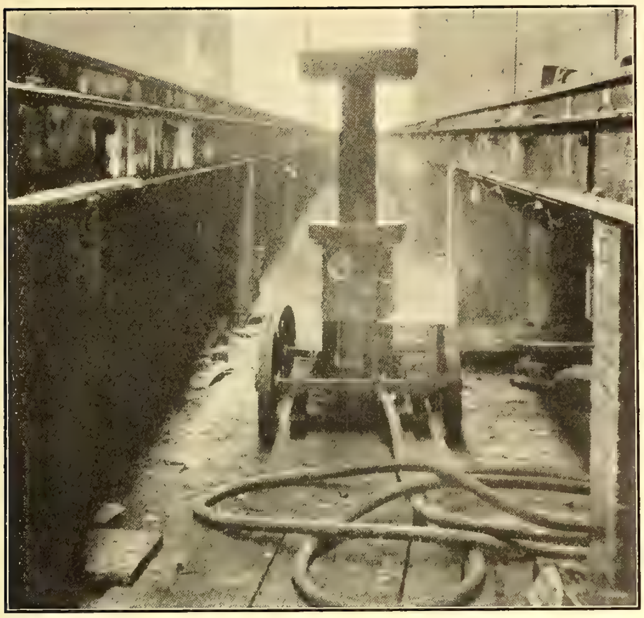


SKETCH OF AIR LIFT

PNEUMATIC HOISTS AND LIFTS

The shop is well provided with air lifts and hoists, all of which with the exception of casting the parts, were made

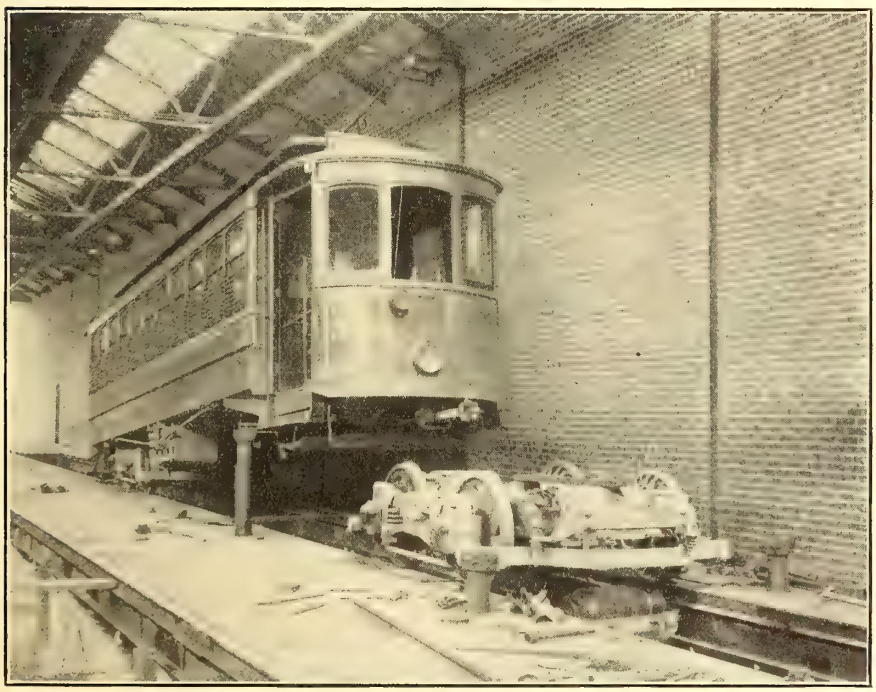
in the shops. Air is furnished by a compressor of 200 cu. ft. capacity per minute, the automatic control of which is provided with a device for throwing the load off the compressor while it is getting up to speed. A tank above the compressor measuring 5 ft. x 18 ft. furnishes storage capacity. From this tank pipes lead to all portions of the shops.



PIT-JACK MOUNTED ON A FOUR-WHEEL TRUCK

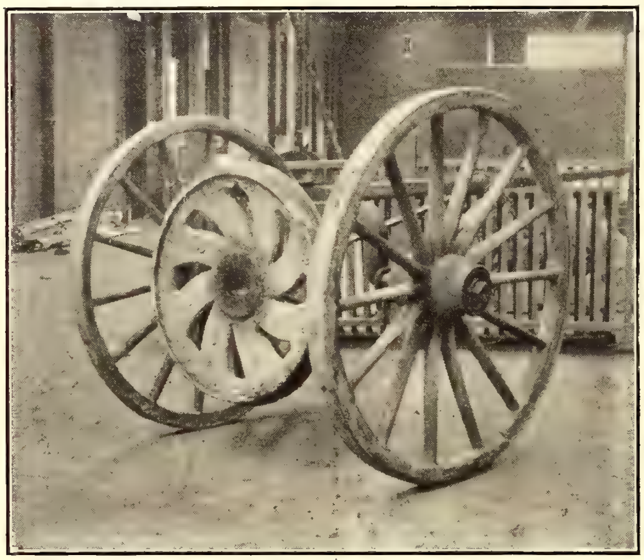
Of the pneumatic hoists, probably the most interesting are the car hoists which were designed by Mr. McWhorter. Two of the reproductions from photographs show these in use and the details of their design may be gotten from an accompanying drawing. The four hoists, which are placed at a distance apart that permits them to be employed to lift a single or double-truck car body off the trucks are identical in design. The cast-iron cylinders are 10 ins. in diameter and are of such a length as to allow the piston to travel about 34 ins. The piston rod is hollow and is filled to within 12 ins. of the top with a hardwood block capped with a ½-in. steel plate. At intervals of about 3 ins. for almost its full length it is drilled with 1-in. holes, as shown in the reproductions, and into which pins are inserted when the piston is to be held in one position. The load on the hoist is carried by a hollow head about 28 ins. long which is placed in the piston and rests on the wood filler. This head is capped with a casting which takes the base of a standard section rail. Two hoists opposite each other are piped in sets, but there is no mechanical connection between any of them. A straight air engineer valve with a three-way cock alongside the wall near the hoists permits the two sets to be controlled independently. When the hoists are not in use, the heads are withdrawn and the piston is allowed to drop below the floor level. When the cylinder is down and the round disc shown in one of the reproductions is placed in the hole in the upper cylinder head the floor presents a smooth surface. At the present time the hoists are operated by air. The elasticity of the air, however, sometimes causes them to move unsteadily and the system will be so piped that water will be forced into the cylinders. The pits are equipped with two 12-in. and one 10-in. air lifts of a design shown in one of the drawings. In many features these are similar to the car hoists. The head of the piston rod is capped by an 18-in. x 18-in. x ½-in. steel plate. The cylinders which have a travel of 25 ins. are controlled by a straight air engineer's valve at

AIR COMPRESSOR AND STORAGE TANK USED IN MEMPHIS



RAISING ONE END OF THE CAR-BODY WITH TWO OF THE CAR HOISTS

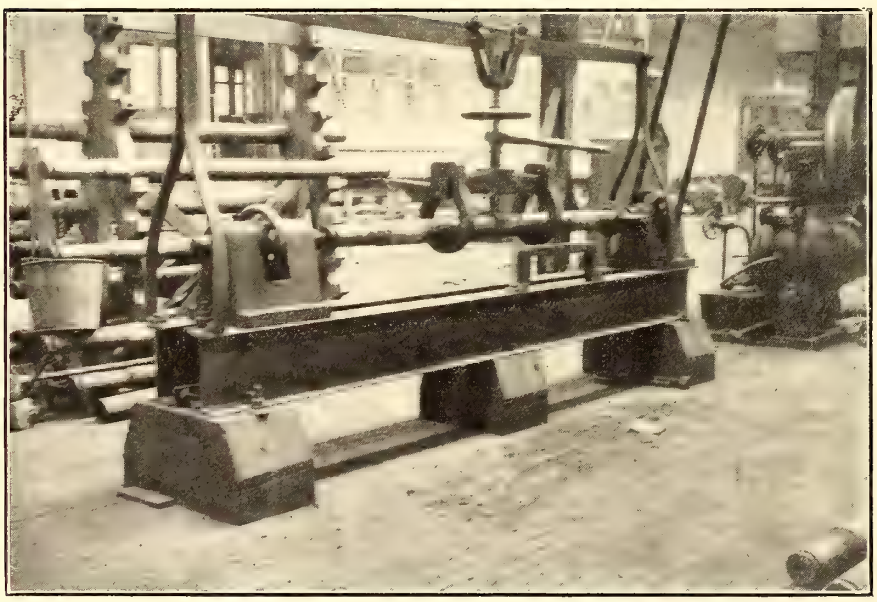
the side of the cylinder. The lifts are mounted on trucks with four wheels having flat treads. Air is led to the cylinders through armored hose from the pipe outlets in the pit walls. For handling heavy parts around the machinery in the machine shop and in different portions of the shops



TRUCK FOR CARRYING WHEELS AND MOTORS ABOUT THE SHOP

several jib cranes and overhead tramways provided with pneumatic hoists made in the shops are used.

A two-wheel cart of rather odd design is also used for carrying wheels and motors about the shop. It is made with wagon wheels of the usual type. Motors are handled by hooking the handles over a hook on the end of the long



APPARATUS FOR STRAIGHTENING BENT AXLES AND SHAFTS

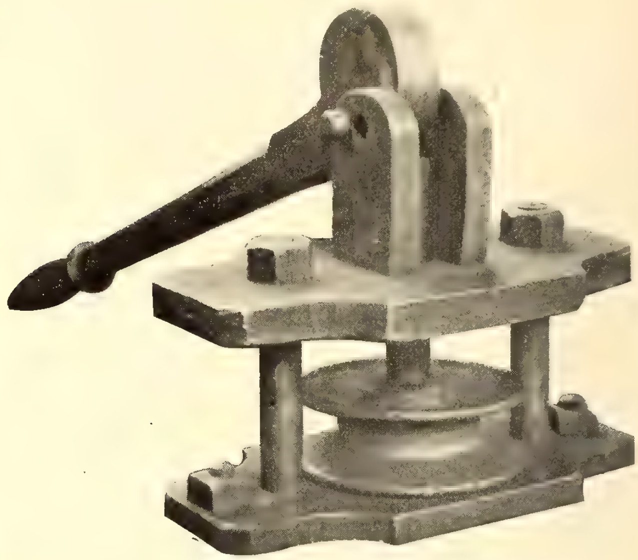
handle of the cart, and wheels are carried as shown in the illustration.

CHANGING WHEELS AND ARMATURES

The method of removing wheels and armatures from double trucks is well shown by the two illustrations of the car hoist. Where the two pairs of a single-truck motor are to be removed both motors are dropped with the use of one pit hoist. One motor is dropped to rest on projecting shelves bolted to the bottom of the I-beams under the pit rails and the hoist is then utilized to drop the other motor.

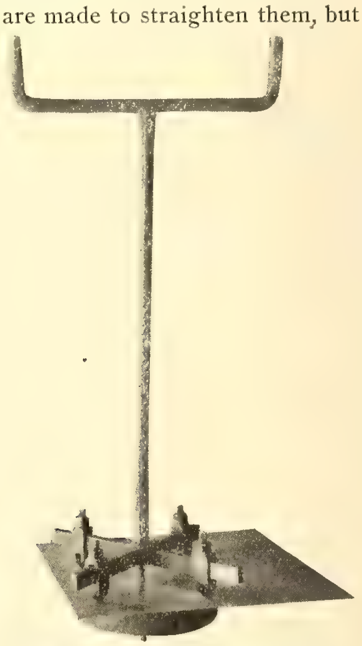
SOME SPECIAL SHOP DEVICES

The work of straightening axles and shafts is very much facilitated and the possible injury to lathes avoided by the



DEVICE FOR PUSHING OUT TROLLEY BUSHINGS

use of the special device illustrated. The bed is made of two 10-in. I-beams. The head stock is stationary and is belted to run at about 40 r. p. m. A trolley above the bed supports a very powerful "jim-crow." In very cold weather or when the bends are very bad the armature shafts or axles are heated before attempts are made to straighten them, but



DEVICE WITH WHICH HEAD-LIGHT HOLES ARE CUT IN DASHES

in warm weather small bends are corrected without heating. Armature shafts are straightened by the use of a bar for which a U bolted to one of the I-beams serves as a fulcrum.

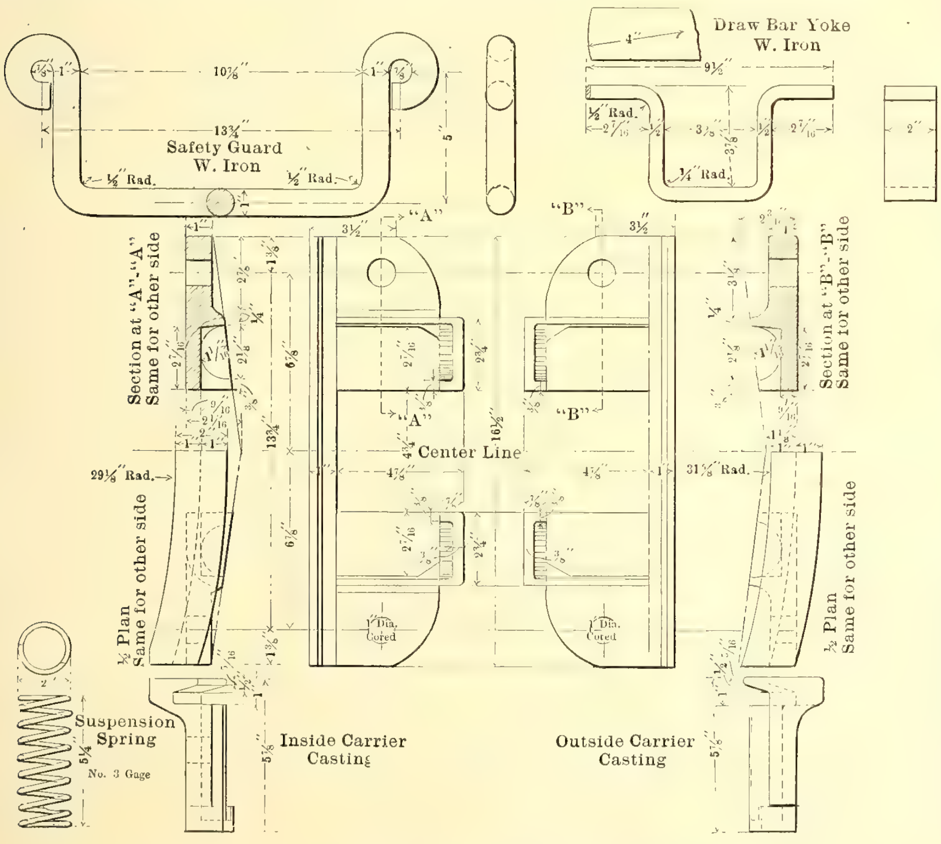
A device for cutting headlight holes in the dashes of cars has saved many times its cost. The work of rebuilding the cars, which has just been completed, necessitated 440 holes being made in dashes of No. 14 gage iron. The devices consist of a long rod with a ladle handle at one end and four radiating arms near the other. The end beyond these

arms is threaded for a nut which holds in place an iron ring of about the diameter of the hole to be bored. When the handle is turned the adjustable cutters on the cross-arms, and which are made from pipe-cutter wheels, cut a circle of any desired diameter up to 17 ins. The friction of the nut on the rear side of the dash keeps the wheels drawn up to about the proper tension. With the device two men can cut a hole in No. 14 gage iron in about twenty minutes. The cross-arm for the handles of such a device should be about 48 ins. long. In boring 440 holes four sets of No. 1 pipe-cutter wheels were worn out.

Instead of pounding trolley bushings out in the usual manner, a device for removing them by the throw of a lever has been made. The end of the lever carries an eccentric, and this acts with considerable force on a plunger which pushes the bushing out of the wheel and through a hole in the bench. One of the illustrations shows the brass armor fastened on the air hose jumpers between cars at points where the jumpers would be worn by chafing on the car bumpers. These, which are about 6 ins. long and 1/8 in. thick, are made slightly curved to correspond with the curvature of the hose when coupled. They have been the means of lengthening the life of the hose considerably.

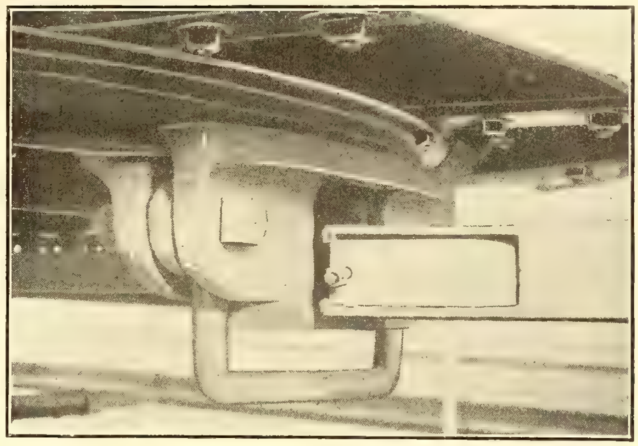
DRAW-BAR CARRIER

Several of the reproductions show the drawbar carrier designed by Mr. McWhorter for use in connection with Van Dorn drawbars. The details of this device are given in a



DETAILS OF DRAFT RIGGING OF SEMI-CONVERTIBLE CARS

separate drawing. The outside and inside carrier castings are bolted together and suspended from a circular I-beam bolted to the platform timbers. The carrier castings contain seats for coil springs on either side of the drawbar opening. The drawbar is supported on a yoke the two ends of which rest on a coil of springs. A safety guard of 1-in. wrought-iron is provided to support the drawhead in the event of the yoke breaking. The springs are of such a length that the drawhead has a movement of 3 ins. above and 3 ins. below its normal position. A weight of about 200 lbs. is required to force the drawbar down to the lowest



DRAW-BAR CARRIER, WITH WHICH THE MEMPHIS CARS ARE BEING EQUIPPED

point of travel. When the drawbar is not in use the two springs push a wrought-iron plate up against the under side of the supporting I-beam with sufficient pressure to keep the bar from swinging on the beam as the car lurches. One advantage in the use of the carrier is that the drawbar heads instead of becoming worn on the top face are held up in such a manner that the wear is distributed over the whole face. The wide range of vertical travel of the bar is also an advantage, and especially so where the tracks are uneven. The carrier, moreover, always holds the drawbar level, and this adds considerably to the appearance of the car.

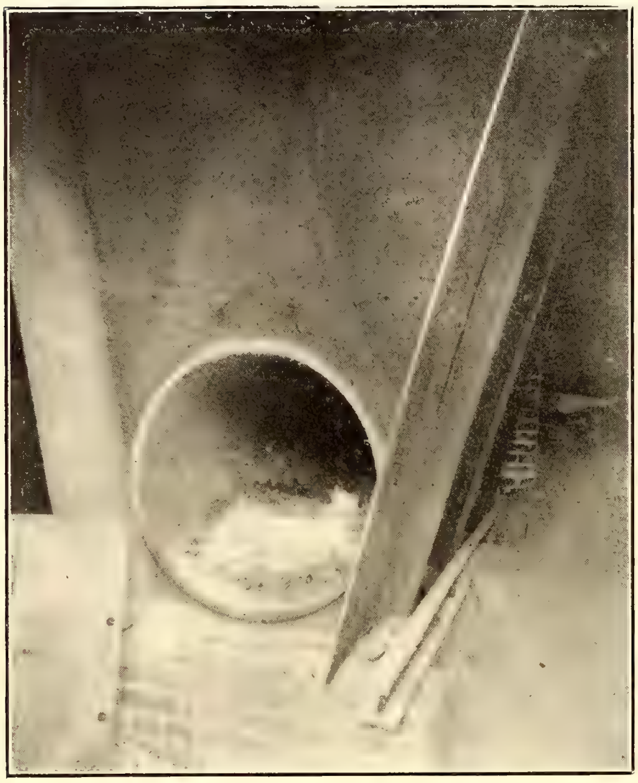
A SHOP WATER-COOLER

The Memphis Street Railway uses in its shops a home-made water cooler which is very simple in construction, comparatively cheap, and which requires very little ice. It consists of a wood box measuring 3 ft. x 3 ft. x 4 ft., well insulated to prevent the passage of heat, and having in the bottom a coil of ½-in. galvanized pipe. One end of the coil terminates in a faucet while the other is connected to the water supply. The ice, which is put into the box through a door in the rear, rests on the pipes and cools the water in them. The water from the melted ice surrounds the pipes and is heated to the temperature of the water in them. The vacant space in the box may be used by the men for keeping milk and other foods cool.

A UNIQUE SAND-DRYER

A novel sand dryer of sufficient capacity for a city road

operating 150 cars is used by the Memphis Street Railway Company. The dryer is built in one side of a sand house near the shops. Around a 30-in. cast-iron water main, which serves as a furnace and which rests on brick piers has been built a hopper of 5-16-in. steel plates. The hopper, which is 6 ft. wide at the top, has a capacity of about 7 cu. yds. Between the pipe and the side sheets of the hopper a ½-in. space has been left through which the dry sand falls. The rear end of the water pipe is built into a brick chimney, and to prevent a too vigorous draft, bafflers have been placed in this end of the pipe. Sand obtained from the bottom of the Mississippi River is bought from sand companies and is thrown directly from the wagons into the hopper. Trash, old cross ties, or any available wood is thrown into the furnace and then the fire is almost allowed to take care of itself. The dryer has a capacity of about 1 cu. yd. of sand per hour. It was built by A. D. McWhorter, master mechanic of the system.



SAND-DRYER MADE OF A CAST-IRON PIPE

PENDULUM PILE DRIVER, SHOWING ANGLE AT WHICH PILES CAN BE DRIVEN

PENDULUM PILE DRIVER BUILT IN MEMPHIS STREET RAILWAY SHOPS

PENDULUM PILE DRIVER

The Memphis Street Railway has just completed a pile driver with 2000-lb. hammer for use on the system, which will drive a pile at any angle up to 10 degs. on either side of a vertical position. The driver was designed by A. D. McWhorter, master mechanic of the system, and was built in the shops of the company under his supervision. It is

constructed on a flat car 32 ft. long and 8 ft. wide. When the driver is not needed for any considerable period of time it can be removed from the car and the car used for other purposes.

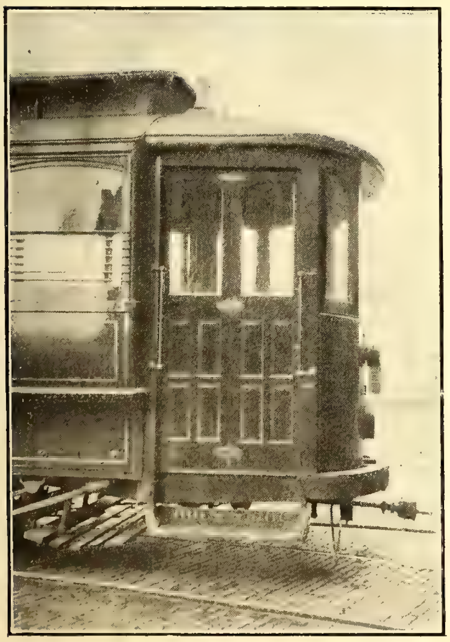
The leads or guides for the hammer are 22 ft. high, of 4-in. x 6-in. pine, with 2-in. x 6-in. oak runners for the hammer, and extend over the end of the car to within 18 ins. of the rail. They are supported in such a manner that while the top part is held stationary the lower ends may be swung over a radius block extending the full width of the car. The radius block is practically free from weight, as all of this is carried by braces and cables behind. A 5½-in. x 8-in. duplex steam hoisting engine mounted on the rear end of the car furnishes power to operate the hammer. Although only one drum is required for the operation of the pile driver, the engine is of double-drum type. When the pile driver is not in use the engine will be removed from the car and used in construction work when both drums will be required.

SINGLE-TRUCK CAR BEFORE OVERHAULING

BRASS LUGS ON THE JUMPERS FOR PROTECTION FROM ABRASION

CARPENTER SHOP

In a period of about eighteen months 139 cars were completely overhauled and rebuilt in the carpenter shop. The work included building closed vestibules on both ends of the cars of the type shown in one of the illustrations. In all 95 cars were equipped with these vestibules. It is the practice in the carpenter shop to keep in stock posts, doors, sash and other parts of the cars most frequently damaged so that injured cars can be gotten out of the shops quickly. All parts of vestibules are kept in stock and a vestibule can be put on a car in about three-quarters of a day. To facilitate rebuilding the cars about $5,000 was spent for wood-working machinery, and the carpenter shop is now fully equipped with frizzer, mortising machines, planers and other tools, all driven by a 35-hp motor.



STANDARD TYPE OF VESTIBULE

MEMPHIS CAR AFTER OVERHAULING

PAINTING

One bay of the shop which contains three tracks, and which is well heated and lighted, is utilized as a paint shop. The under side of the tile roof has been plastered and given a coat of plaster of paris to keep out dust and to prevent the radiation of heat through the roof.

All parts of the exterior of the car, including the trucks, are painted the same shade of green. The reason for adopting the solid color is that the painting can be done somewhat cheaper and quicker and it is considered that it gives a better appearance to the car. No scrolls or decorations are used and the striping and lettering is very simple, as is shown by the reproduction of the overhauled car. From forty to fifty cars are completely repainted every year. The year after being painted it is the practice to give them one coat of body color by cutting it in around the stripping and lettering, and one coat of varnish is put on top of this.

The second year the car bodies are given two coats of body color and two coats of varnish. This process costs about $20 per car per year. With this method it is believed that a car can be kept out about six years before it will be necessary to remove the old paint and repaint them. The practice of "cutting in" one coat or color is preferred to retouching the car, because the latter method gives a more or less spotted appearance and it is believed that "cutting in" can be done at a very little additional cost.

Form 105—500—3 '05.
MEMPHIS STREET RAILWAY CO.

SHOP ORDER No. 96. DUPLICATE.

Issued...190.... To be Completed.................................190....

WORK TO BE DONE (state very fully) ....

....

....

....

....

....

.... SUPERINTENDENT.

Date Completed.......................................190.... .... FOREMAN.

NOTE.—All labor and material used in the work called for in this order must be reported by the Order number and to no other account. The Original will be posted upon the bulletin board at the shops, and remain until the completion of the work. The Duplicate will be sent to the Auditor. The Shop Order tag bearing same number will be attached to the work for identification. All scraps removed from the work should be accounted for and reported, under this number, to the Auditor. Immediately upon completion of the work the Original will be taken from the bulletin board and sent to the Superintendent by the Foreman.

Charge to Account..

Total Labor - - - - $.......................... Final Account..

" Material - - - ....

Total - - - - - $..........................

Less Scrap - - - - - ....

Net Cost - - - - $.......................... .... SECRETARY.

SHOP ORDER FORM 105

Form 222—P P. Co. 6492

MEMPHIS STREET RAILWAY CO.

Daily Time Report.

Name.. **Date**..............................190...

Occupation.. **Total Time**..............................

	HOURS		HOURS	CAR PAINTING	HOURS
Motors 57s....	....	Power House, Mchl...	....	Car No..................	....
67s....	....	Power House, Elec.....	....	Car No..................	....
800....	....	Fenders..................	....	Car No..................	....
Arm. Repairs..........	....	Car Body Repairs.......	....		
Field Repairs..........	....	Truck Repairs..........	....	MISCELLANEOUS	
Controllers............	....	Brakes..................	....	Sweeping...............	....
Car Wiring.............	....	"Air" Equipment	....	Sand Drying...........	....
Inspecting E E.........	....	Wheels and Axles......	....	Trail Car Coupler	....
Headlights.............	....	Track Work	....	Car Shifting...........	....
Trolleys................	....	Line Work..............	....	Car Cleaner............	....
Work Cars..............	....	Building & Fixtures...	....	....	....
Shop Tools.............	....	Oiling Journals	....	....	....

MISCELLANEOUS WORK	HOURS
Shop Order No.	....
....	....
....	....
....	....

DAILY TIME REPORT

SHOP ACCOUNTING

Special jobs in the shop are done on shop orders and all labor and material are charged to them. The orders are made out in triplicate. The original is turned over to the foreman of the department in which the work is to be done, and he posts it on the bulletin board of his department. The duplicate which is sent to the auditor has on the back

RECAPITULATION.

PERIOD.	Labor Charge.		Material Charge.		Scrap Credit.		Net Cost.	
....	....	....	....	....	....	....	....	....
....	....	....	....	....	....	....	....	....
....	....	....	....	....	....	....	....	....
....	....	....	....	....	....	....	....	....
....	....	....	....	....	....	....	....	....
....	....	....	....	....	....	....	....	....
....	....	....	....	....	....	....	....	....
....	....	....	....	....	....	....	....	....
....	....	....	....	....	....	....	....	....
TOTAL............								

BACK OF FORM 105

Form 241. 10m-7-06. S.C.T.&Co.
THE MEMPHIS STREET RAILWAY COMPANY.

DAILY REPORT OF CARS AND EQUIPMENT INSPECTED.

Day of week.................................... Date..

PARTS INSPECTED.	Day Inspected.	Car Numbers.						
Trucks, truck bolts, other parts..................	Daily	1	131	175	322	366	510	554
Brakes..................	"	2	132	176	323	367	511	555
Brake chains..............	"	9	133	177	324	368	512	556
Wheels and axles..........	"	10	134	178	325	369	513	557
Sand boxes...............	"	11	135	179	326	370	514	558
Floor gongs...............	"	12	136	180	327	371	515	559
Motors, bolts, gear cases....	"	13	137	181	328	372	516	560
Armature clearance........	"	14	138	182	329	373	517	561
Motor leads..............	"	20	139	183	330	374	518	562
Carbon brushes...........	"	21	140	184	331	375	519	563
Brush holders............	"	22	141	185	332	376	520	564
Lubrication..............	"	23	142	186	333	377	521	565
Trolley wheels, poles, base.	"	24	143	187	334	378	522	566
Trolley rope..............	"	100	144	188	335	379	523	567
Grab handles.............	"	101	145	189	336	380	524	568
Steps....................	"	102	146	190	337	381	525	569
Gates....................	"	103	147	191	338	382	526	570
Doors....................	"	104	148	192	339	383	527	571
Seats....................	"	105	149	193	340	384	528	700
Fenders..................	"	106	150	194	341	385	529	701
Registers................	"	107	151	195	342	386	530	702
Bell cords and straps......	"	108	152	196	343	387	531	703
Glass....................	"	109	153	197	344	388	532	704
Air compressors, lubrication	Mondays	110	154	198	345	389	533	705
Air governors.............	"	111	155	199	346	390	534	706
Outside journals, lubrication	Saturdays	112	156	200	347	391	535	707
Signs....................	Daily	113	157	201	348	392	536	708
Trolley catchers...........	"	114	158	202	349	393	537	709
Headlight glass............	"	115	159	306	350	394	538	710
Controllers...............	"	116	160	307	351	395	539	711
Air valves................	"	117	161	308	352	396	540	712
Air pressure gages.........	"	118	162	309	353	397	541	713
Lamp circuits.............	"	119	163	310	354	398	542	714
Heaters..................	"	120	164	311	355	399	543	715
Circuit breakers...........	"	121	165	312	356	500	544	716
Push buttons..............	"	122	166	313	357	501	545	717
Cars washed—inside.......	"	123	167	314	358	502	546	718
Cars washed—outside......	"	124	168	315	359	503	547	719
		125	169	316	360	504	548	720
		126	170	317	361	505	549	
		127	171	318	362	506	550	
		128	172	319	363	507	551	
		129	173	320	364	508	552	
		130	174	321	365	509	553	

The car parts and apparatus as above checked have this day been inspected and are in good order.

....Inspector.

....Foreman.

NOTE.—Each employe is required to check the parts and apparatus which he is designated to inspect and numbers of cars inspected, by running line through same. No two inspectors will report on the same blank form.

DAILY REPORT OF CARS AND EQUIPMENT INSPECTED

columns for the labor charges, material charges, scrap credit and total cost, and the actual cost of the work after being obtained by the auditing department is entered on the duplicate. At the time the order is made out the master mechanic notifies all of the foremen interested in the work and others by letter that the order has been issued, and he also gives them any special instructions as to charging material and labor to it. When the first work on the order is started, a tag of heavy manila paper measuring 4 ins. x 9 ins., and bearing the number of the shop order, is at-

Form 106. 500-3-06

MEMPHIS STREET RAILWAY CO.

SHOP ORDER.

No. 96

Attach this to the work and keep it there until completed, then return to the Foreman

SHOP ORDER TAG

tached to the work. The return of this tag to the office is an evidence that the order has been completed and that costs upon it may be computed.

In one instance ninety-five sets of vestibules were built on a single shop order. All field coils are wound on shop orders, and in order to keep the maintenance charges correct they are turned back into the storeroom and the cost is charged up to the storeroom department.

TIME CARD

With the exception of painting, no attempt is made to keep records of the cost of maintenance of each car. The workman's time card is gotten up with the idea of distributing the charges to different parts of the work on all of the cars. However, the charges on the different types of motors are kept separate, with a view of determining the relative cost of maintenance of the old and the new types. The shop time cards are of heavy manila paper and measure 4½ ins. x 6½ ins. The shop practice has been established and for the most part the devices have been designed by Mr. McWhorter since he assumed charge of the shops in March, 1905. In the work he has been assisted by R. G. Stewart, general foreman of the shops.

THE STREET RAILWAYS OF NEW HAMPSHIRE FOR THE YEAR

The electric railroad corporations making returns to the Railroad Commissioners of New Hampshire for 1906 are the same as in 1905, except that the Atlantic Shore Line, in which the Portsmouth, Dover & York was merged Feb. 1, 1906, reports for the last five months of the year. This new corporation has 71 miles of road in Maine and only 3 in New Hampshire, from Main Street, in Dover, to the Elliot bridge, but the great bulk of its traffic is to and from Dover and Portsmouth and the York beaches, and might properly be classed as New Hampshire business In making comparisons, however, the board has eliminated this and confines itself to roads entirely within the State. Taken together these roads make a better exhibit than ever before. The winter of 1905-06 was a favorable one and there was an increased volume of business in the following summer, which partially appears in the returns for the year ending June 3. The companies operated 221 miles of line with 243 miles of track, practically the same as in the preceding year. This, with the appurtenant property, represents an investment of about six and a half million dollars, four millions in stock and two and one-half millions in bonds. Their gross receipts in 1906 were $1,055,488.39, as against $977,919.95 in 1905, and their operating expenses were $870,892.21, against $815,845.94. In 1906 they collected 24,606,611 five-cent fares, against 18,880,742 in 1905. Nine of them showed a divisible income of $145,342.73, and six of them reported deficits amounting to $66,758.76, while a year previous only seven returned a divisible income aggregating $103,325.07, and eight deficits amounting to $95,993.21. The principal statistics of the companies reporting are given in the table on this page.

STREET RAILWAY STATISTICS OF NEW HAMPSHIRE FOR THE YEAR 1906

	Length of Road.	Miles of Track.	Stock.	Bonds.	Current Liabilities.	Gross Income.	Operating Expenses.	Fixed Charges.	Deficit or Divisible Income.	Number Five-Cent Fares.
Atlantic Shore Line*...........	73.91	77.91	$3,000,000.00	$1,871,000.00	$49,477.84	$183,504.28	$108,556.71	$60,176.38	‡$14,771 19	2,496,562
Berlin....................	7.50	7.75	110,000.00	105,000.00	....	44,654.19	35,366.08	7,595.34	‡1,692.77	871,142
Chester & Derry...............	7.75	7.75	50,000.00	50,000 00	7,678.50	14,667.65	9,813.17	2,918.70	‡1,935.78	253,205
Claremont....................	7.32	7.98	260,000.00	180,000 00	122,180.11	29,288.36	23,759.87	5,783.12	§254.63	358,505
Concord & Manchester.........	27.88	30.22	250,000.00	473,000.00	....	147,459.80	122,336.31	2,356.42	‡22,767.07	2,782,827
Dover, Somersworth & Rochester	17.00	17.74	375,000.00	300,000.00	31,625.00	91,882.26	60,453.88	24,449.86	‡6,978.52	1,803,080
Exeter, Hampton & Amesbury...	20.72	21.60	360,000.00	225,000.00	116,838.88	52,496.07	48,682.82	22,720.66	§18,907.41	870,948
Haverhill, Plaistow & Newton...	8.15	8.47	225,000.00	145,000.00	21,750.00	33,041.76	25,379.94	7,632.70	‡29 12	652,096
Hudson, Pelham & Salem.......	27.30	30.21	475,000.00	365,000.00	153,858.93	94,147.04	84,487.36	22,916.55	§13,256.87	1,843,845
Keene......................	8 34	8.58	220,000.00	80,000 00	65,447.78	26,529.53	20,472.92	7,115.59	§1,058.98	524,301
Laconia.....................	8.36	8.87	140,000.00	130,000.00	11,500.00	30,493.35	20,336.85	10,011.11	‡145.39	593,207
Manchester..................	28.65	37.23	944,500.00	....	163,861.11	313,013.20	243,998.05	9,693.91	‡59,321.24	6,102,659
Nashua.....................	14.16	15.52	325,000.00	150,000.00	34,746.19	78,602.59	56,622.60	8,405.76	‡13,574.23	1,506,162
Portsmouth..................	18.10	19.25	....	....	....	65,083.29	91,561.57	....	§26,478.28	1,284,901
Portsmouth, Dover & York†.....	36.97	38.51	650,000.00	710,000.00	19,311.58	103,512.67	58,188.94	21,866.90	‡23,456.83	1,989,632
Portsmouth & Exeter...........	11.98	12.23	185,000.00	145,000.00	35,400.30	19,812.86	19,283.20	7,332.25	§6,802.59	390,349
Seabrook & Hampton Beach.....	5.53	5.80	65,000.00	45,000.00	18,750.00	14,316.44	8,337.59	5,308.26	‡670.59	283,190
Springfield..................	2.25	.....	12,000.00	....	....	....	....	....	....	....
	331.87	355.62	$7,646,500.00	$4,974,000.00	$1,112,426.22	$1,342,505.34	$1,037,637.86	$226,283.51	....	$24,606,611

* Includes Portsmouth, Dover & York for five months, from Feb. 1, 1906.
† For seven months ending Jan. 31, 1906.
‡ Divisible income.
§ Deficit.

Divisible Income..................................	$145,342.73
Deficits..	66,758.76
Excess of Income..................................	$78,583.97

Without doubt the question of switching charges made against the interurban roads by the Toledo Railway & Terminal Company will be brought before the State Railroad Commission. It is claimed that steam roads are charged $1 per car for switching, while the interurbans are charged $3 per car for the same service. This charge is made for transferring cars from the steam railroads to the interurban electric railways or from one interurban railway to another.

FUNERAL CAR SERVICE AT BALTIMORE

For the past six years the United Railways & Electric Company, of Baltimore, has conducted a trolley funeral service with its funeral car "Dolores." This car was put in commission Oct. 1, 1900, and as practically all of the city and suburban cemeteries of Baltimore are reached by some line of the company's system, the car has proved very popular. Last summer it was thoroughly overhauled and refitted. This work included mounting the car on new trucks and equipping it with four Westinghouse No. 49 motors.

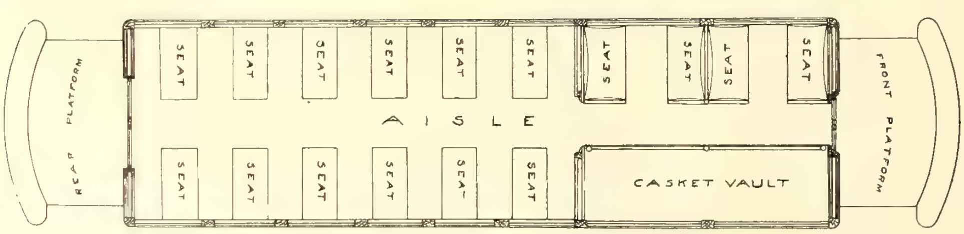
FOLDING BIER FOR CARRYING CASKET

END VIEW OF FUNERAL CAR

No difficulty has been experienced through the car blocking the track at the time of a funeral. If the house is on a street on which there are tracks, the arrival of the car in front of the house is timed so that it will be there at the close of the ceremonies. If it is not on a street on which there are tracks, the folding bier shown on this page is used. This bier consists of a light carriage with pneumatic tired wheels, mounted on an axle which can be folded under the bier when not in use. The bier is purposely made low so that when the casket is placed upon it and it is pushed forward by the pallbearers the appearance is not unlike that if the casket were being carried. As the tracks reach practically every portion of the city the transportation on this folding bier is rarely more than a city block. The bier may also be used for the conveyance of the casket from the car through the cemetery if desired.

The car itself is divided into two compartments which are separated by portieres. The smaller, or forward compartment, contains the receptacle in which the casket is carried, and also seats for eight passengers. The receptacle for the casket extends the entire length of one side of the forward compartment and is of cherry paneling lined with black cloth; it is tastefully draped. To insert the casket the outside panel, which is of thick plate glass, is swung outward, exposing a sliding slab which is held in place by a bolt

SIDE VIEW OF FUNERAL CAR



PLAN OF FUNERAL CAR

Nickel pegs hold the casket in place so that it will not jolt around. The slab runs on roller bearings. The top of the casket compartment is level with the window sills, and upon it the floral contributions are placed, where they are visible not only to the occupants of the car but through the windows from the street. The larger compartment has twelve crosswise seats which accommodate two passengers each, thus giving the

car a total seating capacity of thirty-two persons.

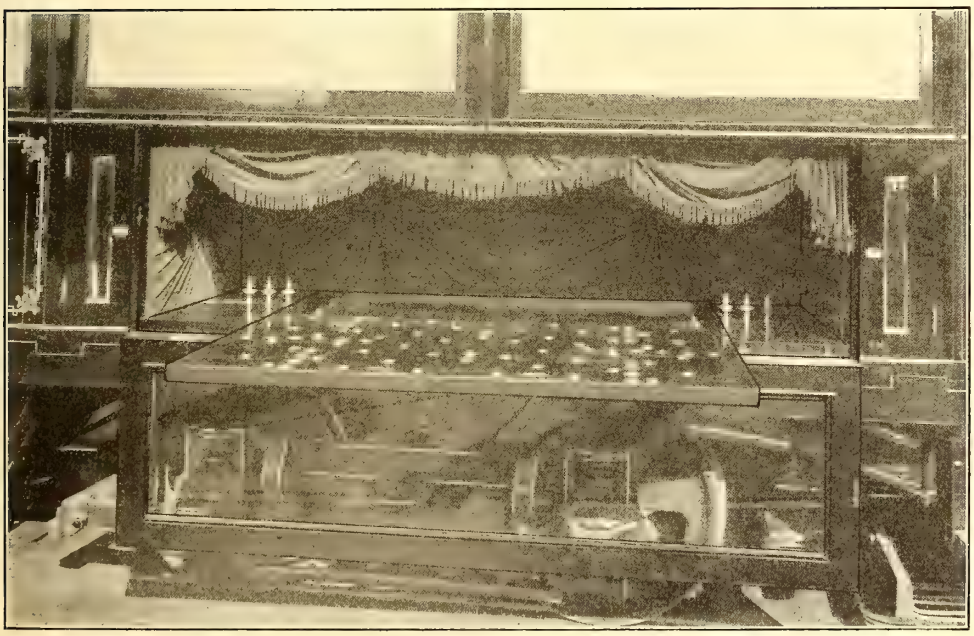
The interiors of both compartments are finished in hard wood, are comfortably furnished and present an attractive appearance. The seats are upholstered in leather; the windows and doors are draped with black curtains and the aisle is carpeted. A system of ventilation keeps the car cool during the summer months, while in the winter it is warmed by electric heaters.

The "Dolores" is in charge of a special crew, thoroughly acquainted with the requirements of its special use, who know how to render all possible assistance looking to the comfort and convenience of those who use the car.

The charges for the car to cemeteries within the city limits of Baltimore are $20, and for service outside the city limits from $2 to $15 additional, depending on the distance to be traveled.

REAR COMPARTMENT

FORWARD COMPARTMENT



RECEPTACLE FOR CASKET, WITH SLIDING SLAB AND FRONT PANEL LOWERED

IMPROVEMENTS BY THE ROANOKE (VA.) RAILWAY & ELECTRIC COMPANY

The Roanoke Railway & Electric Company, of Roanoke, Va., has just announced that it will build a power house to cost $225,000, on property recently purchased in Norfolk from the Norfolk & Western Railway Company. The plant will be 90 ft. x 140 ft. floor area, and will be designed so that it can be extended from time to time to suit the requirements of the service. The building will be reinforced concrete construction. The initial equipment will consist of four 500-hp boilers and one 1500-kw turbo-generator and two 500-kw turbo-generators. In connection with the announcement of its plans for the building of this new station, the company calls attention to the arrangements made at the annual meeting in December for the expenditure of $108,000 for general improvements such as new cars, double tracking and rebuilding some of its line, and increasing the capacity of its car house. An order has already been placed for 72-lb. 6-in. T-rail for double tracking in the paved streets, and also for two double-truck Brill convertible and two double-truck Brill semi-convertible cars, each of which will be equipped with four GE-80 motors. These cars are to be delivered to the company by May 1, 1907.

THE BOW TROLLEY AND THE WHEEL

BY AN AMERICAN ENGINEER

The correspondence columns of the STREET RAILWAY JOURNAL for Jan. 19 and Feb. 9, 1907, contain two letters which present opposite but interesting views of the relative merits of the sliding bow and wheel trolley. During the writer's visits to Europe, and especially to Germany, he has tried to get at the real merits of the sliding bow, and perhaps some further comparison with the wheel trolley may be of interest.

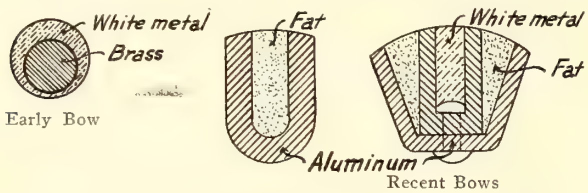


FIG. 1.—SECTIONS OF DIFFERENT TYPES OF BOWS

One point of inferiority of the bow appears to be the limited amount of current it can collect. But this disadvantage can be somewhat overcome at points where large currents are needed by adding another trolley wire beside the first, so that the bow presses automatically up against two conductors instead of one. This is impossible with the ordinary wheel trolley but is of considerable value on grades and curves. This practice of doubling of the trolley wire is followed on the western division of the Amsterdam-Haarlem electric railway in Holland, where the line is most distant from the power house. Another disadvantage laid to the sliding bow is the relatively short life of some of the aluminum contact strips. One recent type was found to have a life of only about 5000 miles, and cost about $1 for renewals. But in another city the life has frequently been as great as 25,000 car-miles. This corresponds to an average mileage per 1 cent of cost for about 69 car-miles, or 48 car-miles if maintenance is included. To compensate for any real disadvantage in this respect, there is the smaller wear on the trolley wire, especially on curves. With a new wire, the only immediate wear appears to be a slight flat on the under side, but even this has sometimes been found hardly measurable after a year's service. The average loss in diameter in Dresden after the first four years' use was about 4 per cent, and wires in both Dresden and Budapest have now been up for over twelve years. The well-known zig-zagging of the wire distributes the wear over the width of the bow. With an 8-mm wire, the flat has been found to reach a width of about 3 mm and then widen but slowly. As the top of the bow is flat, it would have about 3 mm in contact with the trolley wire.

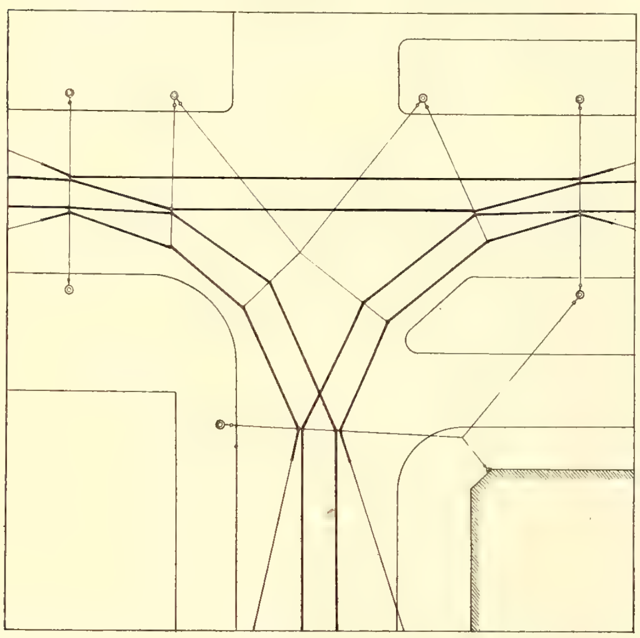


FIG. 2.—OVERHEAD WIRING FOR SLIDING BOW, DRESDEN

The writer rather expected to find the bow noisier than the wheel, because a scraping contact would seem likely to produce more vibration than a rolling one. The contrary appeared to be the case, though the earlier types of bow were said to have been noisy. The contact strip of the bow has a groove filled with grease (Fig. 1), or the under side of the trolley wire instead may be lubricated. This latter practice is said to facilitate the removal of ice from the wire in winter.

The light pressure of the ordinary sliding bow against the wire, as low as 8 lbs., is obviously a disadvantage at high speeds. But it will be remembered that in the Zossen trials a type of bow was devised with which vanes balanced the wind pressure, and only about 6 lbs. pull on the springs was needed to maintain a satisfactory contact at the highest speeds.

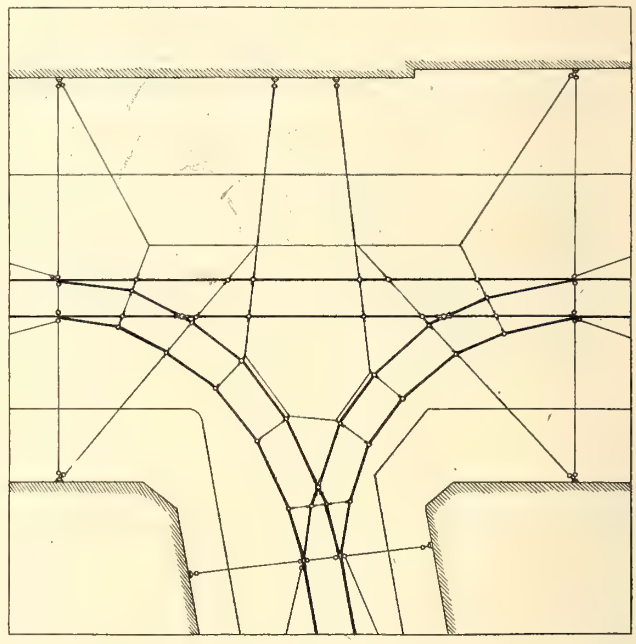


FIG. 3.—OVERHEAD WIRING FOR TROLLEY WHEEL, BERLIN

What impressed the writer most with the value of the sliding bow was the opinion of the chief engineer of one of the largest and best managed street railway companies in Europe, a company that is now using the wheel trolley, who said emphatically that he would use the bow if he could equip his system over again.

The width of the contact piece, which may be about 48 ins., allows a simplification of overhead work at curves and junctions, as illustrated in two accompanying plans of actual wiring for the bow and for the wheel (Figs. 2 and 3). It will be noted that, under the similar conditions, the trolley wire for the bow requires suspension at only fourteen points instead of thirty-eight; that the three frogs and six switches are unnecessary; and that the total length of span wire used is 512 ft. for the bow and 899 ft. for the wheel trolley system. Some allowance must be made with

the latter, however, on account of the fact that in the example the wires are attached to buildings and not poles.

One interesting advantage of the bow is seen in Berlin on a street where two companies operate cars over the same tracks with wholly different trolley wires and power supply. To keep the two sets of wires distinct at every

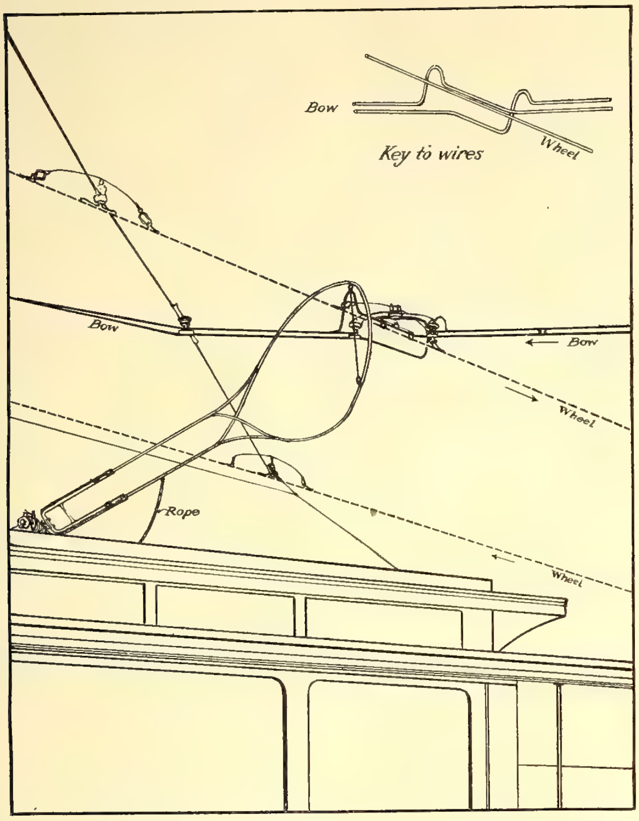


FIG. 4.—WIRES FOR WHEEL AND BOW ALONG SOME TRACKS IN BERLIN

point would seem almost impossible, but was accomplished in Berlin by suspending the wires for the bow system below those for the wheel, though done from the same span wires. Where the bow has to pass across the path of the wheel, its wire leaves a gap for the latter, but is

FIG. 5.—WIRES FOR WHEEL AND BOW (FROM BELOW)

diverted alongside so as to cause the wide contact piece to be kept always at the same level. (Figs. 4 and 5).

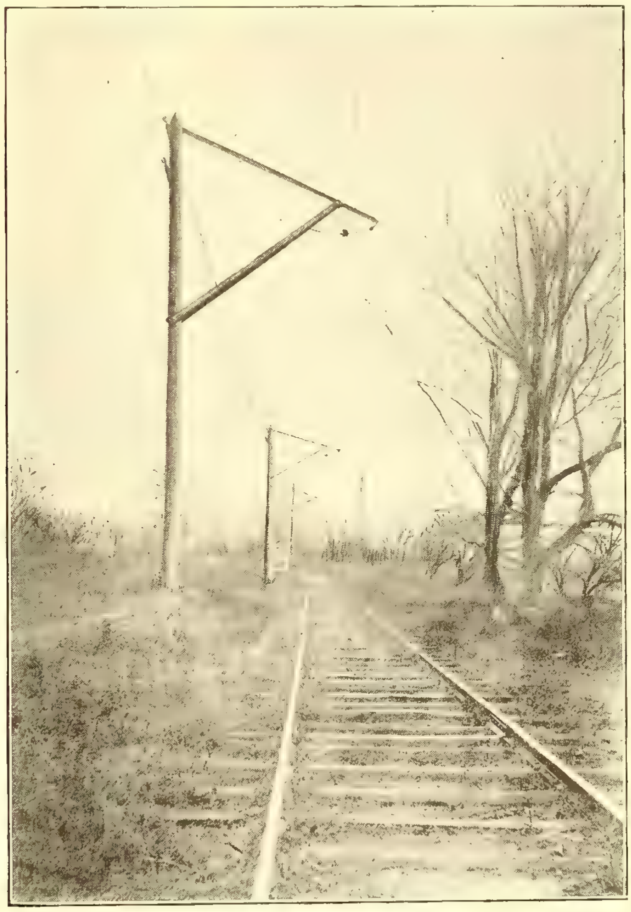
Municipal authorities on the Continent have laid great stress on the simpler appearance of the overhead work. It is interesting to note that in the report of Mr. Barclay Parsons advocating overhead wires in San Francisco, and printed in the Street Railway Journal for Jan. 6, 1906, every photograph published illustrated construction on sliding bow street railway systems.

For bridging over gaps in third rails, or in connection with conduit systems, the bow would have the advantage of striking and leaving the trolley wire without shock or attention from the conductor.

The writer cannot help feeling that the bow is really better, for ordinary street cars at least, than the wheel trolley, and that the almost universal use of the latter in the United States, England and France must be ascribed to some other cause than a superiority which does not seem to exist. The fact that the use of the bow has not spread may be due simply to the reason that the collector must be suited to existing overhead work on old lines, and that a new type cannot be put on all new cars as easily as a truck. Probably it is too late for the bow to be tried now except for single-phase lines, and perhaps the pantograph type of collector may prove better than the bow, especially for high-speed work.

A HOME-MADE TROLLEY BRACKET

The electric railway systems in the Southwest frequently experience delay in receiving shipments, and as a conse-



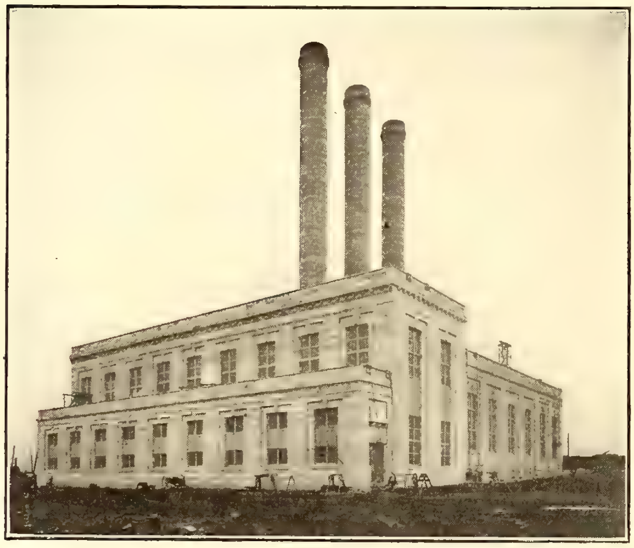
HOME-MADE BRACKET ON A SPUR OF MUSKOGEE ELECTRIC TRACTION COMPANY

quence managers are often compelled to exercise considerable ingenuity to avoid inconvenience when required material is not at hand. The accompanying illustration shows a home-made trolley bracket in use on a spur of the Muskogee Electric Traction Company, Muskogee, Indian Territory. Credit for the design is due to Ira L. Reeves, formerly president of the system. The upper portion consists of a single arm of wood bolted to the pole. Two lower braces extend from the upper arm to each side of the pole.

THE NEW TURBINE PLANT AND SUB-STATIONS OF THE POTOMAC ELECTRIC POWER COMPANY, WASHINGTON, D. C.

A large steam turbine plant of advanced design has just been completed for the Potomac Electric Power Company, of Washington, D. C., by the J. G. White Company, of New York. It was built for the purpose of supplying power for railway purposes in the city of Washington, as well as current for light and power. The plant is located in Bennings, D. C., on the eastern branch of the Anacosta River. The work was carried out under the direct supervision of L. E. Sinclair, general superintendent of the Potomac Electric Power Company.

The layout of the building is similar to many of the modern prominent turbine generator stations. The boiler room is at right angles to the generating room, while the switching apparatus is located in an annex, running along the entire length of the generating room. The boiler room,



TURBINE POWER STATION OF THE POTOMAC ELECTRIC POWER COMPANY, WASHINGTON

which is 164 ft. long x 180 ft. wide, is arranged to accommodate four rows of boilers, thus forming two firing aisles. At present there are installed sixteen boilers, while space is provided for eight more. There are three stacks (one for every eight boilers), and two suspended steel coal bunkers with a capacity of 650 tons each. The boiler house is provided with a basement 14 ft. high, the floor of which is flush with the main generating room floor. It contains, besides the coal and ash-handling plant, a repair shop, storeroom and a locker and toilet room. Of more importance, however, is the machinery in the boiler room basement. Here are installed two exciter units, the boiler feed pumps, oil pumps and two house pumps, as well as the oil filtering tanks and testing tanks. The space occupied by this machinery is separated from the rest of the basement by a hollow concrete block wall, thus forming an extension of the main generating room floor. This is possible owing to the fact that the division wall between the generating room and the boiler room does not start from the main operating room floor, but some 14 ft. above, and is carried on I-beams.

The generating room, which is 164 ft. long x 45 ft. wide, has been laid out to accommodate three 5000-kw and two 2000-kw turbines. At present only two 5000-kw and two 2000-kw turbines are to be installed. The annex for the switching compartments, offices, etc., is 15 ft. wide x 164 ft. long.

Owing to the condition of the soil, it was found necessary to drive piles for the greater part of the footings for the engine room walls, columns, etc. These piles are of the Raymond concrete system and are from 30 ft. to 40 ft. long, while the condition of the turbine foundation itself, owing to their depth, did not require any piling. This was due to the peculiar arrangement of the condensing water intake and condensing water discharge tunnels running directly through the turbine foundations, as will be seen by the accompanying illustrations. This arrangement materially reduces the amount of concrete necessary for the foundations, and at the same time gives a most satisfactory arrangement for obtaining the circulating water. Both the intake and discharge tunnels have an area of 40 sq. ft. each.

The footing of the turbine foundations is calculated for a bearing power at 1.8 tons per sq. ft. of soil. To prevent uneven settlement between the different turbines, old rails have been embedded in the concrete of the tunnel throughout the length of the building. As the entire building covers an area of 29,520 sq. ft., and the normal output of the plant is 19,000 kw, 1.52 sq. ft. is taken up per kilowatt. The structural steel required for the building amounts to about 800 tons.

Up to the basement floor all wall and column footings are made of concrete, while the superstructure consists of a self-supporting steel skeleton frame. The walls are of hollow concrete blocks, self-supporting, with the exception of a few of the lighter walls. These hollow concrete blocks were made by the Lake Stone Company, of Washington, D. C., and are of a uniform size, being 3 ft. x 1 ft. x 1 ft. However, there are some specially designed blocks, such as were required by the door and window lintels and sills. Some of the lintels have a span of 12 ft. and are reinforced by ¾-in. rods; in fact, all lintels are reinforced. The pilasters and cornices of the building are well designed and the architectural features of the entire structure give a pleasing appearance and harmonize with the tall chimneys, also made of concrete.

The coal is brought to the plant on railroad cars and is stored in the yard or dumped into pockets at the side of the boiler rooms, crushed and then delivered to the top of the bunkers in the boiler room by bucket conveyors. From here the coal is distributed into bunkers by two belt conveyors of a capacity of 40 tons per hour each. Ashes may be removed either by railroad cars or by teams. The ashes are collected in reinforced concrete hoppers suspended under the boilers, from where they are removed on an industrial railway and dumped into a receiving hopper feeding the bucket conveyors, to store the same in ash hoppers arranged between the coal bunkers and the end wall of the boiler room. These hoppers are made of reinforced concrete and have a storage capacity of approximately 50 cu yds. each.

EQUIPMENT

Sixteen boilers are now installed, arranged in four rows with every two boilers forming one battery. All boilers are of the Babcock & Wilcox make, with a heating surface of 6040 sq. ft. They are designed for 175 lbs. working pressure and are equipped with superheaters of 1180 sq. ft. heating surface, capable of superheating the steam to 150 degs. The boilers are provided with Roney stokers, each with a grate area of 11.8 sq. ft. The fronts of the boilers are faced with white enamel brick.

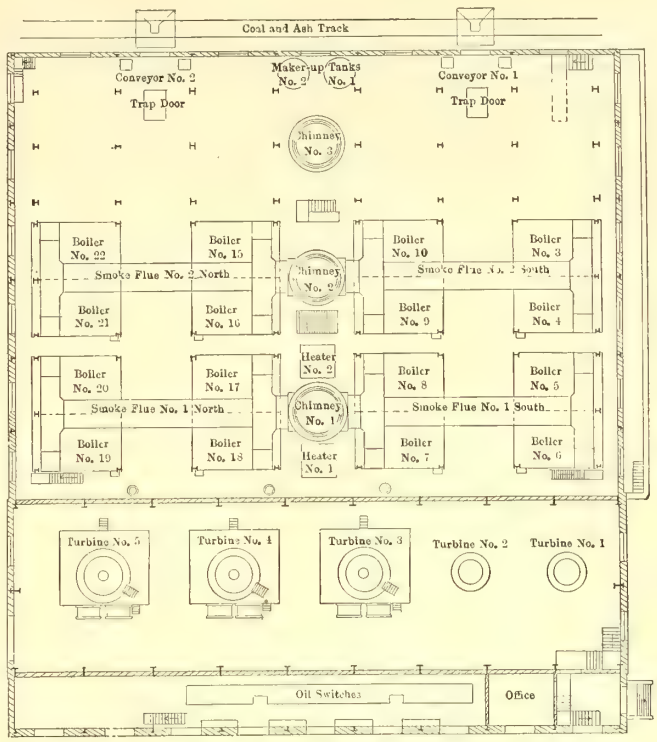
The flue connections are made on the top of the boilers;

four boilers joining in one breeching to give two breechings for each chimney. Each boiler is provided with a hand damper, while the four main flues are equipped with dampers operated by two automatic regulators.

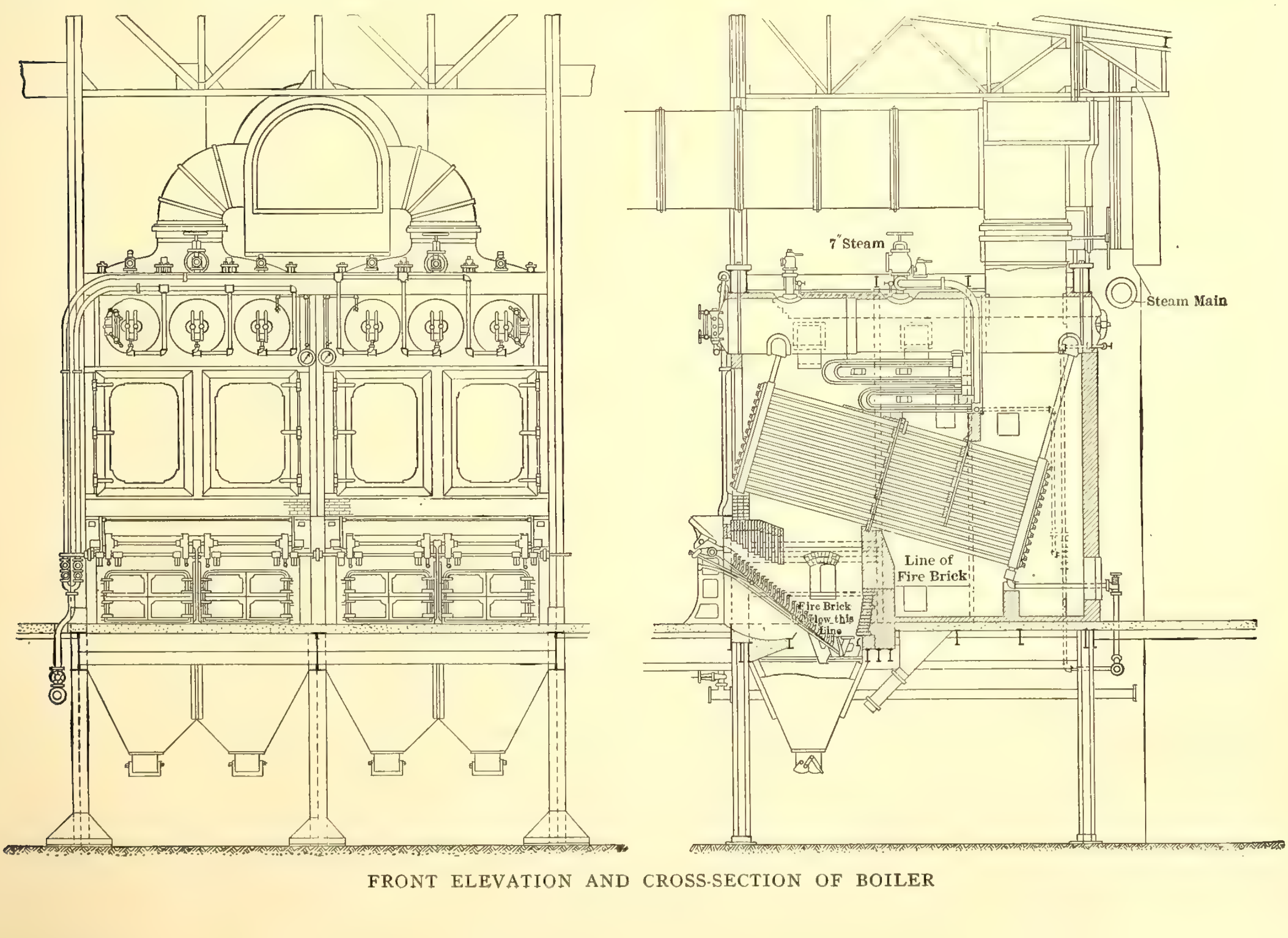
The chimneys are of the Weber concrete steel type. They are 200 ft. in height above the basement floor; 183 ft. in height above the grates; 163 ft. in height above the flue openings, and an internal diameter of 12 ft. One of the three chimneys is reserved for the eight boilers to be installed later.

Between the boilers and the chimneys two Warren Webster open feed-water heaters are installed, each capable of heating 200,000 lbs. of boiler feed water from 80 degs. to 205 degs. F. per hour. To make up the loss caused by leakage, etc., two make-up tanks have been installed in the boiler room, each with a storage capacity of 25,000 lbs. of water. For this purpose two house pumps are installed.

The boiler feed water is supplied by two horizontal duplex pumps, 16 ins. x 10¼ ins. x 16 ins. An additional pump will be installed with the full equipment of the plant. These pumps work upon a 6-in. header ring system from where the branches lead to the boilers. The arrangement is such that either pump may supply water to any of the boilers. Branch connections to the boilers are so centrally located that the water tender may operate the valves of eight boilers from practically one point. All steam leads from the boilers are 7 ins. in diameter, which are connected to the main header system by means of flexible bends, as will be seen in the accompanying illustration. The largest size of this header is 15 ins. O. D. Pipes are all made of steel with the exception of fittings, which are of semi-steel. All pipes have been provided with the loose-type flange, known as the Van Stone flange. From the header the branches lead to the turbines, the sizes of which are as follows: 10-in. pipe to the 2000-kw turbines and a 12-in. pipe to the 5000-kw turbines. The 12-in. pipes were chosen because of the use of superheated steam, which enables a greater velocity than saturated steam. As the turbines operate with 17 lbs. steam per kilowatt, and the volume of superheated steam, at 150 degs., is practically 30 per cent greater than that of saturated steam



PLAN OF POWER STATION



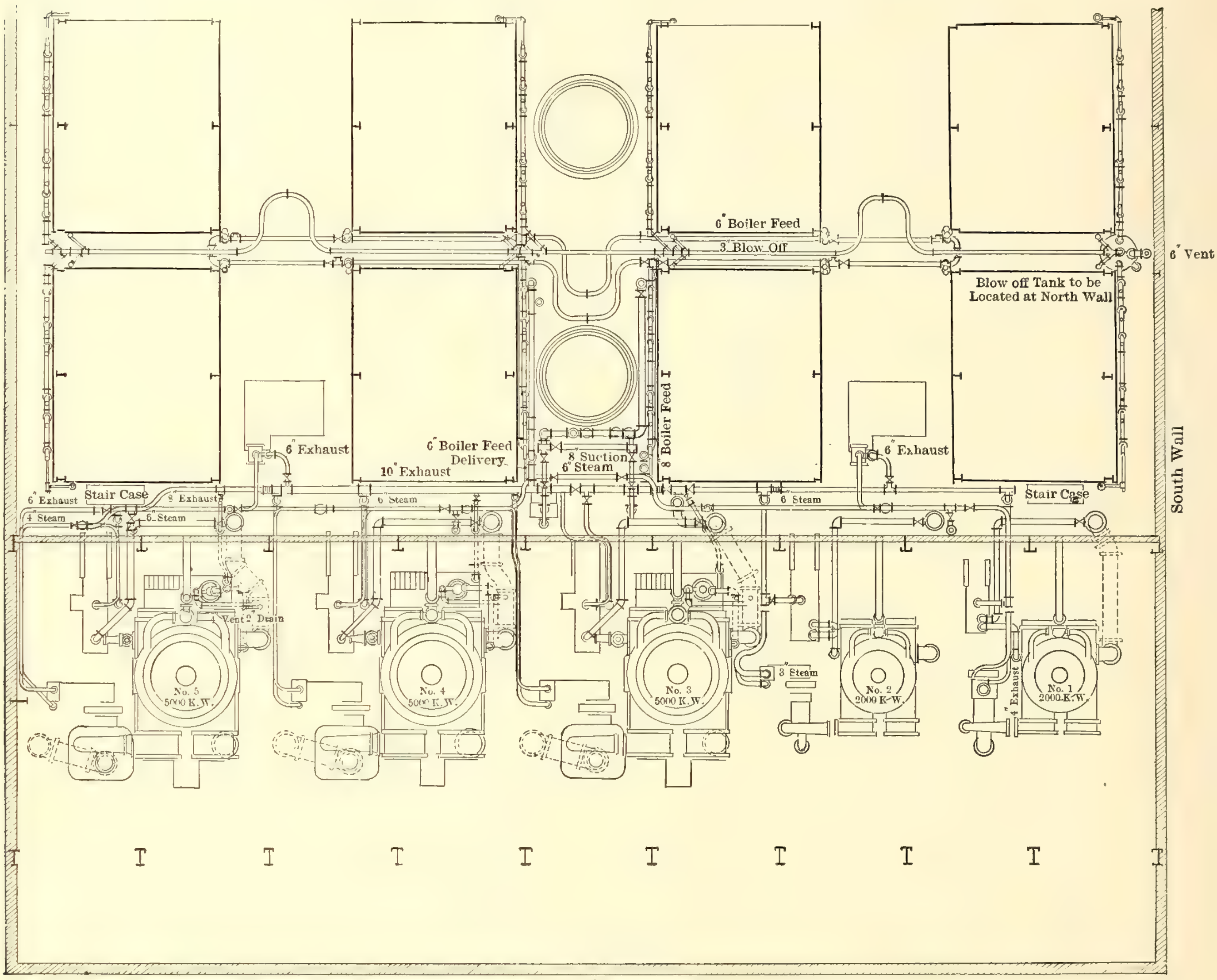
FRONT ELEVATION AND CROSS-SECTION OF BOILER

at the same pressure (175 lbs.), the velocity in the steam pipes will be approximately 7800 ft. per minute.

No separators have been installed in the pipe line, but provision is made to drain the entire system, for which purpose four 1¼-in. traps have been located in the basement of the boiler room. The return of water is fed into the feed-water heater. A separate 6-in. steam header has been installed in the basement for the auxiliary machinery. This header runs the entire length of the plant and draws its steam at three points from the main header by means of 6-in. connections. This auxiliary header is also provided with a drip system of two ¾-in. traps. All steam piping, is covered with 85 per cent magnesia.

The turbines are of the Curtis base-condenser type, the two 2000-kw units being four-stage and the 5000 units five-stage. The alternators are four-pole, 25-cycle, and designed for 6600 volts. The turbines run at 750 r. p. m. The first turbine installed was one 5000-kw unit, which has been in operation since the early part of December. The cooling surface of the condensers of these 5000-kw turbines is 20,000 sq. ft. The circulating water is drawn by a 24-in. steam-driven centrifugal pump. The vacuum pumps are of the rotative single-stage type, also steam driven. The hot-well pumps, located in the hot-well pits, 5 ft. 9 ins. below the main operating room floor, are vertical, two-stage, centrifugal pumps, and are the only pumps motor-driven. The auxiliary machinery is so grouped around one main turbo-generator as to form the most compact unit system.

The 2000-kw turbines to be installed are now in operation in the company's existing power plants. One of these units was exhibited by the General Electric Company at the World's Fair, St. Louis. It is provided with a base-condenser, while the other unit has a separate condenser, but will, however, be re-designed for base-condenser type, to have the entire plant equipment uniform. The auxiliary machinery of these turbines, such as the circulating water pumps, hot-well pumps, etc., will be taken out of the existing plant. Only one of the dry vacuum pumps will be replaced.



PLAN OF THE MAIN STEAM PIPING IN THE TURBINE POWER STATION OF THE POTOMAC ELECTRIC POWER COMPANY

The atmospheric exhaust pipe leads to a tunnel under the generating room floor into the boiler house, where the riser extends through the roof. The exhaust pipes, which are 24 ins. in diameter on the 5000-kw units, are provided with a relief valve. The hot-well pumps discharge into a common header leading to the two heaters. The discharge from the hot-well pump is provided with a gate valve and a check valve, so should one pump fail to work the water of the other pump may not enter the pump in operation. The suction of the vacuum pump is provided with an angle globe valve, hence in emergencies the turbine may operate on an atmospheric exhaust line, while the pump is being repaired.

The discharge of the dry air pumps is connected to the exhaust risers above the relief valve. The exhaust of all auxiliary machinery discharges into one common header connected to the open feed-water heaters.

There are three step-bearing pumps to supply oil to the turbines; arrangement is made for another pump of this kind. The return oil is brought to a collecting tank, from whence it is drawn by an auxiliary oil pump and pumped into a 1600-gallon oil-filtrating storage tank.

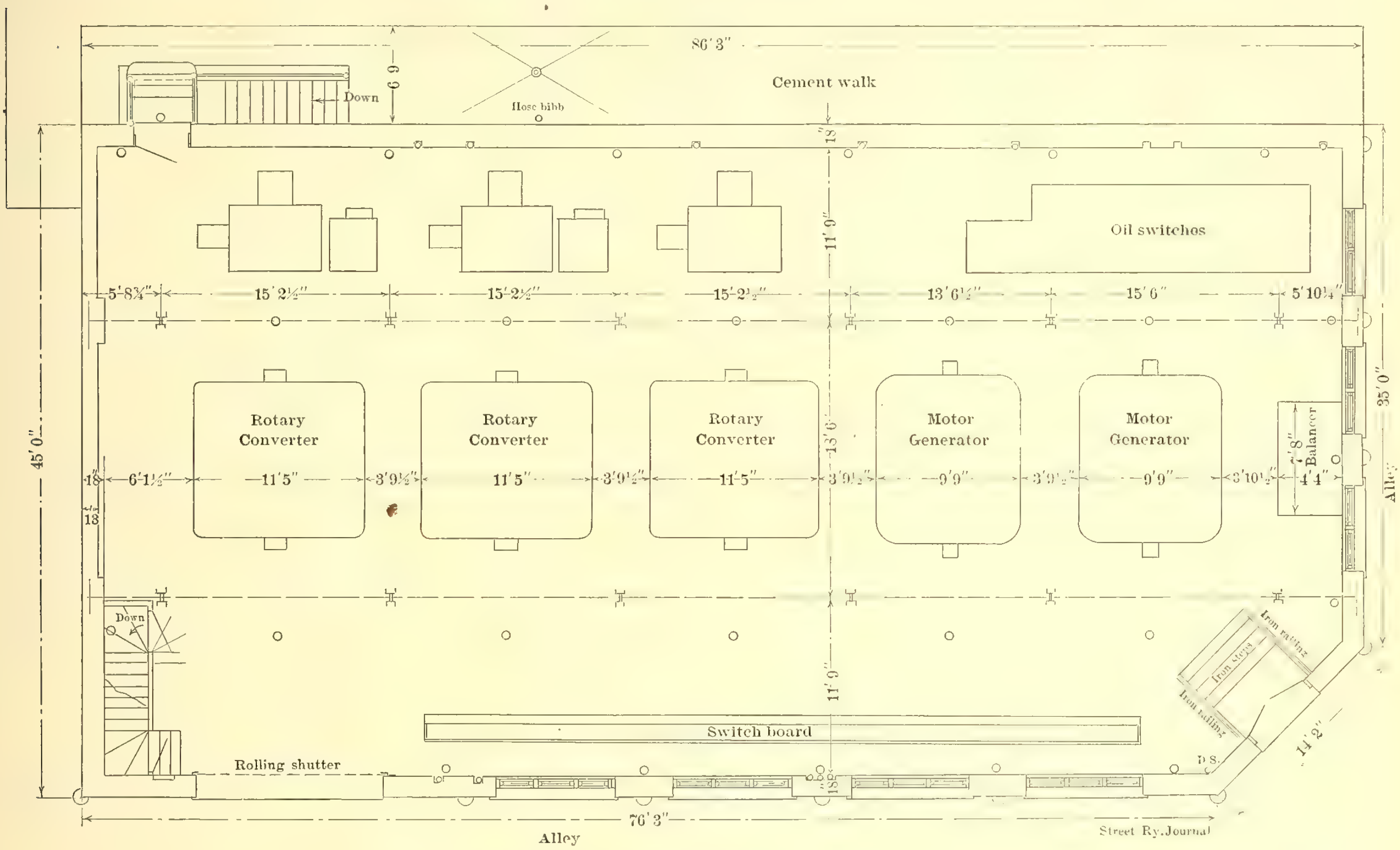
The two 100-kw., 125-volt engine-driven exciters are of sufficient capacity to supply the necessary current for the entire plant. These exciter units are located, as previously stated, in the basement of the boiler room.

The switching room is 15 ft. wide and runs the entire length of the generating room. This annex is three stories. The first floor is flush with the generating room floor, containing the man-holes for the generator leads and the outgoing cables. The latter are arranged in double tile ducts on the side of the wall, from whence they lead underground to the various sub-stations. Here are also the generator field rheostats, while at one end is located a toilet room. Some 9 ft. 5 ins. above the floor is a gallery containing the oil switches. The oil switches control the generators and the outgoing feeders, together with two bus-sectionalizing switches. These switches are of the cellular type, each pole being mounted in a separate concrete compartment, arranged in one row. Directly back of these cells are the bus-bar compartments. The static discharges and disconnecting switches are between the bus-bar compartments and the wall. The switches are in brick compartments. The second gallery, which is above the former, contains the switchboards. The generator switchboard is made up of five panels (one for future use) each, while the exciter switchboard is made up of two panels, each 16 ins. wide. The feeder switchboard is made up of nine panels, each 16 ins. wide. Three of these panels are for future equipment. The switchboards are made of black enameled slate of dull finish, supported by a pipe framework and containing all controlling switches, indicating lamps, instruments, etc. The entire switching compartments are separated from the main generating room by a division provided at the upper switchboard gallery with large openings to overlook the generating room.

THE SUB-STATIONS

In addition to the main station the Potomac Electric Power Company has erected four new sub-stations to take care of the increasing low-tension lighting, railway and 2400-volt lighting loads. Taken in order these sub-stations are: Sub-stations No. 2, No. 10, No. 11 and No. 12.

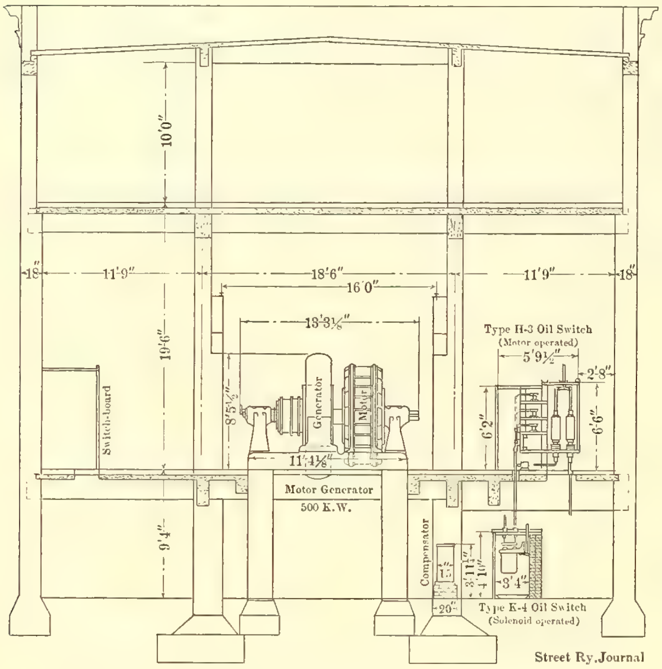
Sub-station No. 2 is located at No. 450 Washington Street N. W., adjoining the old sub-station No. 2. It is 100 ft. long, 14 ft. 8 ins. wide, and one story high. The building is of steel, brick and reinforced concrete for roof and floors. This station is designed for 6000-kw capacity, and we have installed at the present time two 1000-kw rotary converters with two 1100-kw three-phase transformers. These transformers are equipped with dial switches to vary the voltage on the direct-current side of the rotary transformers. This station, which is to be the principal sub-station, contains several type-H-3 oil switches for automatic remote control. The current is brought from the main power station and is distributed to other small sub-stations through the switches mentioned. One type-H switch controls the apparatus in the sub-station, while the oil switches that control each rotary separately are of the K-4 non-automatic type, it being assumed that in case of any trouble inside of the station the H-type switch will protect the sub-station as well as prevent any of the other lines being disturbed. This sta-



FIRST-FLOOR PLAN OF SUB-STATION NO. 10

tion is also furnished with a large-size three-wire lighting switchboard connected to a storage battery in the adjoining building, and which can be used either on the railway or lighting bus.

Next in order is sub-station No. 10, located in the alley between H and I, Fourteenth and Fifteenth Streets N. W. It is 86 ft. long, 45 ft. wide and two stories high. This



SECTION OF SUB-STATION NO. 10, WASHINGTON

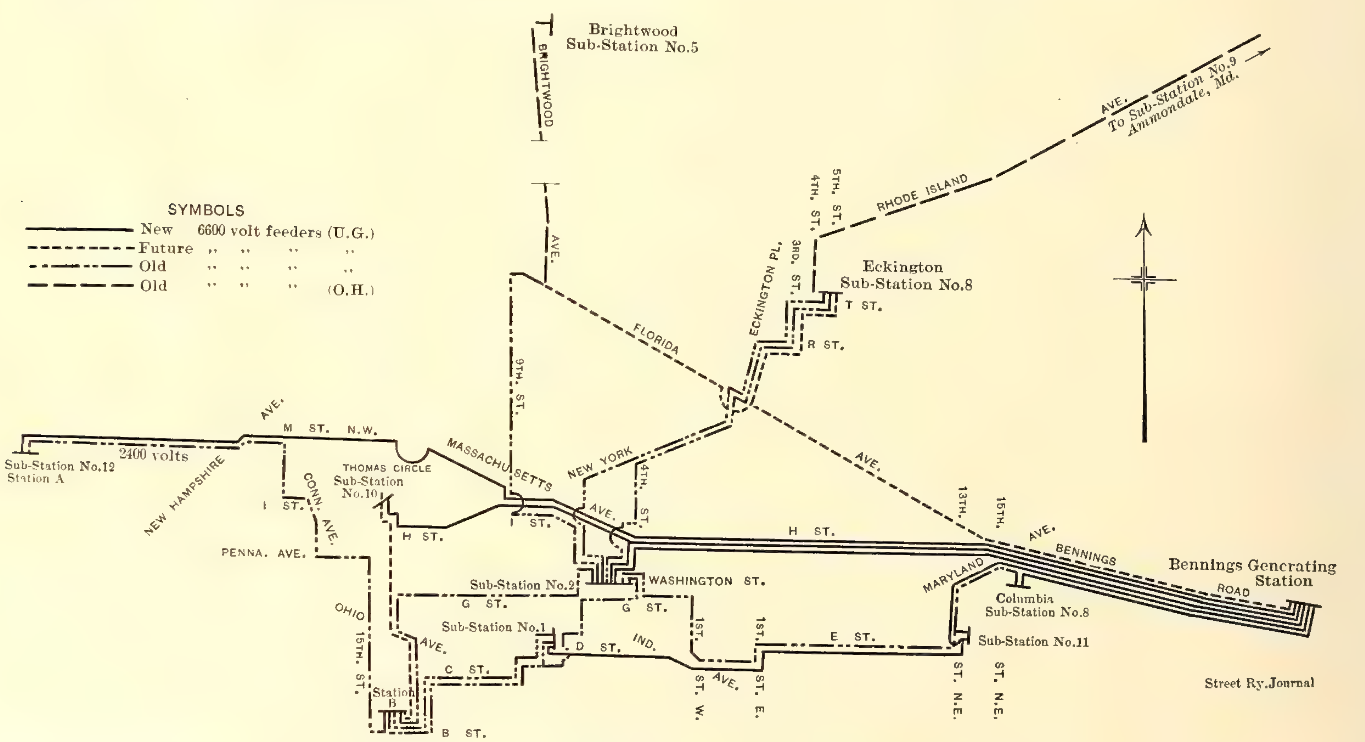
building, with the exception of the brick walls, is built of concrete. A 10-ton traveling crane on concrete girders is provided for handling apparatus. This station is designed for 5000-kw lighting capacity to feed into the Edison three-wire system, and is equipped with two 500-kw induction motor generator sets and also a balancer set with a capacity of 75 kw. This station is provided with an air duct and the foundations are laid out so that either rotary transformers or motor generators can be installed.

The second story is laid out for a storage battery of 250 cells. Attention was given to the floor of the battery room to insure it being practically acid proof. It is designed to drain both ways of the building so that it can be washed down at any time. The floor is built of acid-proof brick laid in boiling pitch with ⅜-in. joints which were filled with hot pitch. This room is well ventilated and lighted, with practically no metal to be attacked by fumes, and is separated from the end cell switch rooms and other rooms by cement partitions. The controlling apparatus is of the same type as is used at sub-station No. 2 except that the motor-generator sets are started through compensators.

Sub-station No. 11 is located at Thirteenth and D Streets N. E. This building was remodeled from an old office building into the present sub-station. It is 80 ft. long, 30 ft. wide and one story high. This station is designed for three 500-kw rotaries and to be used entirely for railway work, and feeds into the ends of four roads whose extreme easterly lines are in the vicinity of this sub-station. This apparatus is controlled by type-H-3 automatic, remote-control oil switches. The rotaries are started up from the a. c. end through taps that have been brought out from the transformer for that purpose.

Sub-station No. 12 is located in the old steam power station at Thirty-Third and K Streets N. W. The apparatus is located in the northwest corner of the building, consisting of two 500-kw rotaries for railway work and one 500-kw frequency-changer set, from 6600 volts to 2400 volts for alternating-current lighting in that territory. It is believed that in case anything happens to this sub-station the steam station can be gotten under steam at very short notice. Men familiar with the steam service are to be retained.

At the Fourteenth and B Streets plant one 1000-kw frequency-changer set has been installed for the purpose of supplying the 2400-volt commercial lighting.



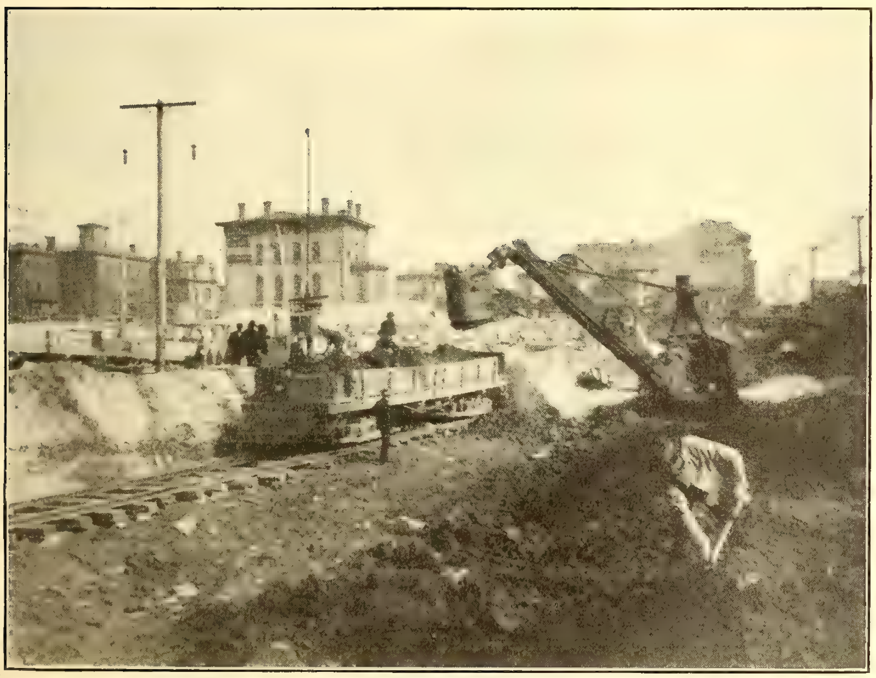
MAP SHOWING LOCATION OF POWER STATION, SUB-STATIONS AND ARRANGEMENT OF HIGH-TENSION FEEDERS

HANDLING DIRT FROM EXCAVATIONS IN ST. LOUIS

The accompanying views from photographs show some work of handling dust from a building excavation by the United Railways Company, of St. Louis. The excavation covered a city block and is bounded by Seventeenth, Olive, Eighteenth and Locust Streets. The building being erected on this block will be of concrete and eight stories high. The site was previously occupied by some old residences and stone buildings, some of which were situated upon an elevation at least 10 ft. above the street level.

The contractors, James Black Masonry and Construction Company, rented a standard railway 1¼-yd. steam shovel and at night hauled it to the scene of the work over the street railway tracks, although these tracks are 4-ft. 10-in. gage. Permission was granted by the city for a switch into the lot, and several tracks were laid across it and a trolley wire was strung into the lot for a distance of 100 ft. A lead wire attached to the trolley and the motor car permitted operation of trains to any point in the property. The tracks were moved as required by the progress of the shore. The dirt was hauled from the excavation by two-car trains, each car holding approximately 20 cu. yds. The amount excavated was about 80,000 cu. yds. Work was started in September and was completed during the first part of November. Day and night crews were employed and the work progressed steadily.

VIEW OF EXCAVATION, LOOKING WEST FROM SEVENTEENTH STREET



STEAM SHOVEL AT WORK FILLING ELECTRIC CARS

The excavated material was hauled about 2½ miles and dumped into an abandoned quarry in the north part of the city, at Twenty-Second and Angelica Streets. This quarry, which is the property of the railway company, has for some time been used as a dump for the dirt excavated in the process of reconstructing the city tracks. Unloading the material excavated from the building block was accomplished manually, a force being at work continuously. Several of these quarries have been filled during the past summer and the ground values greatly increased thereby.

Eighteenth street, the route over which the dirt trains passed from the excavation, is the route of three car lines, and the traffic is very heavy. Although dirt trains were continually running over the same track, passenger cars were not blocked to any extent.

Some objection was raised by team owners to this method of disposing of dirt on account of the business it took away from them, and the circuit attorney has been called upon by those who insist that the company exceeded its charter rights, to bring suit against the company. However, it is not likely anything serious will result from this proceeding. The condition of the streets around the property was remarkably clean. A comparison with the wagon method is afforded by a walk of two blocks, where an excavation has been made for the Ely-Walker Dry Goods Company. The pavement is a sea of mud continually and the police are constantly arresting team owners.

One of the accompanying engravings shows the shovel in the act of dumping a bucket of dirt into the car. The other is a general view looking west from Seventeenth Street, showing the switch into the property from the Eighteenth Street tracks of the United Railways Company.

The Marion, Bluffton & Eastern Traction Company has been admitted to membership in the Central Electric Railway Association. The mileage over which the interchangeable coupons are good is now nearly 2300 miles.

REPAIRING BY THERMIT AT DAVENPORT, IA.

An account was published in the Street Railway Journal for Dec. 22, 1906, of the methods followed in the shops of the Montreal Street Railway Company in repairing broken motor castings by thermit. Another company which employed thermit extensively for this purpose is the Tri-City Railway Company, of Davenport, Ia., and Moline and Rock Island, Ill. This company has also used thermit for repairing broken truck frames and for machine welds, but the work on motor casings has constituted the greater part of the application of thermit in Davenport. The part of the motor cases found to be most frequently broken is the lug through which the bolts to secure bearing cap to frame pass. The illustrations presented herewith will give a clear idea of the method of making the weld.

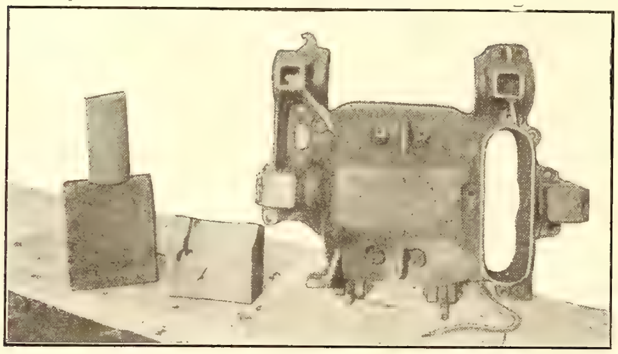


FIG. 1.—MOTOR FRAME WITH BROKEN LUG

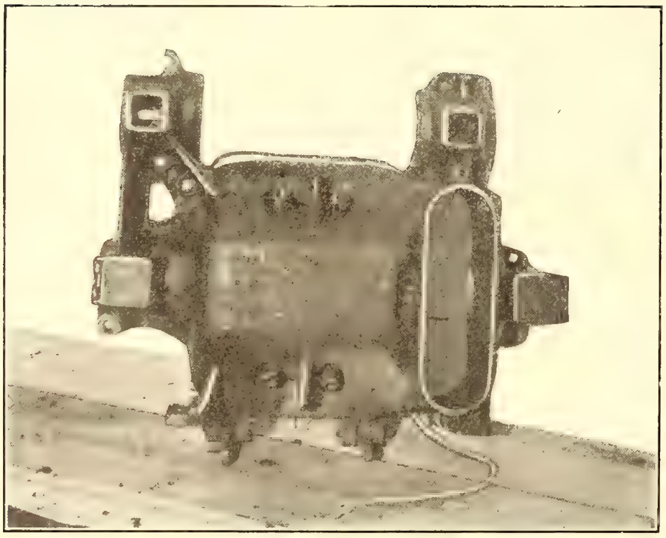


FIG. 2.—MOTOR FRAMES AND MOLD FOR WELDING

FIG. 3.—PLACING THE MOLD ON THE MOTOR BEFORE WELDING

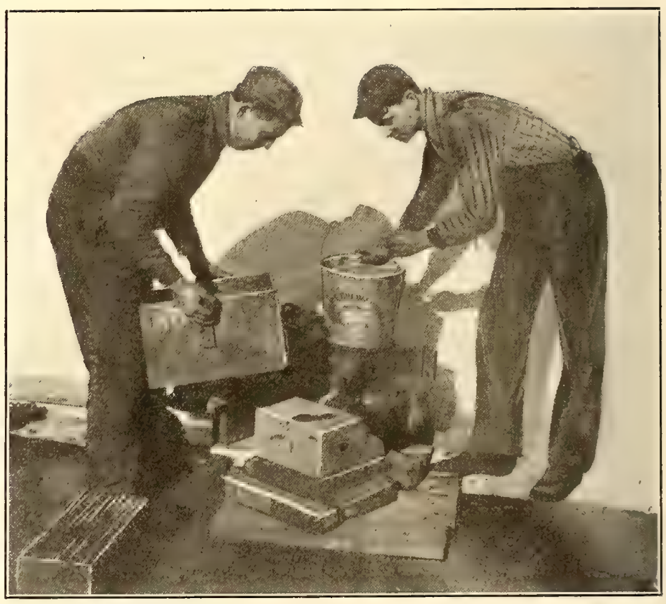


FIG. 4.—PLACING THE COVER AROUND THE MOLD

FIG. 5.—READY TO TOUCH OFF THE MIXTURE

Fig. 1 shows the motor frame with the broken lug. The first step in the process is to clean the frame of all grease and dirt which may be on it. It is then heated to a cherry red in the forge fire, after which it receives a thorough cleaning with a wire brush to remove any remaining dirt. It is then ready for welding. In Fig. 2 motor frame and molds used in making the weld are shown together. These parts are dried by the fire until all moisture is removed. The molds are made half and half of brick clay and sand and are made from a pattern of the same shape as the

original casting. Fig. 3 shows a workman placing the mold on the motor in position for the weld.

Fig. 4 illustrates the next stage in the process, which is that of placing the cover around the mold. This cover is used to hold the sand required to stop the fine cracks in the mold; otherwise thermit when in the fluid state would escape through the small openings, and the use of the sand has been found desirable for this purpose. Fig. 5 shows the cover and surrounding case of sand, the crucible in place and the workmen ready to touch off the mixture with a red-hot iron. The man at the right holds the cover of the crucible to drop over it as soon as the reaction commences.

FIG. 6.—THE FINISHED WELD

Fig. 6 shows the finished weld as it comes from the mold and with the gates still clinging to the casing.

About seventy of these welds have been made by the company to date, with only a very small percentage of failures. These failures consist of four fractures of which three proved to have been caused by a flaw in the casting while one was a clean break. The company has found as a result of experiment that the addition of about ½ per cent of nickel thermit makes a tougher weld, and is now using nickel thermit for this purpose.

The amount of thermit compound required in an average weld is 15 lbs., and the total cost of an average weld is about $12, not counting machine work, which will run about $2 per weld additional.

This paper is indebted to James F. Lardner, general manager of the Tri-City Railway Company, for the information and photographs presented in this article.

THE SELECTION OF WOODEN POLES

BY H. S. STOUT

The highest electrical, mechanical and civil engineering talent is being devoted to the design of track, rolling stock and power stations for electric railway systems, but the subject of wooden poles seems to have been largely neglected by the engineering profession. In buying poles, purchasing agents often follow a different policy than in selecting cars or other parts of the equipment. Beauty seems to be the only criterion, while in all others the desiderata are strength and durability.

There are only a few woods accepted in this country for electric pole lines, viz: cedar, both Northern and Western; cypress and chestnut. These woods are used principally because they contain more tannin, the preservative of all vegetation, than any others which are commercially available.

The first question in comparing poles of these materials is, then, which possesses the most preservative or tannin, and which contains it in the most insoluble state; in other words, which carries the tannin protected against moisture, which is its solvent? The second question is that of tensile strength when new and when in partly rotted condition.

Cedar has been used for pole lines perhaps more extensively than any other wood, and has been found very desirable for this purpose, but in a great many localities its high reputation has been established simply because other woods have not been tried. Moreover, the Northern cedar, which is far better for poles than any other cedar growing, is becoming scarcer every year and necessarily higher in price.

Chestnut is a wood that grows practically all over the Eastern United States, but its home is especially in the Appalachian chain of mountains in the Southeast. This wood has not had the same opportunities to be tested as cedar. It might be also well to say that the farther south the chestnut is cut the larger is the percentage of tannin or preservative in it and the tougher is the protecting ring or fiber which protects the heart against moisture.

The existence of tannin and its preservative qualities can be substantiated from any chemical source. If this is the case, then it is the strength of fiber or ring growth in the wood which will determine the toughness of the wood and its maximum resistance to moisture.

All trees are made up of annual growths, or rings, as can be seen by looking on the end of a piece of timber. All the tannin cells are between these layers, and those directly exposed to moisture are dissolved with comparative ease. Now the layer or growth in the chestnut, or what might be called a covering to the tannin cells, is tougher by 100 per cent than the layers of any other wood which carries the same amount of preservative or tannin, and will absorb less moisture than any other wood of its class. This being the case, it is reasonable to believe that the life of this piece of timber must necessarily be longer than the other.

Another advantage of chestnut is its tough growth as a resistant to vibration. This is an important feature in electrical work. It takes very little wind, if steady, to cause vibration in a pole line, and chestnut contains in its tough fiber a larger resistance to this vibration than any other wood used for the purpose. A chestnut pole when new will stand 23 per cent to 25 per cent more tension than any other timber used for poles, that is, it takes that much more to protect it, and when poles are rotted at the base, as is the case with all of them, the chestnut when rotted down to 6 ins. or 7 ins. diameter will stand at least 100 per cent more than any other wood.

Many companies have sustained losses in pole lines on account of the pole being burnt off at the ground, especially at a point where lines are parallel to steam railroads which are continually setting fire to the dry grass along the track. Chestnut resists fire a great deal better than any other material that is used for poles.

Cypress is also being used in some places on account of its straightness; so is the Western or Idaho cedar, but it will be easily ascertained that neither of these woods compare with the other for life or strength.

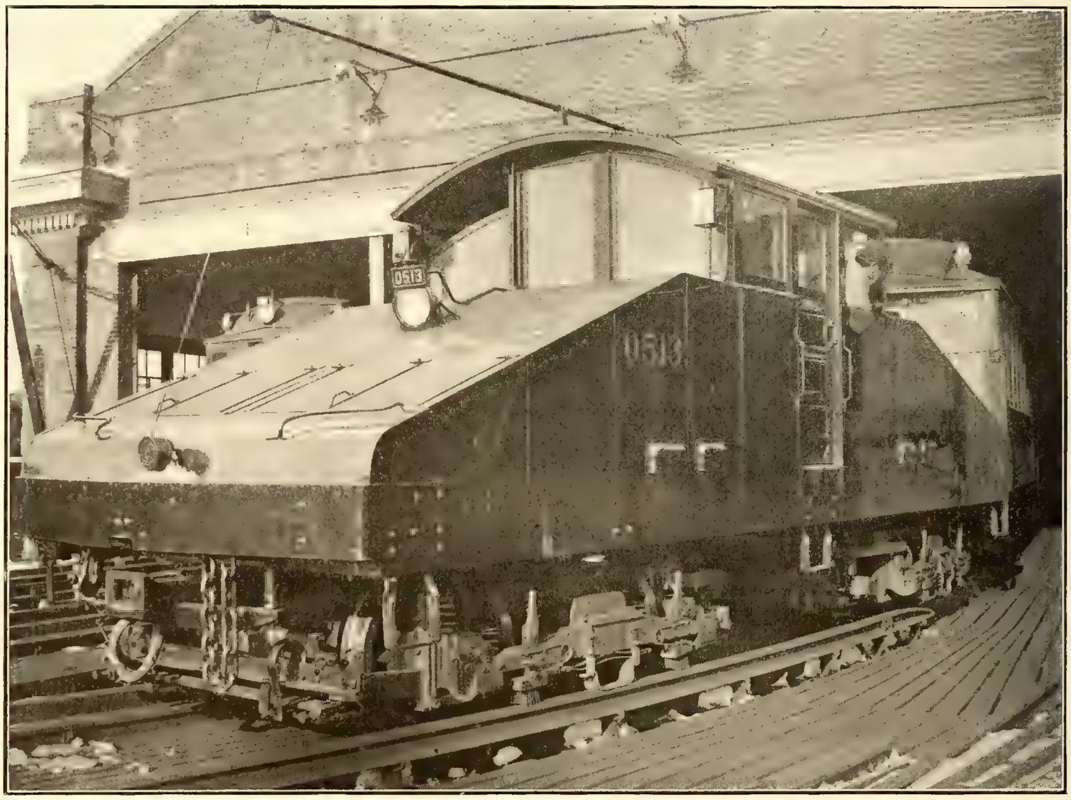
An objection at times urged against chestnut is that it is not quite as straight as the other woods, but it is possible to set a very pretty line out of chestnut poles. The writer has seen lines that were made up of what he would term very crooked poles, but were so set that an even effect was produced.

NEW ELECTRIC LOCOMOTIVE OF THE BOSTON ELEVATED RAILWAY COMPANY

Two electric locomotives have recently been designed by the Boston Elevated Railway Company for heavy yard and general haulage service on the elevated division. One of these machines has already been completed and placed at work in the Sullivan Square terminal yard, and the second is in process of construction. Both locomotives, when the second is completed, will have been manufactured in the company's own shops, and in detailed design the two are practically duplicates. One machine will probably be used exclusively in yard work, while the other will be employed in the haulage of materials, flat cars, box cars or other rolling stock in connection with the work of the road department.

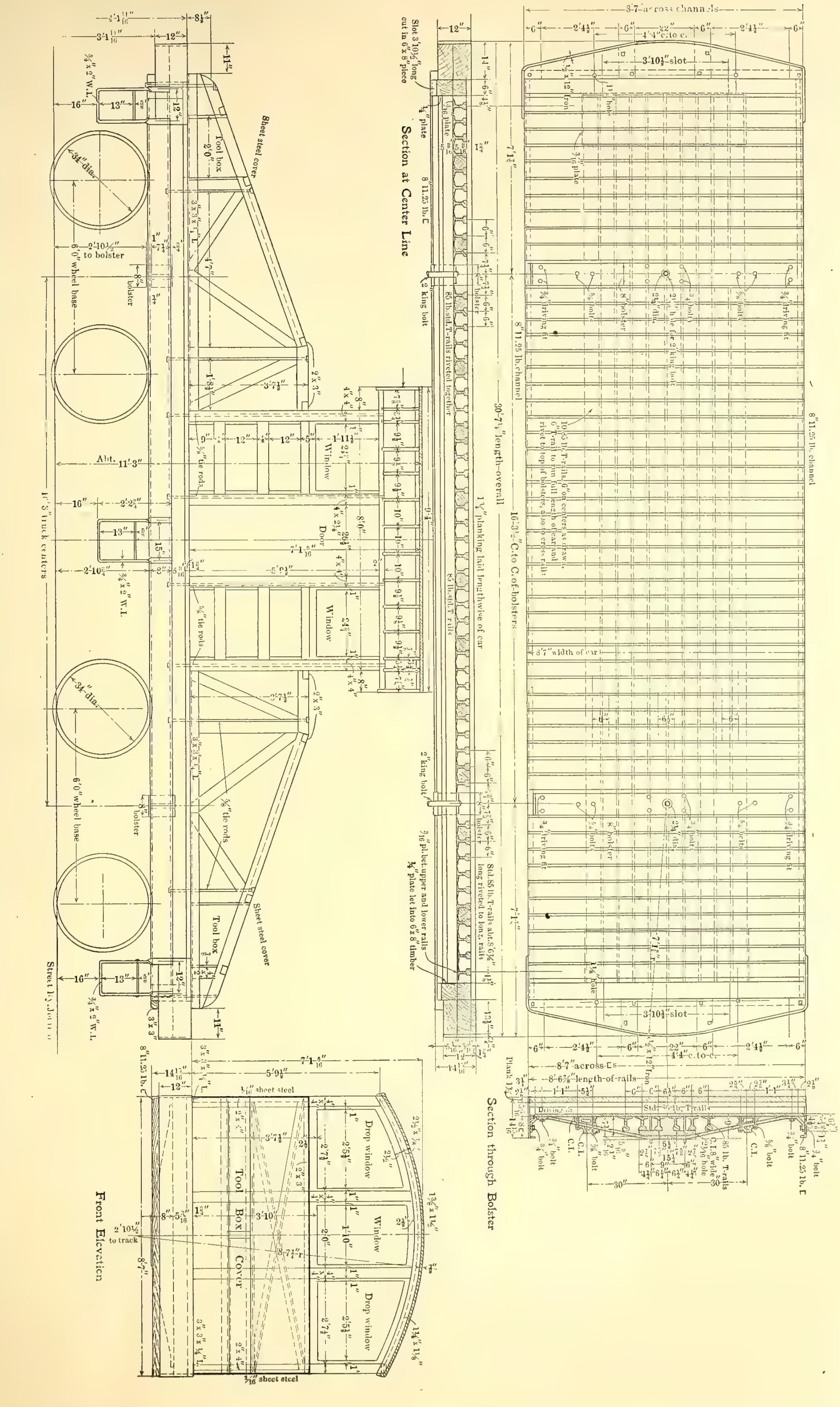
As is shown in the accompanying illustrations, each locomotive is 30 ft. 7¼ ins. over all and 8 ft. 7 ins. wide. The height of the top of the cab from the rail is 11 ft. 3 ins. The locomotives were designed to pass through the subway as readily as a standard elevated car, and each weighs, complete, 77,000 lbs. The floor is 4 ft. 1 11-16 ins. high above the rails. In general design the locomotives conform to the usual arrangement of a central cab and body with sloping ends on each side of the cab supported on a heavy underframe, the latter being carried upon two four-wheel trucks. The strengthening of the underframe, however, was accomplished in this case by the novel method, shown in the illustrations, of using a horizontal lattice work of longitudinal and transverse steel rails riveted together in place of the castings which have sometimes been employed for the purpose of getting sufficient dead weight in electric locomotives. Both cross and longitudinal rails are of T section, weighing 85 lbs. per yard. There are ten longitudinal rails in the bottom framing, spaced 6 ins. apart on centers, and fifty-one cross rails 6 ins. apart on centers. Six of the longitudinal rails run the entire length of the car, and these are riveted to the tops of the bolsters as well as to the cross rails. The longitudinal rails are inverted as they pass through the framing. On top of the cross rails is laid a floor of 1¾-in. planking which extends the entire inside length of the locomotive. The bolsters are each 8 ins. wide and the center pins are 2 ins. in diameter, spaced 16 ft. 3½ ins. apart on centers. At the sides and ends of the locomotive the framing consists of 8-in. 11.25-lb. channel irons. Filler blocks of wood are wedged in at intervals between the cross rails to serve as nailing strips for the flooring.

The motor equipment of the locomotives is in each case four G. E. 73's, geared for a maximum speed of about 12 m. p. h. As 100 per cent of the weight of the machine is on the drivers the maximum possible tractive effort without slippage of the wheels on 20 per cent adhesion would be about 15,000 lbs. The trucks are each similar to the motor trucks used under the cars of the elevated division, having 34-in. steel-tired wheels, a 6-ft. wheel base, and being 16 ft. 3½ ins. apart on centers. The control is type 17 multiple unit. The contactors are mounted in a fireproof compartment in the center of the cab, which is about 8 ft. long. The master controllers are mounted in diagonally opposite corners of the cab, and are arranged for right-hand operation of the locomotive, facing each end. The reverser, circuit breaker, fuse box and rheostats are installed under the sloping end at one side of the cab, and the main reservoir cylinders, air compressor and governor are installed under the opposite sloping end. The wooden flooring is fire-proofed by sheet tin in the compartment which holds the control apparatus. Minor control switches and fuses are mounted in a special asbestos lined compartment at one end of the cab, and a single-pole, double-throw switch is installed to connect the main motor circuit either with the trolley pole with which the locomotive is provided or with the circuit of the four third-rail shoes. The air brakes are of the new Westinghouse electro-pneumatic type with graduated release and quick recharge features.



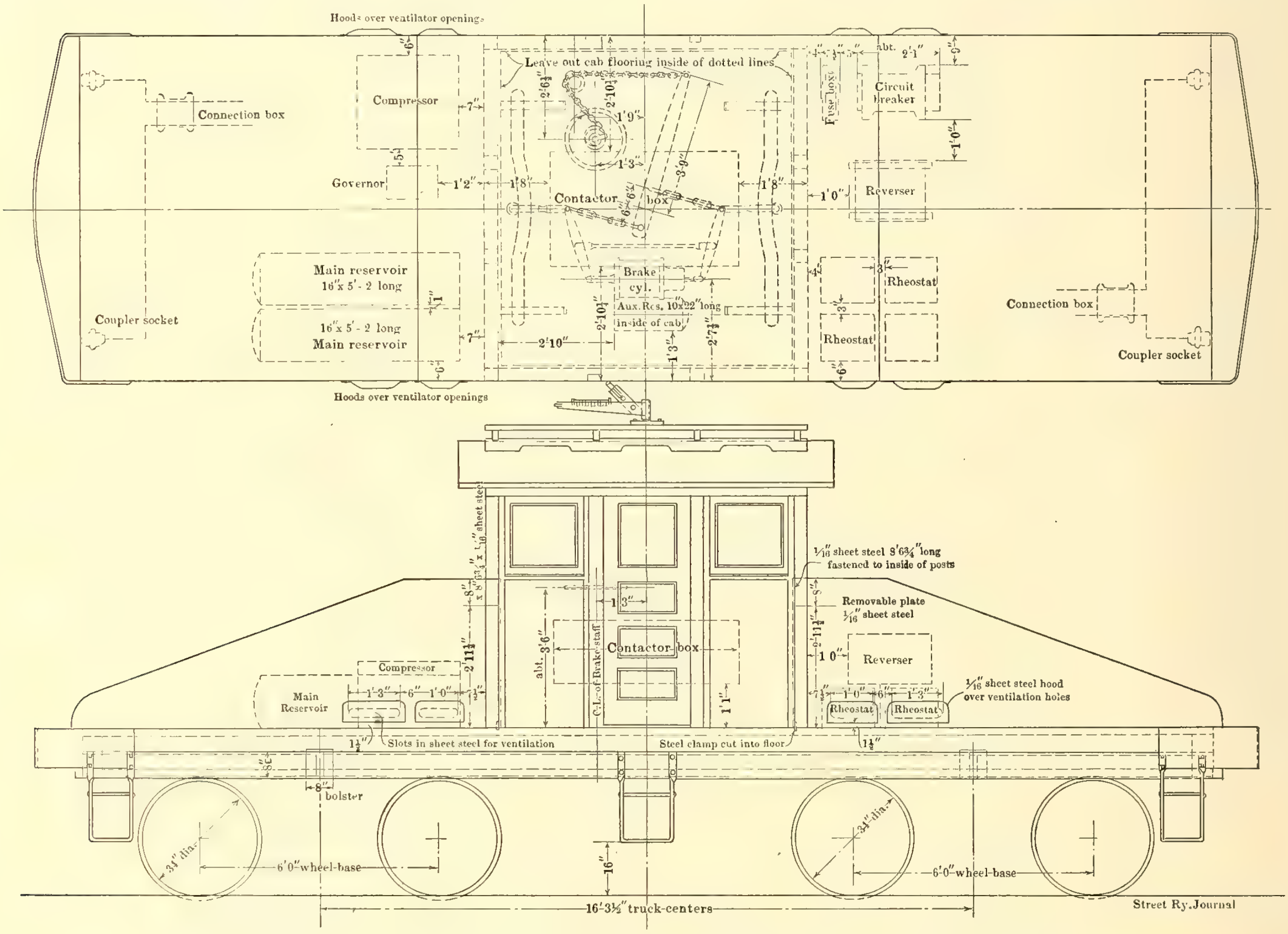
ELECTRIC LOCOMOTIVE USED BY THE BOSTON ELEVATED RAILWAY

Arc headlights and electrically-lighted markers are provided, and part of the space at each end of the locomotive housing is given up for tool-box purposes. Special ventilators are installed in the sides of the housing, and both end and center steps are attached to the frame. A full set of steel sleet brushes of the company's standard adjustable type has been attached to the trucks. The motors are inside-hung. Van Dorn drawbars were used, as on the regular elevated cars of the system.



PLAN, ELEVATIONS AND SECTIONS, SHOWING THE CONSTRUCTION DETAILS OF THE BOSTON ELEVATED RAILWAY COMPANY'S ELECTRIC LOCOMOTIVE

The principal work of the first of the two locomotives consists in shifting cars in and out of the northern division of the Sullivan Square shops for the purpose of wheel grinding or truck changing. About forty-eight pairs of wheels are ground daily, and the locomotive is constantly at work transferring cars to and from the special track in the shops which is served by an elevator connecting with the machine shop on the ground floor. Ever since electric train operation began in Boston it has been necessary to shift dead cars by a passenger car withdrawn from service. On this car the facilities for looking back at the rear of the train were not good, and safe movements could not be made without considerable delay in signaling. In the case of the locomotive the driver can readily see all that is happening at the end of the train, and the control is graduated so that the locomotive can be moved an inch at a time if desired. Eleven elevated cars weighing about 33 tons each have been hauled at one time by the new locomotive without the least difficulty.



PLAN AND ELEVATION OF BOSTON LOCOMOTIVE, SHOWING ARRANGEMENT OF THE APPARATUS

With the first day of March came the closing of the prize trolley trip story contest which has been conducted the past few months by the passenger department of the Boston & Northern and Old Colony Street Railway Companies. Prizes of $25, $15 and $10 were offered for the best stories of the best trips taken by the contestant on either of these systems. This inducement caused many people to send in some very entertaining descriptions of trips they have taken which will live in the memories of the writers as especially enjoyable and attractive.

A NEW BOAT FOR THE KEY ROUTE

The new Key Route ferryboat "Claremont" has been completed by the Union Iron Works and will soon enter the regular ferry service. She is a duplicate of the "San Francisco," but unlike that vessel is a product throughout of San Francisco firms, while the "San Francisco's" engines were made in the East. The "Claremont" has engines of 1800 hp, and is expected to make a trial speed of nearly 18 knots an hour. She is 200 ft. long, with a beam of 58 ft and draws about 14 ft. of water, and carries 2000 passengers.

RESEARCH FELLOWSHIPS IN ENGINEERING AVAILABLE AT THE UNIVERSITY OF ILLINOIS

The University of Illinois has extended and strengthened the field of its graduate work in engineering by recently establishing ten research fellowships in the engineering experiment station. These fellowships have an annual value of $500, and are open to graduates of approved universities and technical schools, both American and foreign. They must be accepted for two consecutive collegiate years, at the expiration of which period, if all requirements have been met, the master's degree will be granted. Preference will be given to men who have had some experience in practical engineering work outside of college. The appointments will be made upon the recommendation of the station staff of the engineering experiment station, and upon the approval of the faculty of the graduate school and the president of the university.

DUTIES AND DISCIPLINE OF SUPERINTENDENTS

BY G. E. MILLER
Superintendent Union Electric Company, Dubuque, Ia.

So many papers have been written in the past about the "Discipline of Employees" that it may not be amiss to leave the beaten path, take to the woods, and write about the duties and discipline of superintendents.

The first thing to be remembered is that, while you are an important personage, you are not the only berry on the bush, as there are over nineteen hundred street railways, with superintendents and assistants, operated in the United States alone, and working on each system there are men who are competent and willing to take your place should you drop off when the bush is shaken.

As to the public, be courteous and honorable in all your dealings with them—they are the nickel givers. Pay attention to complaints and investigate each one. Keep the cars clean, well ventilated and on schedule time. Adopt schedules that can be depended upon, and the public will soon be educated to wait for the cars. In making engagements, keep them—to the minute. Do not get hot under the collar when things go wrong, but control your temper and wait until you get to your office and then—saw wood. The Sage of "Trolley Talk" hits the nail on the head when he says:

> It's easy enough to be pleasant,
> When life goes along like a song;
> But the man worth while is the one with a smile
> When everything goes dead wrong.

Study every phase of the transportation problem and make your preparations ahead of time for the days on which travel will be exceptionally heavy. While cold chills are occasionally sent up and down the back by urgent hurry-up calls to move large crowds, it should act as a good, wholesome stimulant towards your best endeavors and resources to accomplish successfully the demands that are made upon you.

The rowdy element should be handled firmly and all violations of the law should be prosecuted vigorously. Do not allow cheap politicians, saloon keepers, forgotten parents or relatives to persuade you that "they are such good boys" and that you cannot or dare not arrest them. A few good fines, with some healthy exercise on the rock pile thrown in, and publicity in the newspapers, have a quickening effect in checking the inclination of others to be mean and quarrelsome on the cars and company property. The lesson is very seldom forgotten.

Now as to employees: In dealing with subordinate officers and employees be firm, but fair. Keep in close touch with them and see that all of your desires are carried out faithfully. Do not attempt to do all the work yourself, but surround yourself with good assistants. Never hire cheap men for responsible positions, as they are always the most expensive. Let all the men look alike to you and show no favoritism. Write and date all important orders, retaining a duplicate. These books can be purchased in convenient pocket sizes and are invaluable to your success. Check and correct all signs of discord at once. Be ready to consider grievances and afford the necessary relief if they are legitimate. Never correct before others.

Meet with your employees once a month and eliminate the Quaker meeting idea and let them do some of the talking. You will be surprised at the many good and valuable suggestions that are offered. Continually keep before their minds and discuss with them that "Safety to passengers is the first consideration, "How to avoid accidents," "How to take care of accidents," "To report all accidents no matter how trivial," "Courtesy to passengers," "The care of children and the aged," "Delays," "Fares and transfers," "When, where and how to eject passengers," "The use and abuse of the controllers," and if you have steep grades, "How to handle the cars safely." Prepare a list of the number of complaints, delays and accidents during the month and read it to them at a meeting, and it will surely set their thinkers going.

In discharging an employee never allow your personal feelings to interfere with your duties. Consider well all the facts of the case, look up and study his record, and then show him the justice of your decision.

The Manager: In your business relations with the manager, report to him only such things that are necessary to a successful management. Do not waste his time and try his patience by reciting all the trivial things that happen during the day or try to convince him what a nice, good, faithful, hard-working sort of a fellow you are. He has troubles of his own and not all of his dreams are sweet, but you can rest assured he knows all about your case and the number of complaints from patrons, the discipline of employees, the receipts and expenditures of your department speak volumes for themselves. Attend strictly to your own business. When advice is wanted he generally knows where to get it, and should you be consulted for some of it, give him the best at your command.

While suggestions from directors, stockholders or the public are always welcome for improvements in the service, orders must only be taken from the manager and then implicitly obeyed. If they are red hot and straight from the shoulder, handle them carefully, cool them off and season them properly with thought before passing them along the line of subordinates. You are the keystone of the arch, with the public and employees on one side and the manager and directors on the other.

Gain and hold the friendship of the newspaper reporters, but let the manager only give them the news or accounts of new or difficult undertakings. Many extensions and improvements have been lost or delayed by a premature disclosure of the intentions of the management by an overzealous superintendent. Never abuse the confidence placed in you.

In conclusion: Learn to say "Yes" or "No."

Be willing to learn. Do not "know it all."

Sleep losers are poor business mixers.

Accidents are open bung-holes to the dividend barrels.

Subscribe for and read the trade journals and papers. They keep you next to all the latest ideas and improvements.

Pomposity, stiffneckism, or sour face cult are sadly out of place in your business; they are the cause of comment, foster resentment and—your retirement.

Your confidential clerk, or some one in authority, should know at all times where you can be reached by 'phone or messenger. This is very important at times.

Good superintendents are always in demand and not much difficulty is experienced in securing positions. Dreamers hot-air artists, fire eaters, and slick pen pushers are very often placed in these responsible positions, but it is not long before a "want" adv. is placed in the trade journals and the move is made to the next temporary stopping place.

NOTES ON SPEED-TIME CURVES

New York, Feb. 23, 1907.

Editors Street Railway Journal:

In the Street Railway Journal of Feb. 9, 1907 (Vol. XXIX, pp. 244-248), I find an article entitled "Notes on Speed-Time Curves," by Mr. Tracy W. Simpson. I would like to supplement his notes by a few notes bearing upon the actual *evolution* of the methods outlined in his article.

Mr. Simpson, while admitting that these methods are, in reality, those first made public by me in my A. I. E. E. paper, in 1902, calls attention to certain presumed innovations ("several differences of procedure") in the use of these methods. Mr. Simpson's statement conveys—quite unintentionally, I have no doubt—a misleading impression in regard to the *novelty* of these "differences of procedure," and also, in regard to the *utility* of some of them, especially the slide-rule method of obtaining the time-values.

One of these novelties is in use, for the ordinate values, in Mr. Simpson's Fig. 1 ("general speed-tractive-effort curve") of a scale of "pounds of tractive effort" instead of "equivalent accelerations." The following extract from my discussion of the A. I. E. E. paper of Mr. F. W. Carter, on "Predetermination in Railway Work" (Niagara Falls, 1903, see A. I. E. E. Trans. XXII., 1903, p. 165) is of interest, since the solid line graphs in Fig. 9 of Mr. Carter's paper are the prototypes of the solid line graphs in Fig. 1 of Mr. Simpson's article:

The solid-line curve in Fig. 9 is one which gives gross tractive efforts as a function of the speed. The author uses the ordinates for tractive efforts per motor in pounds. The abscissae indicate speeds. In my paper I also use abscissae for speeds, and I use the same ordinate *values,* but they are plotted according to a different *scale.* I call them acceleration coefficients. Now, the acceleration coefficient is, as is easily shown, nothing more than the tractive effort multiplied by a reduction factor, which we know to be 91.1. This factor (which we may here call F) includes the coefficients necessary to change weights from pounds into tons, to convert speeds from feet per second into miles per hour, and to take into consideration the gravity value or measure of acceleration, thus,

$$F = \frac{5280 \times 2000}{3600 \times 32.2} = 91.1$$

Consequently, if, without changing the curve, we change the scale in the ratio of 91.1 to 1 in either of the two curves they become identical in mathematical character. They both have the same meaning; that is to say, the solid-line curve in Fig. 9 of this paper has precisely the same significance as curve M in Fig. 9 of my paper. They both express the force which is available per motor for producing acceleration. What is still more remarkable is that the solid-line curve at the bottom of Fig. 9 of this paper is identical with the curve R in Fig. 9 of my paper. It is the curve of train resistance expressed in terms of equivalent acceleration. The dotted line curve, which is the curve of net acceleration factors, is also exactly the same as the curve N in Fig. 9 of my paper.

In my earlier work with speed-time curves (prior to 1901), I had myself used these same "force-velocity" ("F-V") graphs (like Fig. 1 of Mr. Simpson's article, or Fig. 9 of Mr. Carter's paper), instead of the "acceleration-time" ("A-T") graphs, such as are used in the "Charts of Coefficients." This was the way which suggested itself first, seeing that the motor characteristic curves furnished by the manufacturers of railway motors give the horizontal tractive effort values in pounds per ton. In those days we not unfrequently measured or expressed acceleration in terms of the tractive effort in pounds per ton producing it. In due time, I became convinced that train acceleration was most conveniently as well as most logically expressed in *acceleration units,* such as the "mile-per-hour-per-second." There is no more logic in expressing acceleration in terms of equivalent tractive forces than in terms of equivalent grades. Finding, then, that the "acceleration-factor" (which is

$F = 91.1$, when $g = 32.2$, or $F = 91.3$, when $g = 32.16$), always entered into every calculation related to train acceleration, I looked about for a way of getting rid of this factor at the outset. I saw that this could be done by changing the scale of ordinates of the "force-velocity" ("F-V") graph, or by using, instead of it, the "acceleration-velocity" ("A-V") graph, whereby the forces either *producing* or *opposing* acceleration could be expressed in terms of equivalent accelerations. I soon found that one could thus obtain a more logical and direct relation between acceleration, velocity and time, because we then have

$$dt = \frac{1}{a}\,dv \text{ instead of}$$

$$dt = \left(\frac{1}{91.3}\right)\frac{1}{a}\,dv = .01095\,\frac{1}{a}\,dv.$$

From this to the "theorem of accelerations" (given in "Appendix B" of my paper) was but a simple step. The idea of the *reciprocals* was suggested by the constant appearance of the acceleration value (a) as a reciprocal $\left(\frac{1}{a}\right)$ in the preceding equation. At first I calculated these reciprocals by the slide rule, or else obtained them from a table of reciprocals. It was not long before I realized that those values could be very conveniently used in the form of "reciprocal" curves.

The "chart" method outlined in my A. I. E. E. paper was completely worked out by the end of August, 1901. Since that time I have myself always found it preferable to use, for the graphs of the forces concerned in acceleration, scales of ordinates, expressing "*equivalent accelerations.*" At the same time, in my lectures on electric train movement, at different technical schools in the last four years, I have always pointed out carefully and even emphasized the fact that these forces can be also expressed in equivalent *tractive-force* units, or in *grade percentage* units. I recommend the students to show *all three* of these scales of ordinates on each "chart of coefficients." The following quotations from the mimeographed syllabus of my lectures on Electric Train-Movement, at the Brooklyn Polytechnic Institute (1905-1906), are of interest as evidence:

(Lecture No. 13, syll., pp. 8-9).

It is also possible to transform equations (50) in such manner as to express the force corresponding to "grades" and to "acceleration" in terms of the "train resistance," "*fi*," or more properly in terms of an "equivalent tractive force."

In such a case the equivalent "resistances" would not be resistances capable of absorbing or consuming energy, but they would have to be resistances comparable to the resistance produced by "reactance" in an electric circuit. (See A. I. E. E., XIV., p. 910.) Equation (51), in reality, represents such a condition, since, as we have already seen (equation 41), all that is necessary to transform accelerations into tractive efforts *per ton* is to multiply the acceleration *coefficient a* by the acceleration *factor* 91.3. It would also be possible to express all the forces in terms of "equivalent *grades,*" of which one kind, corresponding to the "intrinsic" resistance, would be proportional to the force-factor of an amount of potential energy which would have to be regarded as "non-recoverable."

The equivalent acceleration method is the theoretically preferable and most logical method, as will be seen presently. The equivalent tractive effort method may be used advantageously to supplement it as will be seen.

The same statements are, in substance, to be also found in the syllabus of the course of lectures just given (1906-1907).

In the same lecture it is shown that the ordinary curve of train-resistance in pounds per ton as a function of the

train-velocity represents, by a scale of ordinates 91.3 times greater, a "loss" of acceleration.

(Lecture No. 13, syll., p. 12):

"Intrinsic" Accelerations.—The term "intrinsic" acceleration is a convenient one to designate the acceleration "loss" (a') due to train resistance, because it suggests the nature of this loss. from the values of f_i, obtained by some train resistance formula, the values of the "intrinsic" acceleration may be calculated by the formula

$$a' = a_i = \frac{f_i}{91.3} = .01096\ f_i \qquad (51)$$

Table XII. contains the values for f_i obtained by train-resistance formula No. 34, and the values of a_i obtained by formula (51) for cars of 25 tons, 35 tons and 45 tons total weight, in trains of 1 to 5 cars.

The following extract is also of interest:

(Lecture No. 14, syll., pp. 10-11):

Since there is, both in the curves and in the tables, a speed value for every tractive effort value, it follows that we can, from these simultaneous values plot a curve of tractive effort F as a function of the velocity (V), (i. e., the F-V curve); and, by analogy with the train-resistance curve, it is evident that the same curve would also represent "equivalent accelerations," by reference to another scale, 91.3 times larger. Such a curve would not be exactly what we want, however, because it would represent the equivalent acceleration for a total train weight of only *one ton* per motor. What we need to know is the total acceleration *per ton of total train weight.* We must, therefore, before plotting the tractive force values (or their equivalent acceleration, a_t), *divide* the total tractive effort per motor by the number of *tons* per motor. If M = number of motors per train, and if F_t = the total tractive force exerted by each motor, at any instant, then the total tractive effort *per train* will be $F_T = MF_t$. The total tractive effort *per ton* of train (when W = total weight in tons will be

$$f_t = \frac{MF_t}{W} = \frac{F_t}{(W/M)} = \frac{F_t}{W} \qquad (A)$$

where $w = \dfrac{W}{M}$ = total train weight *per motor.*

The equivalent acceleration *per ton* of train will be

$$a_t = \frac{f_t}{91.3} = .0195\ f_t = .0195\ \frac{F_t}{W}\ . \qquad (B)$$

The values of f_t depend upon the motor characteristic curves, as already seen. The quantity w will depend on the train and its load.

The quality a_t is, in reality, what might be termed the "gross acceleration" *per ton* of train weight, and the "actual" acceleration, as we shall find, could also be called the "net" acceleration.

In this lecture reference is made to tables giving, by way of illustrative examples for the students, the "equivalent" acceleration values for various train units and for various motor equipments. Every student is also given a "sample" chart of coefficients, reproduced from Fig. 9 of my paper, and containing, in addition, *eight* graphs of "gross" accelerations by motor efforts and *three* graphs of acceleration losses by train resistance. This shows that the idea of putting several curves on one chart is not as new as might be supposed from Mr. Simpson's statement. The novelty of plotting the graphs for all the gear ratios of one motor on the same sheet, as is done in Mr. Simpson's Fig. 1, is "anticipated" in the following language:

(Lecture No. 15, syll., p. 3):

The engineer must be prepared to expect, therefore, that many different "combinations" of cars and of motor equipments may have to be "studied," and that a large number of different kinds of service-run diagrams may have to be predetermined in the course of the detailed study of a project. Consequently, it is likely that many a_t and a_i curves will have to be used on "Charts of Coefficients." It is advisable, for reasons already given, to plot only a few curves on each sheet. It is advisable to plot on any chart sheet the a_t curves corresponding to one kind of motor equipment only for different gear ratios. Such charts when once made up are useful for other cases where the same motor equipment, gear ratios, etc., are applicable.

It is obvious that the chart of reciprocals does not need to be duplicated, since the same chart may be used with all charts of coefficient *whose scales of acceleration coefficients are the same.*

In the latter part of 1902, the idea occurred to me to prepare and publish a chart of coefficients for every railway motor, showing the curves for every gear ratio used or likely to be used for this motor. I prepared a large number of "blank" charts for this purpose and actually began the task of making these charts. This task was, after a time, abandoned, partly from lack of time, but, principally, because I foresaw the possibility of developing analytical methods which would supersede all "point-to-point" methods. An extended reference to such analytical methods will be found in my discussion of Mr. Carter's paper (see A. I. E. E. Trans. XXII., 1903, pp. 165-174). I am still at work on such a method which would, possibly, have been perfected and made public before now, had it been possible to give the problem the uninterrupted thought and study which this solution requires.

We now come to the slide-rule method of finding time-values. Here, again, there was evolution. Being addicted to the use of slide-rules to a "notorious" extent, it was quite natural that I should begin that way. I did so; and I used the slide-rule method until the happy thought of the reciprocals came to me, whereupon I quickly found by actual trial that I could save time, eye-sight and nervous energy by using a chart of reciprocals and a pair of dividers, instead of a slide-rule, even though my slide-rule was one having a logarithmic scale 1 m. long, and giving three figures even at the end of the scale. I have had occasion several times to astonish some of my colleagues by the rapidity and quality (precision) of the work which can be done by the Mailloux Chart Method. In every case, I have found that those who objected to it or found fault with it, had not, in reality actually tried it. They had, usually, only read of it. If they had made or procured a chart of reciprocals and had actually done some work with it, they would have found what a remarkable labor and brain-saving "tool" it is. They shirked, however, the task of preparing such a chart, even though the work (which is not, after all, so gigantic), has to be done only once, since *only one* chart of reciprocals is needed for *any number* of charts of coefficients, provided the same scale of values are used on all the charts of coefficients.

One of the most enthusiastic converts to this chart method is a prominent electrical engineer, who attended my lectures last year and there, for the first time, got in touch with the method and saw, by practical demonstration in the class, what it could really do. The method never fails to appeal to the students the moment they begin to do actual work with it in the class-room.

The calculation method (either with or without a slide-rule) is useful at certain points, notably when the time-values to be found are those corresponding to velocity increments, which are not round numbers or numbers for which a curve of reciprocals is available. The chart method, when used with proportional dividers, enables the correction for rotational kinetic energy to be made in a very simple and accurate manner. With the slide-rule either one more "setting" is required or else an *addition* has to be made separately, before using the rule, as indicated by the sum ($W + W_1$) in Mr. Simpson's equation.

Prof. Freudenberger's method is of considerable theoretical interest, but, unfortunately, not of great practical utility, for reasons which are given in my discussion of Mr. Carter's paper, already mentioned. C. O. MAILLOUX.

TWO NEW TYPES OF REGISTERS

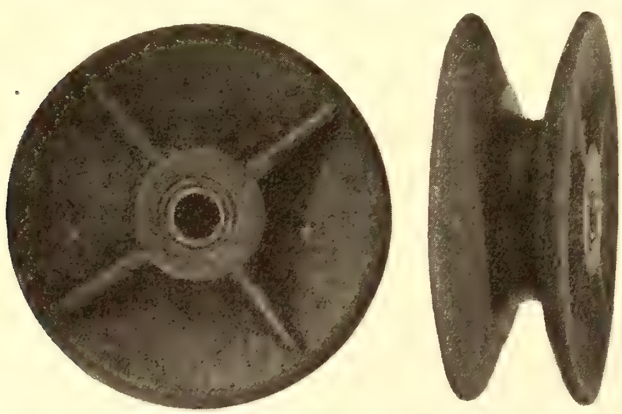
The Recording Fare Register Company, of New Haven, Conn., announces two new types of fare registers, the F and G, for which very strong claims are made. The machines are full geared and contain very few parts, the aim being the elimination of springs and small parts. The cases are of seamless drawn cartridge brass, finished in antique copper, and the face dials are of steel enameled in any color desired. Both the trip and the total figures are very large and plain. The "set-back" is automatic, the knob returning to position instantly upon canceling the trip or changing the direction indicator. Type G is a recording register and furnishes a printed record showing the number of the register, the number of trips, the direction of the trip, and the total statement at the end of each trip. Type F is of exactly the same construction as Type G with the exception that the recording feature is omitted. Both of these machines can be supplied with a "not set" indicator, which requires an extra push of the knob to unlock the register after canceling the trip or changing the direction. This enables the conductor to lock his register so no fares can be rung up during his absence from the car.

REGISTER FACE

A LONG-LIFE TROLLEY WHEEL

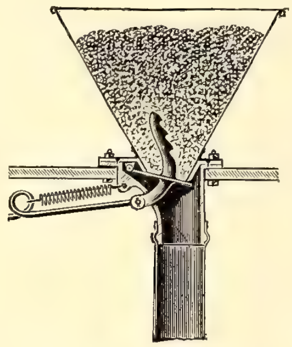
In an article on the Keystone trolley wheel, published on page 42 of the STREET RAILWAY JOURNAL for July 7, 1906, reference was made to the fact that it had been adopted as standard by the Stark Electric Railway Company, of Alliance, Ohio. In connection with this it may, therefore, be of interest to publish the accompanying reproduction of one of these wheels after it had run over 10,000 miles on this company's lines. The wheel was placed in service on Sept. 17, 1906, and ran up to and including Nov. 26, averaging 146 miles per day, or 10,220 miles in all.

While a reproduction made from a photograph can give no fair idea of the excellent present condition of the wheel, it may be said from personal inspection that the wheel certainly showed very little wear for this mileage, nor did it exhibit any evidence of sparking, despite the severe current-collecting conditions in high-speed interurban service. As noted in the article mentioned, this wheel, which was made by the Keystone Steel Company, of Sebring, Ohio, is not of copper or brass, but consists of a secret composition whose base is iron. It is claimed, nevertheless, that for all practical purposes the conductivity is equal to that of the more expensive metals and that the wheel wears out less rapidly.


COMPOSITION TROLLEY WHEEL AFTER 10,000 MILES OF SERVICE ON AN OHIO INTERURBAN LINE

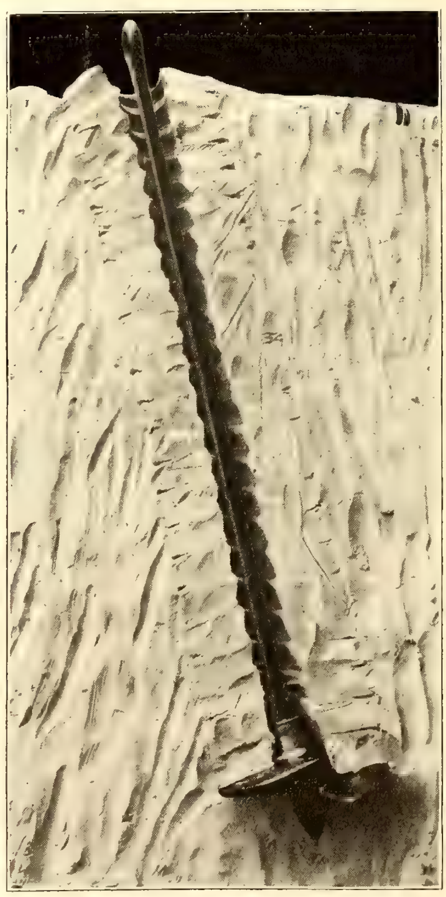
A SIMPLE SAND BOX

A sand box with swinging valve, serrated knife and lever to which the pulling rod is attached, all in one piece, is being manufactured by the De Witt Sand Box Company, of Troy, N. Y., and is known as the Simplex box. In this box the valve is so arranged that the vent cannot be held open by anything in the sand, any foreign matter reaching the vent at the time of closing the valve being forced either out or in. It is said for this box that moisture from below is positively excluded, the lugs on which the valve swings being embedded in a way that insures an almost perfect junction. The box is said to feed very quickly. Slight pressure will give all the sand necessary for an ordinary stop.


SAND-BOX AND OPERATING MECHANISM

TESTS OF GUY ANCHORS

Seventy-odd tests of different sizes of Stombaugh guy anchors made by Prof. Carpenter, of Cornell University, recently with the aid of a dynamometer established the strain for a 5-in. anchor at 12,500 lbs.; a 6-in., 15,000 lbs.; an 8-in., 20,000 lbs.; a 10-in., 25,000 lbs., and a 12-in., 30,000 lbs. The illustration herewith of a 12-in. anchor, from which half of the clay into which it was screwed was carefully dug away, shows very clearly the application of the device. The place is very plain where the helix or screw of the anchor passed through the clay, but the solid clay was not disturbed, the anchor leaving practically no trace of where it went in. At the recent electrical show in Chicago the manufacturers of the Stombaugh anchor, W. N. Matthews & Brother, of St. Louis, had on exhibition a Stombaugh anchor in a large box of modeling clay, in which the cuts of the helix were opened up to show the path of the anchor. In this instance modeling clay was used because it held its shape.


ANCHOR IN CLAY

COMBINATION CARS FOR OLEAN, N. Y.

The Western New York & Pennsylvania Traction Company has recently purchased from the J. G. Brill Company six combination cars of the grooveless-post semi-convertible type (patented), three of them being of the passenger and baggage type shown in the illustration, the remainder having passenger and smoking compartments. The company, which is now operating about 60 miles of electric road, 50 miles of which are interurban, includes the Olean Street Railway, the Olean, Rock City & Bradford Railway, and the Bradford Street Railway.

EXTERIOR OF THE OLEAN CAR

INTERIOR OF OLEAN CAR

Following are the chief dimensions of the new rolling stock, which apply to both types of cars: Length over end panels, 31 ft. 8 ins.; over crown pieces and vestibules, 41 ft. 1 in.; width over sills, including sheathing, 8 ft. ½ in.; over posts at belt, 8 ft. 4 ins.; sweep of posts, 1¾ ins.; centers of posts, 2 ft. 8 ins.; size of side sills, 4¾ ins. x 7¾ ins.; end sills, 5¼ ins. x 6⅞ ins.; sill plates, ⅜ in. x 12 ins.; thickness of corner posts, 3⅝ ins.; side posts, 3¼ ins. All of the cars are equipped with the No. 27-E1 trucks with 6-ft. wheel base. These trucks have solid forged side frames and have the manufacturer's type of brake hanger known as the "Noiseless." Four motors of 40-hp capacity each were installed on each car. The interiors are finished in mahogany, inlaid. The partitions dividing the smoking and passenger departments have windows on each side. The baggage compartments are 9 ft. 2 ins. long and have the regular equipment; the smoking compartments occupy the space of three windows. The cars are equipped with spring cane seats which have push-over backs and are of the Brill type.

INTERESTING CARS FOR PENSACOLA

The Pensacola Electric Company, which is under the management of Stone & Webster, connects Pensacola, Warrington and Fort Barrancas. It has a trackage of 25 miles and operates about fifty cars, some of which were recently supplied by the J. G. Brill Company, of Philadelphia.

The new cars have flush platforms with two steps at each side, as the cars are intended for mixed conditions of city and interurban service, necessitating high-speed trucks, which carry the body too high to admit of single steps with drop platforms. The car in the photograph was temporarily mounted on trucks which were at hand for photographing; these trucks were later replaced by the Brill No. 27-E1, which is in standard use on the system. Brill portable vestibules and folding gates are provided for the platforms.

INTERIOR OF PENSACOLA CAR

The window system is of the stationary upper sash and lower drop sash type. The interiors are finished in cherry with birch veneer ceilings. Spring cane upholstered seats with push-over backs are of Brill make, as are also other specialties with which the cars are equipped. The chief dimensions follow: Length over end panels, 36 ft.; over crown pieces, 46 ft.; width over sills, including sheathing, 8 ft. 5½ ins.; size of sie sills, 4 ins. x 8¾ ins., plated with ⅜-in. x 15-in. steel; center sills, 4½ ins. x 5½ ins.; end sills, 5¼ ins. x 6⅞ ins.

EXTERIOR OF PENSACOLA CAR

The Columbus, Marion & Delaware Railway Company is building a freight station on North Main Street, Marion.

LONDON LETTER

(*From Our Regular Correspondent.*)

The fact that the London County Council elections take place within the next few weeks has brought the whole London tramway situation into somewhat undue prominence, the two parties, the Progressive and the Moderates, making the most contradictory statements regarding the results of the tramways. In the daily papers columns upon columns have been appearing, some from outside writers, but some also from the pens of the chairman and the ex-chairman of the tramways committees of the London County Council, and were it not for the fact that most of these are written for electioneering purposes, they would be valuable contributions to the economics of tramway management. Naturally the Moderates accuse the present London County Council of extravagant management and lavish expenditure in connection with the tramways, but the statements are so mixed up with the extravagant electioneering propaganda that the truth is not easily arrived at. The fact remains above all else, however, that London has been extremely backward in providing herself with tramways, and that, notwithstanding the huge expenditure, the area of London is not yet one-half equipped. From that point of view alone, the Progressives, so far as the tramways are concerned, are worthy of all encouragement, and though the London County Council may have put down a system of tramways involving the conduit construction, which necessarily has made the cost very great, still in the central portions of London it would have been impossible to get the consent of the various boroughs to a proposition for overhead equipment. Even now, after the experience of several years in the outlying districts where they are endeavoring to electrify the tramways, these districts will not give their consent to overhead construction, so that the County Council have a difficult task to satisfy all. In the writer's opinion mistakes were certainly made in putting down in the outlying districts so much underground conduit, but that should be no reason why such boroughs as Islington or Bow should now insist upon conduit construction being put through their boroughs from an aesthetic point of view. How it would be possible for well-constructed overhead system to spoil the aspect of the streets in these districts it is difficult to imagine, and the objections from these outlying boroughs are simply of an obstructive character and petty in the extreme. Meantime the work of the London County Council on new tramway schemes is making excellent progress. A very useful connection has just been made at the south end of Westmininster Bridge, by which the Embankment tramways are now available for all of the cars operating on the route from St. Thomas' Hospital, southward by way of Battersea and Wandsworth. The Council has decided to commence at once the electrification of the South London horse tramways recently acquired by it, and the first part to be electrified is that between Brixton Road and Vauxhall, the old tramway depot in the Stockwell Road being converted into a sub-station. The Council has also decided to invite tenders for the construction of the tramways from Grove Vale to Newlands, by way of Peckham Rye, giving a direct service from this district to the bridges. The conduit system on this line will be adopted, particularly in view of the adjacency of the Greenwich Observatory. While mentioning this observatory, it is interesting to note that the two committees appointed some time ago are working in entire harmony, and a solution of the difficulty is within sight. Other important electrification schemes have been decided for various routes from Greenwich to Lewisham and for connecting links in that vicinity and for certain portions of that line the overhead system will be used. It is also proposed to construct a line of tramways across Putney Bridge, so that it may link up the Middlesex County Council's tramways at Harlesden with Shepherds Bush, Hammersmith and the south of London. The electrification of the tramways in the Islington district are at present, however, being held up, as the Islington Borough Council has refused its sanction to the electrification of the tramways by the overhead system. The London County Council has decided that it will apply to the Board of Trade for approval of an overhead installation, pointing out that this system would effect a saving of £40,000. All the schemes of the London County Council which have been submitted by the highways committee amount to a total length to be electrified in the immediate future of over 30 miles, and involving an expenditure of about half a million pounds. The highways committee is also carefully considering the matter of half-penny fares, and is recommending the adoption of these fares on the northern section of tramways, similar to that which is already in operation on the southern tramways. It is pointed out that during the past year on the southern electric tramways over sixty-one million people took advantage of the half-penny fares, which is one-third of the total number carried.

At Bristol, a few days ago, a conviction was secured against two colliers for refusing to go on top of a car instead of inside when they were asked to go outside by the conductor. It appears that the car was a workmen's car, but these colliers came direct from their work at the pit's mouth, and in the opinion of the conductor their clothes were in such a condition that they might soil or injure the cushions or other passengers' clothing. In the court, the company was careful to explain that it was not objecting in any way to colliers in themselves, but did object to any passenger going inside a car with his clothing in such a condition as would make it disagreeable for anyone else to sit next him. The Bench decided in favor of the company and fined each of the colliers the sum of 25 shillings. By the way, the Bristol Tramways & Carriage Company has had a most successful year, its profit for 1906 being over £90,000, a little more than £5,000 more than the previous year. After paying all interest and putting an adequate sum to depreciation in reserve, the company is able to pay 9 per cent on the ordinary shares for the year. The most interesting point about last year's work, however, has perhaps been the company's experiment with motor omnibuses, though nothing very definite is published in the annual report about the working, further than the proof of their ability to carry a large volume of traffic. These experiments have naturally been in the way of using these motor omnibuses in outlying districts, where the tramway lines did not reach, as feeders to the system. Though no figures are given in the report as to their working expenses, the general statement is made that the percentage of working expenses is necessarily high.

The Dublin Tramway Company continues in its successful career, the amount available for distribution in dividends during the past half year being £51,704, which is more than £2,000 over that of the corresponding period the previous year. Substantial amounts have also been placed to reserve and renewals, and a large amount has been placed to their maintenance account. Several important improvements have been made during the past year, and a number of new cars have been put on various routes. The company is also doing excellent work in providing a number of cottages for the use of its own employees and the first lot of twelve erected have been completed and immediately occupied. This housing accommodation has been provided near the depots so that the employees will be able to reside near where they begin and end their day's work.

The Corporation of Manchester has had a rather curious experience during the past month as regards the extensions to its valuable tramway system. One would have thought that the tramways had found favor in the sight of all Manchester residents, but it would appear that recently when it was proposed to extend these tramways through certain streets there arose considerable opposition, so strong in fact that the Corporation was compelled to resort to a poll of the inhabitants to find out whether its bill in Parliament to go on with these extensions was to be proceeded with or not, costing Manchester for this experience something like £2,000. Needless to say, however, the result of the poll was entirely favorable to the Corporation; in the first place the ballot cast being a very small one, and the result being overwhelmingly in favor of the tramway extensions. The reason for so small a proportion of the electors voting, only about 10 per cent having been induced to go to the polls, may be that the extensions proposed are really connecting-links from already existing routes, and the objections naturally came from people who thought they would be disturbed by tramways in these streets. A great portion, therefore, of the electors were sufficiently apathetic in the matter not to vote, but fortunately for the Corporation, sufficient voted to defeat the opposition. The result also goes to show how local opposition can be easily defeated when it comes to a question of benefiting a whole city.

Despite the report of the deputation of the Edinburgh Tramways committee, who had the satisfaction of visiting a number of cities for the purpose of deciding on the best method of providing an extension of Edinburgh's tramways, and despite the report from its own expert and all sorts of advice from electrical engineers representing various systems of electric tramway construction, the members of the tramways committee of Edinburgh

Town Council have now committed themselves once more to the cable system for the extension of the tramways of the Gilmore Place routes, the other extensions before the committee being rejected. Thus the whole question of the Edinburgh tramways has been once more postponed as no one thinks for a single moment that the cabling of the Gilmore Place route will solve the problem. Naturally the decision has given rise to a great deal of comment, even by the most conservative of Edinburgh citizens. The cable system does not fill the necessities of the case and many of the inhabitants of the city who have traveled much are quite willing to admit that even Princes Street, which is the great show street of Edinburgh, would not be ruined by an installation of the overhead system. As far as the other streets of the city are concerned, I do not know that anyone has ever claimed any special beauty for them, and they are certainly not any better than the streets of any other city, and many of them are a good deal less beautiful. It certainly would be quite possible to make a combined overhead and either underground or surface contact system, and this Edinburgh will surely be compelled to do in the years to come.

The report of the work of the Glasgow Corporation Tramways for the past six months by Mr. Dalrymple, the general manager, contains some interesting information. Firstly, it is pointed out that more electric plant will be required at Pinkston power station, which was opened in 1901, and is at present equipped with four vertical engines of 2500-kw capacity each, besides two smaller auxiliary engines. The demand on the plant has steadily increased, so that as 75 per cent of the plant is in use at one time, there is really no standby-engine in case of accident. He now advises the committee to advertise for two turbo-alternator sets of 3000-kw capacity each, together with the necessary boilers. Mr. Dalrymple also makes a report on the question of double-bogie cars and has come to the conclusion, after experiments, that for Glasgow conditions the present single-truck car is more useful. He believes in having a larger number of comparatively small cars rather than a smaller number of larger cars; the smaller cars are safer on the curves, weigh very much less and only cost about three-fifths of the large double-bogie cars and can be run more frequently with better results.

An extension of the car system of the Lanarkshire Tramways Company from Cambuslang to Blantyre opens up a possibility that would hardly have been thought of some years ago. The rails of the Glasgow Corporation Tramways already extend to Cambuslang, a distance of about 15 miles, and with the new section now opened, the whole systems of the Lanarkshire Tramways Company and the Glasgow Corporation are now connected, making a direct open stretch of about 28 miles from the furthest point of the company's system to the most westerly point of the Glasgow tramways. Another interesting point in connection with this is that the Dumbartonshire Tramways Company is about to lay down a line from Dalmuir to Balloch, and this system also joins the Glasgow Corporation Tramways, so that when this link is completed, by means of the Glasgow Corporation Tramways and the tramways of the two above mentioned companies, it will be possible to journey a distance of about 40 miles from the heart of the busy coal region in Lanarkshire to the beautiful scenery on the banks of Loch Lomond. Blantyre is also interesting as the birthplace of Dr. Livingstone, while the tramways in the Lanarkshire coal-field district also pursue a route which has many picturesque and historical associations. The battle of Bothwell Bridge was fought in the immediate vicinity and the battle of Langside not far away. Hamilton Palace is also in the immediate vicinity and the Falls of Clyde.

It is reported from Macclesfield that Parliamentary powers are likely to be sought for the construction of a light railway from Sheffield, via Tideswell, Buxton, past the famous "Cat and Fiddle" Inn, to Macclesfield, then proceeding to Knutsford, and thence to Warrington. It is stated that a survey has been made, and that already many influential public men in the districts to be served have given their hearty support to the undertaking.

By a resolution adopted by a small majority, the shareholders in the Torquay Motor Omnibus Company agreed to sell their eight omnibuses and accessories to the Harrogate Road Car Company, and voluntarily to wind up the company. The step is taken, not because the omnibuses have not paid, but because electric tramways are about to begin running in the town, and their competition is feared. The shareholders will receive back the whole of their capital and a bonus also.

The total receipts for 1906 of the Leeds Corporation Tramways were £318,234, or an increase of £17,612 as compared with 1905. This is equivalent to an expenditure in tram fares of 13s. 11¼d. per head of the city's population, as compared with 13s. 2d. in the previous year. The number of passengers carried was 71,750,330, as against 67,314,334 in 1905. This is equal to carrying the entire population of the city 157 times during the year. The receipts per car-mile were 10.57d., an increase of .30d. over the previous year.

The Light Railway Commissioners have approved the application of the Llandudno & Colwyn Bay Tramway Construction Company for powers to carry a light railway through the town. Three years ago a partial scheme for the outskirts was passed, and now the promoters sought powers to tap the main business thoroughfares, supported by the District Council. The tramways will not run on Sundays.

At the London, Brighton & South Coast Railway Company's meeting, the figures of 1906 were compared with those of 1903, when the tramways of South London first began to compete with the railway. A diminution of over 6,000,000 in the number of passengers carried was shown, the second class alone showing a falling off of nearly 25 per cent. Comparing the half year with the corresponding period of 1905, there was a decrease of over 1,000,000 passengers, and on the whole year nearly a million and a half, mainly in the suburban and short-distance traffic. The additional rail motor services established by the company had resulted in about 1,000,000 passengers being carried, as compared with 130,000 in 1905. As the cost of running a motor train was about one-third of that of an ordinary train, additional cars were to be built and more of the small engines converted for those services.

A. C. S.

PARIS LETTER

(From Our Regular Correspondent.)

Early in the year a strike occurred on the system of the Tramway Sud of Paris, which affected the service on a number of lines on the southern side of Paris. The Tramway Sud is perhaps the most important of all the lines in the French metropolis, and the suspension of its service caused very great inconvenience to thousands of Parisians. The whole of the operating force, to the number of 1600, ceased work, and there was almost immediately a total suspension of the service on the lines of the company, which not only include some 20 miles within Paris but also extend from the city to various suburban districts. The cause of the strike was the new law relating to weekly rest for workmen and employees, which went into force late in 1906, and immediately became the cause of heated discussion and disputes in many trades and industries. Tramway companies were included among the other commercial interests affected, and legal cases were not slow to appear in view of the rather lax wording of the law. It was apparently left to the local authorities to decide whether the tramways and interurban railways in their districts came under the new law. In one case at least, that of Brest, the magistrates decided that the tramways of that town came under the same category as railways, and to this class of industry the obligatory clauses regarding the weekly day of rest do not apply, although the employees must be compensated by a rotation holiday, which need not necessarily fall on Sunday. Previous to the passing of the new law the Tramway Sud had allowed its drivers, conductors and other employees two whole days holiday per month with pay. There was nothing obligatory about this. The new law obliges the employer to allow four days rest per month, which was duly done, but the company protested against the payment of wages on these four days, while the men claimed that full pay should be given. It will be seen that the company, in continuing the payment on two days, paid what is equivalent to four half days' wages, beyond which it flatly refused to go. Hence the strike. The lines of the system have been completely shut down for weeks. Attempts have been made to run a certain number of tramcars by means of new men, but the municipal regulations on this point are severe and strictly applied, and progress along these lines has been slow. A motion was made in the Municipal Councillor's meeting to annul the company's franchise, but matters have not gone so far as to warrant such a measure. At the present time everything is at a complete deadlock, and the attitude of the men is only equaled by the firmness of the company, which declared that it positively cannot afford to allow the men full pay for the four days rest imposed by the new law.

CHICAGO TRACTION QUESTION IN POLITICS

The contest for the nomination for Mayor of Chicago on the Democratic ticket between ex-Mayor Harrison, who favors the street railway franchise ordinances passed recently by the City Council, and Mayor Dunne, who opposes the ordinances and contends for municipal ownership, terminated in the selection of Mayor Dunne, upon a platform almost entirely devoted to the traction question, which denounces the present traction ordinances and declares for municipal ownership. The platform in part reads:

The Democratic party is unalterably pledged to municipal ownership of all public ulitities, to the end that service for the whole people rather than profit for a few shall result from the operation of public necessities.

In the course of these negotiations (those to secure immediate rehabilitation of the lines) the traction companies, backed by the stock-jobbing interests of New York and Chicago, made unreasonable demands upon the city and finally secured from the Council, over the veto of Mayor Dunne, ordinances that are so drawn as to make municipal ownership practically impossible.

These ordinances are now before the people on referendum, and should be voted down. Pretending on their face to provide for municipal ownership, they are, in fact, private franchises for twenty years or more.

Much was conceded by the administration during the negotiations for the ordinances, with a view of making a peaceful settlement, enabling the city to municipalize at any time upon reasonable notice. These concessions were reasonable if that object could have been accomplished, but, under these ordinances as submitted to the people, municipal ownership is practically impossible. For this reason the Democratic party condemns the ordinances and urges the people to defeat them at the polls.

The Democratic party irrevocably pledges itself and its candidates to the principle of the referendum. Whatever may be the will of the people as expressed at the polls must be executed faithfully by their representatives. Should these ordinances be approved by the people, notwithstanding their dangerous character, we must have public officials who will steadfastly guard the people's rights therein. If, however, these ordinances are defeated by the people we must have public officials who will prevent the enactment of other franchise ordinances. In the event of the defeat of the ordinances at the polls the city should assert its right under the eminent domain act and condemn these properties in the courts. Pending the condemnation of the property and rights of the companies the city should not enter into any further negotiations except for the purpose of temporary occupancy of the streets under licenses revocable at any time at the will o the city.

We reiterate our demand for home rule in Chicago on matters of local concern, and insist that all citizens should have the largest measure of personal liberty that may be compatible with peace and good government.

We oppose the granting of any further franchises or privileges to the Union loop. This loop has become a tremendous obstacle against the development of the city and should be removed from our streets as soon as this can be legally accomplished.

The Republican mayorality platform, it is reported, will approve the traction ordinance. Chairman James Reddick, of the Republican county committee, after a meeting of the committee, is quoted as saying:

The committee was of one mind concerning the traction ordinances. It is possible that there are some sections that could be improved, but the committee believes that on the whole they are the best measures that can be secured by the city from the traction companies. They represent the best judgment of the Council committee on transportation and nearly all the members of the Council, and with that approval the committee feels that it should go on record in their favor. The committee believes that it is time that the traction question should be taken out of Chicago politics forever.

With this purpose of indorsing the ordinances in view, Aldermen Milton J. Foreman and Bennett were appointed members of the committee as having led the fight in favor of the measures, both in the Council committee and on the floor of the Council.

The most likely candidates for Mayor on the Republican ticket are Postmaster Busse and Alexander H. Revell, both business men.

What was known as the "three-pronged petition," which was one of the petitions circulated recently to secure a referendum vote on the traction ordinances, has been declared illegal by the Board of Election Commissioners.

Various organizations throughout the city are passing resolutions favoring the passage of the traction ordinances at the April election. A joint committee of the Chicago Commercial Association and the Chicago Real Estate Board, appointed in the interests of the ordinances, has engaged a secretary, will rent down-town headquarters, and has sent out a letter asking all non-political organizations to send delegates to a meeting to be held Feb. 26. The name of the present organization is the Citizens' Non-Partisan Traction Settlement Committee.

Plans for the reorganization of the Union Traction Company into the Chicago Railways Company, with authority to accept the traction ordinances now pending, are being formulated in New York. The reorganization program, it is said, will be submitted to Prof. John C. Gray, of Harvard University, and Judge Grosscup, receiver of the road.

TEXAS LEGISLATURE GRANTS RIGHT OF EMINENT DOMAIN

The Texas Legislature has passed a bill giving interurban electric railway companies the right of eminent domain. The bill was drawn especially in the interest of the proposed interurban electric railway that is about to be built between Houston and Galveston by Stone & Webster, of Boston. It is stated that this line will now be built without further delay. It will be 51 miles long, with a branch line to one or more pleasure resorts on Galveston Bay.

NEW YORK SUBWAY CONTRACTS APPROVED

The original contract for the Lexington Avenue subway was approved last week by the New York Rapid Transit Commission without any of the modifications asked for by the Interborough Company, which had objected to the "burden of proof" clause allowing the Commission to order increases in rolling stock and changes in the stations, and to go into court to enforce its orders, the burden of proof that such orders were unreasonable being placed upon the operating contractor. The contract as approved carried the section provided that the bidder should state to what lines transfers would be issued. The issue of transfers was not mandatory, however, but was to be a factor to be taken into consideration in the awarding of bids. So far as the transit commission is concerned the matter of the Lexington Avenue contract is settled. It must next go to the Board of Estimate. It provides for the cut and cover method of excavation on Broadway.

The matter of the Behr mono-railroad to Coney Island from Atlantic Avenue, also came up. Mr. Orr brought the matter up by saying that he had received a letter from Mr. Behr asking that the Commission recede from its former position.

"He promises that he will get the consent of the abutting property owners," said Mr. Orr, "that he will get the capital, and that he will build the road without aid from the city in a year's time. The route he plans does not interfere with any of ours. If the people want it and the city does not have to pay anything I think we should consider it."

"I think so, too," said Charles S. Smith, "if the company is willing to pay a reasonable price for a franchise and will carry people from New York to Coney Island for a single 5-cent fare."

It was finally decided that the committee on contracts should determine whether Mr. Behr was able to carry out the project and had sufficient backing.

Controller Metz thought that the Fourth Avenue, Brooklyn, subway should be delayed until the Third Avenue and Bronx to Coney Island line, known as the Tri-Borough route, should be in shape. Then more bids would be obtained than by advertising the Fourth Avenue route separately. This was agreed upon. Engineer Rice stated that he would have the complete specifications ready in six weeks, and the specifications for the Seventh and Eighth Avenues routes in three weeks.

The Commission voted to pay the bills for the work of ventilating the subway, on the ground that the installation was construction work.

President Bryan, of the Interborough Rapid Transit Company, has written to the Rapid Transit Commission intimating that his company will shortly send in a demand for payment for the extra work done in the construction of the present subway. While the tunnel was building, and since its completion also, the Commission has ordered additions to the original plans and certain modifications, the extra cost of which are estimated by Chief Engineer Rice at about $5,000,000 The largest item in the bill will be for the building of the conduits for electrical wires.

CHICAGO & MILWAUKEE TERMINAL PLANS CHANGED

The Chicago terminal station of the Chicago & Milwaukee Railway Company will be located at Second and Wells Streets, the company having secured a ninety-nine-year lease of the property on the northwest corner of those two streets. An ordinance granting the company the right to lay its tracks from the north end of the Sixth Street viaduct northeasterly to Fifth Street, thence north to Wells Street, thence east to West Water Street and on Second Street from Wells Street to Grand Avenue has been submitted to the Common Council. It had been supposed that the terminal station of the company would be located in the vicinity of Sixth and Wells Streets, but the fact that the curves on the original route at the corners of St. Paul Avenue, Sixth and Seventh Streets are too sharp to permit the operation of the large cars, the company, through its president, A. C. Frost, desires to change the route. The company also asks the right to build the tracks on 12-ft. centers instead of 11-ft. centers, which, it is believed, will make a better and safer construction. This will increase the paving 1 ft. in width. Mr. Frost has asked the Council to extend the time in which to complete the road until Oct. 1 of this year. Under the ordinance, the company is obliged to complete the construction work by Aug. 27, but Mr. Frost declares there is a great deal of heavy construction work to do just south of Milwaukee, and this may cause some delay. He promises to take advantage of the extension of time only if it becomes necessary. The ordinance relating to the change in the route was referred to the committees on judiciary and railroads, and will be reported to the Council at an early date.

STEEL TIES BELIEVED TO HAVE BEEN PARTIALLY RESPONSIBLE FOR PENNSYLVANIA WRECK

As a result of the investigation of the wreck of the Pennsylvania Railroad's Chicago flyer, near Mineral Point, Friday, Feb. 22, the committee appointed by the Pennsylvania Railroad Company to investigate the cause has issued a report, in which it says:

"We are unable to account definitely for the cause of the accident, but the best reason for it that we can advance is that at the point where the derailment occurred some foreign material became wedged between the flange of the left rear tender truck wheel and the inside rail.

"We are of the opinion, on account of the lack of positive evidence as to the cause of this derailment, and on account of the fact that the damage subsequent to the derailment was more serious than would have been the case with wooden ties, that the remaining steel ties should be removed."

ORGANIZATION IN PENNSYLVANIA

The electric railway interests of Pennsylvania propose to look after their interests systematically, and have formed a temporary street railway association, with W. E. Harrington, president of the Pottsville Union Traction Company and manager of the Eastern Pennsylvania Railway Company, as chairman, and have retained Ex-Attorney-General Hampton L. Carson, of Philadelphia, to advise the association on all legal points connected with legislation now under consideration or in process of enactment. The electric railway interests favor the introduction of a bill covering the subjects of eminent domain, freight transportation and the right to absorb railroad companies.

PEORIA & PEKIN TERMINAL PROPERTY SOLD

The Peoria & Pekin Terminal Railway was recently sold at receivers' sale to John S. Stevens for $600,000, Mr. Stevens representing the stockholders of the newly organized Peoria Terminal Railway Company, the officers of which are: T. A. Greer, president; W. J. Conzelman, vice-president; W. J. Jack, secretary; Frederick H. Smith, treasurer. This sale insures a close alliance of the property with the Rock Island & Alton Railroad. In connection with the sale a number of important improvements are rumored, the first of which is said to be an effort to gain another entrance into the heart of Peoria. At present the Terminal Company is operating into Peoria over the Central Railway Company's lines, but the contract with the latter company is said not to be entirely satisfactory to either of the parties to the agreement.

LEGISLATION IN IOWA

The present session of the General Assembly of Iowa has witnessed the introduction of about 400 bills, about sixty of which affect the railroads. Fifteen of the sixty relate to the lowering of passenger rates, and vary as to rates from 3 to 2 cents per mile.

The interurban interests as well as the steam railroads of the State made a determined fight before the railroad committees in the two houses against the low-fare bills, the representatives of the steam lines declaring that the business within the State did not justify the lowering of the passenger rates, and the representatives of the interurban lines declaring that the lowering of the rate on the steam lines would drive the interurbans out of business, as it would make the steam lines more of competitors than ever; that this would make Eastern capitalists hesitate before investing in interurban projects, and as a result the building of interurban lines would be retarded. Despite these arguments a bill was reported before the House for passage and passed. This bill provides for a straight 2-cent fare rate on all steam railroads with normal gross earnings of $4,000 per mile or over; 2½ cents per mile for railroads with gross earnings of $3,000 and not over $4,000 per mile; and 3 cents per mile for railroads with gross earnings of less than $3,000 per mile. Before the bill went to the Senate committee the steam railroad interests made a proposition to sell family mileage books for 500 miles and over at the rate of 2 cents per mile, and then to make a flat rate of 2½ cents per mile on all steam railroads in the State regardless of class. It is believed, however, the Senate committee will report the House bill for passage.

It is also believed that a reciprocal demurrage act will be passed, and that acts to increase the powers of the Railroad Commission to fix freight rates and establish joint rates between interurbans and steam railroads will pass. The anti-pass act of one year ago will be so amended as to conform to the national law on that subject. The interurban interests are supporting the joint rate act, and hearings on this subject were set for Feb. 26.

Several acts requiring street and interurban railroads to vestibule their cars have been introduced.

UNDERWRITERS' NATIONAL ELECTRIC ASSOCIATION

The annual meeting of the electrical committee of the Underwriters' National Electric Association will be held at the rooms of the New York Board of Fire Underwriters in New York, on March 27 and 28, for the purpose of making changes and additions to the national electric code. As is well known, it has always been the endeavor of the electrical committee to make only such changes in the code as are made necessary by progress in the art, or such as have been shown by some field experience to be necessary to safeguard against hazard, since changes in the code, even if necessary, cause more or less confusion and trouble. It will be remembered that at the last meeting of the electrical committee in December, 1905, there were submitted matters of such importance as to require further consideration before action was taken. These various matters were referred to sub-committees, by whom they were considered during the past year, and their reports will be considered by the full committee and finally brought before the general meeting in New York for action. The following committee reports will be considered: Committee on rules for signaling system; committee on slow-burning, weather-proof wire; committee on wiring and equipment of street railway property, including rolling stock; committee on double and single-pole switches; committee on variable-speed motors; committee on theatre wiring; committee on construction and installation of rheostats; committee on series lamps; committee on insulating joints; committee on outlet boxes; committee on metal mouldings; committee on laboratory report in condulets; committee on rule 13A; committee on omitting fuses in neutral of three-wire systems, and committee on electric signs. There are also a number of suggested changes in the rules to be given consideration, as well as a number of miscellaneous suggestions.

INCREASE IN CAPITAL PROPOSED FOR DENVER TO BE USED FOR IMPROVEMENTS

At the Denver City Tramway Company's annual meeting, to be held Feb. 19, the capital stock will be increased from $5,000,000 to $20,000,000, and a new bond issue of $20,000,000 authorized. The money will be used mainly for the construction of 70 miles of new track, the extending and improving of two viaducts, and the erection of new shops and car houses. The courts recently decided that the company legally acquired a new twenty-year franchise over certain streets. The franchise was attacked, but found valid. It does not seem probable that there will be any further litigation in connection with the matter. Part of the money will be used to continue the construction of the Denver, Northwestern & Pacific Railway, building from Denver to Salt Lake City. David H. Moffat and William G. Evans, head officers of the Tramway Company, are in New York City completing arrangements for the financial reorganization of the company.

HAVANA ELECTRIC MEETING POSTPONED—REPORT OF CHANGES IN THE COMPANY

The annual meeting of the Havana Electric Railway Company, operating the electric railways in Havana, Cuba, which was to have been held in New Jersey, Tuesday, Feb. 26, was postponed until March 6. This postponement, it was reported, was at the request of certain stockholders of the company, presumably for the purpose of allowing more time for the adjustment of the company's affairs. From unofficial reports it would seem that differences as regards policy have developed between the Cuban interests on one side and the Canadian and American interests on the other side, who control the property. It was even reported that General Manager Greenwood had tendered his resignation to the company, his connection to cease May 1, and that Edwin Hanson, the president of the company, would also retire from the company. William Hanson, of Montreal, the brother of the president, however, discounted the statement regarding the retirement of the president. As regards Mr. Greenwood's resignation from the company nothing of a definite nature could be obtained.

DES MOINES COMPANY'S FRANCHISE UPHELD

Judge Smith McPherson, in a decision filed in the Federal Court, Wednesday, Feb. 22, holds that the Des Moines City Railway Company had a franchise in the city of Des Moines, that the old Turner franchise granted Dr. Turner in 1866 is still in force and effect, but that the monopoly feature of that franchise expired in 1898, and enjoins the city of Des Moines from tearing up the tracks of the street car company as the Council so voted last fall.

The decision is the first one upon the merits of the case in the litigation brought to test the validity of the franchise of the Des Moines City Railway. Under quo warranto proceedings the Civic League, through Robert Fullerton et al., went into the District Court of Polk County and secured from Judges Howe and Brennan a decision that they, as relators, had a right to appear in such proceedings to test the validity of the Turner franchise as to its perpetuity. This decision of the District Court was appealed to the Supreme Court of Iowa and affirmed, which in effect sent the case back to the District Court of Polk County on its merits for trial. There has as yet been no trial. The City Railway asked for a rehearing in the Supreme Court, and this motion is still before the Supreme Court. If upon rehearing the Supreme Court still holds that the original decision of Judges Howe and Brennan is good law the case will come up in the District Court of Polk County on its merits. In all of the legal sparring in Polk County and the Supreme Court of Iowa there has been no evidence taken or argument made as to the merits of the City Railway's claim, hence no decision upon this point. This may still be taken up in the District Court. The decision of Judge McPherson is the first where the facts were all taken into consideration.

CONSOLIDATION PROPOSED IN BUENOS AYRES

The London financial papers announce the organization of a strong Belgian and German syndicate which proposes to consolidate two or all of the tramway undertakings of Buenos Ayres. These number no less than eight different companies. Seven of these are British, the eighth being a small company, with Argentine capital and control. The British companies are: Anglo-Argentine Tramways Company, capital £2,900,000; B.A. & Belgrano, capital £850,000; Buenos Ayres Electric Tramways, capital £250,000; B.A. Grand National Tramways, capital £1,075,000; B.A. Lacroze Tramways, capital £2,000,000; B.A. New Tramways, capital £216,000; B.A. Port & City Tramways, capital £200,000; total, £7,491,000. This is exclusive of debentures, which bring up the total to considerably over £8,000,000, or about $40,000,000.

ACCOUNTANTS QUESTION BOX

Frank R. Henry, auditor, United Railways Company of St. Louis, has been appointed editor of "Question Box" of the Accountants' Association this year, and requests that members should send their questions promptly to him. In writing the questions illustrations may be used if they will make the question clearer.

The executive committee has decided to follow a slightly different course this year in connection with the Question Box than that employed formerly. The following is the plan adopted for this year:

1. All "questions" are to be "edited" before being submitted to the members.
2. All "answers" are to be "edited" before being printed and sent out to the members.
3. Only such questions and answers as are of general interest, or upon which additional information is desired are to be taken up in the convention.

ANNUAL REPORT OF THE LOUISVILLE RAILWAY

The Louisville Railway Company has issued its annual report for the year ended Dec. 31, 1906. The income account compares as follows:

	1906	1905
Gross receipts	$2,523,343	$2,298,619
Operating expenses and taxes	1,563,314	1,422,953
Net earnings	$960,029	$875,666
Other income	69,653	57,201
Total income	$1,029,682	$932,867
Fixed charges	350,271	351,500
Surplus	$679,411	$581,367
Dividends	596,706	501,706
Surplus	$82,705	$79,661
Charged off for depreciation, etc.	70,000	65,000
Surplus for year	$12,705	$14,661

The condensed balance sheet as of Dec. 31, 1906, is as follows:

ASSETS	
Securities owned (including interurban lines)	$1,264,605
Bills and accounts receivable	118,572
Material, supplies, live stock, etc.	193,922
Cash	310,426
Real estate and buildings	958,249
Machinery and car equipment	1,940,739
Permanent way, franchise, etc.	10,838,856
Total	$15,625,370
LIABILITIES	
Capital stock paid in	$7,456,500
Bonded debt outstanding	6,999,300
Funds for taxes and insurance	114,530
Interest and dividends accrued	325,829
Pay rolls and accounts payable	80,450
Profit and loss account	648,761
Total	$15,625,370

TOKIO UNDERGROUND RAILWAY

"The Bulletin Commercial" has received from the Belgian legation in Tokio particulars of a scheme to construct across Tokio an underground railway. The distance is about 12 miles, and the cost is estimated as low as $625,000 a mile. A company is to be formed with a capital of $7,500,000. It is expected that a uniform fare of 2½ cents will produce a dividend of 8 1-5 per cent. The Electric Tramway Company, of Tokio, has asked for sanction to extend its system by the construction of an addition of 60 miles.

NEW ENGLAND STREET RAILWAY CLUB MEETING

The February meeting of the New England Street Railway Club will be held at the American House, Boston, Thursday evening, Feb. 28. Dinner will be served at 7 o'clock, and at 8 o'clock the regular business meeting will be held, after which Prof. A. S. Richey, of the electric railway engineering department, Worcester Polytechnic Institute, will give a lecture on "Electric Car Testing."

CINCINNATI, COVINGTON & NEWPORT PROPERTIES LEASED

The Columbia Company has closed a lease for the properties of the Cincinnati, Newport & Covington Light & Traction Company for a period of ninety-nine years and has agreed to deposit $1,250,000 in cash or bonds in Cincinnati banks to insure the agreement being carried out. It is also stipulated that the stockholders of the old company may acquire bonds of the new company in the ratio at par of two to one, and with each amount of bonds thus subscribed for an equal amount of the Columbia Company's stock shall be given. President Ernst is to be retained as the head of the properties. The Cincinnati, Newport & Covington Light & Traction Company controls the light and traction business in Newport, Covington, Dayton, Bellevue, Ludlow, West Covington, Bromley, Fort Thomas and Latonia, and some other lines have been planned which the new company will probably build. The Columbia Company is having some trouble in acquiring the two artificial gas companies in Cleveland on account of an injunction suit one of the stockholders of the Peoples' Gas Light Company has brought, and also because of the uncertainty as to the offer of furnishing natural gas instead of artificial. While it is understood that an agreement has been reached by which the properties will be acquired by purchase, many of the details will have to be worked out.

Some of the improvements that have been decided upon are the extension of the Lewisburg line to Erlanger, extension of the Monmouth Street line from Evergreen Cemetery to Fort Thomas, new line over a new bridge over the Licking River from the new Andrews steel mill at Finchtown back of Wallace Woods down into Covington, $100,000 in new rolling stock and the erection of sub-stations and new mains when natural gas is substituted for artificial. The amount to be expended for these improvements and extensions is $884,000.

UNOFFICIAL STATEMENT OF TERMS OF CONNECTICUT RAILWAY & LIGHTING-CONSOLIDATED DEAL

While the terms of the lease of the Connecticut Railway & Lighting Company's property to the Consolidated Railway Company are still withheld from publication, having been given out only in confidential form, a statement issued in New Haven gives the following particulars, which are, of course, open to inaccuracies and the aforesaid possibility of change:

"The preferred stock which, Aug. 1, 1906, was 60,228 shares of $100 each, is to be raised to 81,429 shares by the issue of 21,201 shares, representing cumulative dividends upon the preferred stock, first to be issued in the form of scrip. Of this amount the United Gas Improvement Company, of Philadelphia, will have about three-fourths. Provision is made for payment of $4 a share a year in quarterly dividends on the preferred stock (by its terms a 5 per cent stock, at least, originally) the common stock coming in for the same amount of dividends, provided the $10 assessment is met, and the payments by the lessee company justify it. Attached to the agreement is the lease by the Consolidated Railway Company of the Railway & Lighting Company. This provides for a first payment beginning Aug. 1, 1906, of $975,000, rising to $1,400,000 on Aug. 1, 1914, to be made in quarterly payments except the sums required for fixed charges. The total amount to be paid into the treasury by the lessee company for interest and sinking fund is $673,882, the sinking fund being one-half of 1 per cent upon the bonded debt of the lessor company outstanding, which is $12,491,378, and in addition an underlying bonded debt of $209,000 of the old Connecticut Lighting & Power Company, and $706,000 of the Derby Street Railway Company. The total annual payment to the sinking funds are $62,445 a year up to the 1st day of July, 1980. The lease is made for 999 years.

"Earnings for years ending June 30:

Year	Gross	Net	Other Inc.	Taxes	Interest	Bal. Sur.
1905-06.....	$1,682,740	$747,989	$328,293	$104,483	$584,848	$385,951
1904-05.....	1,420,094	582,477	207,390	92,865	556,422	140,580

"Of the other 'other income,' $327,351 in 1905-06 and $206,737 in 1904-05 was from the gas and electric departments."

AN IMPORTANT CANADIAN CONSOLIDATION

At the annual meeting of the shareholders of the Cataract Power Company, held at Hamilton, the announcement was made that the Cataract Company had been absorbed by the Dominion Power & Transmission Company, which was incorporated a few weeks ago with an authorized capital of $25,000,000. Increase of business and the need for the extension of existing plants of the Cataract Company and the acquisition of other enterprises made it necessary that additional capital be secured, and the organization of a new company was the plan decided on to reach the desired end. As soon as the Dominion Company was organized and incorporated a controlling interest in the Cataract Company was turned over to it. The balance of the stock will likely be transferred in the very near future. The Cataract Company will continue in existence as an operating company, but its stock will be mainly held by the Dominion Company.

The stock of the new company is divided into three classes—preferred, limited preferred and common. The preference stock, by the terms of the Dominion Company's charter, will pay dividends for three years at 6 per cent, and afterwards at 7 per cent per annum. The limited preferred stock will be preferred stock for five years only, after which it will become common stock. The preferred stock of the Cataract Company was taken over by the new company on an equal basis, one share of preferred stock in the Dominion Company being given for one share of preferred in the Cataract Company. The holders of common stock in the Cataract Company shared somewhat better, however. For every share of Cataract common three shares of limited preferred were given by the Dominion Company.

Just what the company intends to do with the roads now controlled by the Cataract Company is unknown. From one source it was learned that the new company had in contemplation the building of electric lines from Windsor to Niagara Falls, and so reach Buffalo.

The Hamilton Street Railway Company, although its stock is held by people who are prominently connected with the Cataract Company, has been operated separately, and will continue as an entirely independent concern.

THE PROPOSED NORWICH-HARTFORD LINE

The petition signed by Costello Lippitt, of Norwich, and others and presented to the General Assembly of Connecticut, as previously noted in the STREET RAILWAY JOURNAL, requests a charter with the right to construct an electric railway to connect Norwich and Hartford, extending through the borough of Colchester and the villages of Yantic, Fitchville, Bozrahville, West Chester, Marlboro, Marlboro Mills, East Glastonbury and Addison. In addition the rights are sought to develop water power to generate electricity and to sell electricity for lighting or power.

The route of the proposed road will have easy grades, and will be more than 10 miles shorter than the distance by the steam railroads through Willimantic, that route being 49 miles. About midway the proposed line crosses the Air Line division of the New York, New Haven & Hartford Railroad, a branch of which division enters Colchester. More than 25 miles of the

central portion of the line, however, are remote from any carrying facilities except these mentioned. The distance to Norwich from Colchester by the highways is 15 miles, and by railroads 31 miles, with two changes of cars and only three trains per day. The distance to Hartford by highway from Colchester is 23 miles, and by the railroad, via Middletown, it is 41 miles, with four trains a day. Via Willimantic the distance is 49 miles, with three trains, the earliest arriving at Hartford at 11 a. m.

Hartford is now connected by electric lines with all the cities and important villages of the fertile and prosperous Connecticut Valley, and Norwich is connected by interurban lines with New London, Westerly and intervening towns, and upon the completion of lines now under construction will be connected with all points of the ocean shore of Rhode Island and Eastern Connecticut, and the proposed line would link the groups of railways at either end. The population of Hartford is more than 200,000, and that of Norwich as a center more than 50,000. George E. Manning, of Yantic, is in charge of the affairs of the company.

THE NEW YORK CENTRAL ACCIDENT

The Coroner's inquest as to the causes of the accident on the New York Central Railroad on Feb. 16, when five cars drawn by two electric locomotives were derailed on a 3-deg. curve near Bronx Park, has been continued this week. The testimony showed that the heads of the spikes on the east side, or outside, of the spread rail were sheared off, and that the rail was elevated for a speed of about 46 m. p. h. Prof. E. B. Lovell, adjunct professor of civil engineering at Columbia University, stated his belief that the spreading of the rails was caused by the excessive weight and speed of the wrecked train, which he said might cause the shearing of the spikes. This was denied by other experts.

ELECTRIC MOTORS AND HEAVY ELECTRIC TRACTION DISCUSSED AT MEETING OF WESTERN RAILWAY CLUB, CHICAGO

At the regular meeting of the Western Railway Club, held at the Auditorium Hotel, Chicago, Feb. 19, James Lyman, Western manager of the engineering department of the General Electric Company, presented a paper, illustrated with experimental apparatus and stereopticon views on the development of the railway motor, motor control systems and the adaptability of the electric motor for heavy traction.

After calling attention to the fundamental principles upon which the operation of the electric motor depends slides were presented showing early types of railway motors and those of the New York Central locomotives. In speaking of the efficiency of motors, Mr. Lyman said that when running free the distribution of the losses were approximately: Copper losses, 4 per cent; iron losses, 6 per cent; gear and bearing losses, 10 per cent; total, 20 per cent. During acceleration they were: Copper losses, 10 per cent; iron losses, 2 per cent; gear and bearing losses, 5 per cent; total, 17 per cent.

The treatment of controllers was rather fundamental in its character, being intended particularly for the steam railway men not at all familiar with them. With regard to the substitution of the electric for the steam locomotive for suburban service and when traffic was congested, Mr. Lyman gave the following advantages for the electric locomotive: (1) From 50 to 100 per cent increased train capacity with the same track facilities, because of increased tractive effort, length of train limited only by station facilities, and operation of locomotives in either direction. In one case being investigated in the West with an investment in electrical equipment of about 30 per cent of the cost of double-tracking a road, the capacity for handling trains will be doubled. (2) Convenience, cleanliness and general comfort of passengers. (3) Safety. (4) Economy of operation. (5) Increased speed at which the electric locomotive can maintain its maximum tractive effort. (6) Ability to maintain higher speeds with safety. In this conection he said that experimental motors were now being designed for express service with a maintained maximum speed of 90 m. p. h.

In the discussion which followed the paper, C. F. Street, of the Westinghouse Electric & Manufacturing Company, said he did not think as did some enthusiastic electrical engineers, that the steam locomotive had seen its day. He said that in Mr. Stillwell's recent paper regarding the subject, Mr. Stillwell was very particular to say that it must not be considered practical or desirable to make substitution in all cases, but that each individual case must be threshed out and solved as an individual problem.

Prof. Woodworth, of the Lewis Institute, Chicago, thought the question of change to electricity as a motive power largely depended on capacity. Where a steam road had reached its capacity it was of advantage to electrify.

M. K. Barnum, assistant to the second vice-president of the Chicago, Burlington & Quincy Railroad, said the question of failures was important, and that in the electric locomotive it appeared that a large percentage of the causes for failure present in the steam locomotive was eliminated. Another feature which appealed to him was the adaptability of electric traction to roads through mountainous regions, where power could be generated by electricity. He said he understood the question had been discussed by one or two of the railroads crossing the Rocky Mountains, and it had resolved itself into the question of how much business they had to transact.

STREET RAILWAY PATENTS

[This department is conducted by Rosenbaum & Stockbridge, patent attorneys, 140 Nassau Street, New York.]

UNITED STATES PATENTS ISSUED FEBRUARY 12, 1907.

832,575. Automatic Switch; Albert N. Bradley, Washington, Ind. App. filed Dec. 20, 1905. Provides a safety device to prevent the closing of an automatic time-switch in the event that a train is entering or leaving the siding at the expiration of the time limit.

843,625. Power Brake; Louis Pfingst, Boston, Mass. App. filed Nov. 19, 1904. The brake spindle is rotated by a solenoid to put on or take off the brakes.

843,641. Automatic Switch Operating Mechanism; Cisco R. Traxler, Winston Salem, N. C. App. filed April 28, 1906. Provides a switch-operating rail and an abutment rail and a swinging shoe suspended from the car and adapted to pass between the switch rail and the abutment rail.

843,701. Automatic Air Brake Coupling for Railway Cars; Frank H. Rutherford, Chicago, Ill. App. filed June 13, 1906. An automatic coupler for air brakes, comprising a longitudinally movable coupling head having a limited swiveled movement oblique to the line of draft, and a longitudinally reciprocal plunger normally pressing forward against the rear end of the coupler head.

843,703. Railway Signal System; Alfred L. Ruthven, Topeka, Kan. App. filed April 20, 1906. A special third rail is provided between the track rails, which is deflected at intervals so as to exert a cam guide action to throw a switch on the car in addition to its function of establishing a signal circuit. The purpose is to provide a block signal system.

843,739. Electric Insulator; Frederick A. Feigert, Shelbyville, Ind. App. filed March 19, 1906. Has a saddle on its upper surface for a messenger cable and a hanger depending therefrom to support the trolley.

843,749. Brake Control System; Laurence A. Hawkins, Schenectady, N. Y. App. filed Oct. 8, 1904. Each car of the train is equipped with a pneumatic brake system controlled by a local engineer's valve, which is operated by an electrical pilot circuit extending throughout the train.

843,758. Air Brake System; George Macloskie, Schenectady, N. Y. App. filed June 22, 1906. Two brake cylinders on a car and means for automatically releasing the pressure in one cylinder upon the admission of pressure to the other.

843,761. Trolley Retriever; Francis M. Miller, Arcadia, Ind. App. filed April 22, 1905. When the wheel leaves the wire a winding drum is operated through sprocket and gear connection with one of the car wheels to retrieve the trolley pole.

843,788. Electric Locomotive; Asa F. Batchelder, Schenectady, N. Y. App. filed Dec. 11, 1905. Bearing members journaled upon the driving axle and supporting the locomotive frame, a motor having an armature revolubly supported by the bearing members and a driving connection between said armature and axle.

843,844. Third-Rail Insulator; Robert N. Redmayne, Newcastle-on-Tyne, England. App. filed March 12, 1906. An insulating block having over-hanging ledges on all sides so as to shed dampness and moisture and keep the insulator dry.

843,879. Tongue Switch; Edward Bradbury Entwisle, Johnstown, Pa. App. filed April 11, 1906. Comprises a body structure having a depressed floor portion forming the bed for the body of the tongue, and a rearwardly and downwardly diverging portion forming the bed for the heel of the tongue.

843,896. Slot Switch; Clarence C. Korns, Johnstown, Pa. App. filed April 11, 1906. A slot-switch tongue supported on a sector provided with projections to shift the tongue.

843,897. Adjustable Guard Rail Fastener; Clarence C. Korns, Johnstown, Pa. App. filed April 11, 1906. An adjustable rail chock having a plurality of wedge members provided with wedge-shaped frictionally-interlocking tongue and groove connections.

843,918. Railway Rail Joint; James C. Wallace, Denver, Col. App. filed Jan. 26, 1906. A rail joint comprising a device open at both extremities to receive the rail ends, the device being provided on one side with a removable angle-plate of a length equal to the length of one of the rail ends inclosed by the joint.

84,116. Amusement Device; August Francovich, Paris, France. App. filed Feb. 10, 1906. A gravity railroad comprising suspended bicycle mechanism provided with a propeller whereby the speed may be increased.

844,133. Passenger Car; Walter A. Jacobs, Adamant, Vt. App. filed Feb. 27, 1906. Comprises seats movably connected to the body and adapted to be arranged transversely of or longitudinally of the body, a portion of said seats being arranged directly beneath the other of said seats when in longitudinal engagement.

844,209. Railway Switch; George E. Stewart, East St. Louis, Ill. App. filed Oct. 23, 1906. Details.

844,224. Car Seat; Joseph A. Wolle, Philadelphia, Pa. App. filed Sept. 14, 1905. Details of construction of a back-to-back car seat.

PERSONAL MENTION

MR. FRANCIS H. ELY, M. E., formerly chief engineer of the Union Railway Company, of New York, has become associated with Mr. Harold P. Brown, of New York, manufacturer of plastic rail bonds.

MR. JAMES McCABE, formerly in charge of the turnpike line of the Public Service Corporation of New Jersey, between Newark and Jersey City, has been appointed division superintendent in charge of the Elizabeth lines, succeeding Mr. F. C. Southard.

MR. JAMES A. ROBERTSON has been appointed division superintendent of the South Side lines of the Georgia Railway & Electric Company. Mr. Robertson has been in the employ of the company twenty-five years, starting in as a driver in the old horse car days.

MR. A. A. HOEHN has resigned as superintendent of the San Jose & Santa Clara Street Railway Company, of San Jose, Cal., and the office has been abolished. Mr. Hoehn, it is announced, will engage in business for himself in San Jose, of which place he is a native.

MR. CLYDE M. GRAVES has been appointed general manager of the Coeur d'Alene & Spokane Railway Company, of Spokane, Wash., to succeed Mr. R. F. Blackwell, resigned. Mr. Graves will also continue in his present position as general manager of the Spokane Traction Company.

MR. BION J. ARNOLD, of Chicago, has been retained by the city of Toronto, Can., to give expert advice on the traction situation there. The street railway company in that city is operating under a franchise ordinance and under certain regulations imposed by the municipality. There is a misunderstanding between the company and the city, and Mr. Arnold has been asked to interpret the conditions of the agreement.

MR. WILLIAM FOSTER, JR., one of the builders of the Sixth and Second Avenue elevated railroads of New York, is dead, aged 83 years. In 1874 Mr. Foster became interested with Dr. Gilbert, Mr. William R. Garrison and others in the project of establishing elevated railroads. They received from the State a charter for the Sixth and Second Avenue lines, and in 1879, while the roads were in progress of construction, Mr. Jay Gould and Mr. Russell Sage bought out their interest.

MR. J. W. SMITH, whose appointment as general manager of the City & Elm Grove Railroad Company, of Wheeling, W. Va., to succeed Mr. L. S. Kirker was noted recently in the STREET RAILWAY JOURNAL, formerly was with the Schuylkill Railway Company, of Girardville, Pa., from which company he resigned to assume charge of the City & Elm Grove Railroad Company. Mr. Smith was connected with the Electric Traction Company, of Philadelphia, in 1893 and 1894 as one of the engineers on construction work, and not as manager as previously stated in these columns.

MR. DAVID S. PLUME, of Waterbury, Conn., vice-president and director of the Connecticut Railway & Lighting Company, is dead. Mr. Plume was long identified with manufacturing and commercial interests at Waturbury and throughout Connecticut, and was one of the original owners of the Waterbury horse railroad and later was president of the Waterbury Traction Company. At the time of his death Mr. Plume was treasurer of the Plume & Atwood Manufacturing Company and the American Ring Company, besides being president of the Colonial Trust Company, president of the Thomaston National Bank and a director in a number of other corporations.

COL. MICHAEL HURLEY, a prominent electric railway contractor, died very suddenly at his home in Trenton, N. J., on Feb. 20, from acute indigestion. Col. Hurley was born in Ireland fifty-seven years ago, coming to this country at the age of 3 years, since which he had been a resident of Trenton. He was in the Civil War, and for many years was prominently connected with the National Guard of New Jersey. He also held a number of political positions in the Democratic ranks, being minority leader in the City Council at the time of his death. Col. Hurley was the first contractor to lay a brick pavement in the city of Trenton, and he built part of the Trenton, Lawrenceville & Princeton Railroad, the Yardley, Morrisville & Trenton Street Railway, the Camden & Trenton Railway from Bordentown to Trenton, and other pieces of road in different sections of the country.

AS A STEP IN THE PERFECTION of the organization of its electric railway properties the Delaware & Hudson Railroad is extending the jurisdiction of several of the officials of the steam road over the traction properties. Mr. J. White Sprong, purchasing agent of the Delaware & Hudson, will at once become the purchasing head of the United Traction and Hudson Valley lines. Beginning March 1, Mr. Axel Eckstrom, the consulting electrical engineer of the Delaware & Hudson, will assume charge of all mechanical and electrical work connected with all traction operations of the steam road. Mr. Eckstrom will have the title of general electrical and mechanical superintendent of the traction department. Beginning also on March 1 the traffic officials of the Delaware & Hudson, both in the passenger and freight departments, will have the entire supervision of the traffic of the associated traction properties controlled by the road. This will extend over the electric railway lines the jurisdiction of the newly-appointed general traffic manager, Mr. William J. Mullin, and his assistants, Mr. Paul Wadsworth and Mr. J. W. Burdick.

MR. ROBERT C. BROWN, the managing director of the Mexico Electric Tramways, Ltd., who is now acting as general manager of the company, owing to the resignation of Mr. W. W. Wheatly, as recently announced in the STREET RAILWAY JOURNAL, will, it is said, remain in Mexico for about six months, irrespective of what course is taken regarding the appointment of a successor to Mr. Wheatly. A number of changes have already been announced in the personnel of the company. Mr. W. H. Bellamy, who has been superintendent of the first division, with headquarters at the kiosko, in the Zocalo, has been transferred to the office of the general superintendent at Indianilla, where he will assist General Superintendent J. A. Peirce in the operation of trains. Mr. A. B. Wells, who has been superintendent of the second division, has been made superintendent of the first division, to succeed Mr. Bellamy. Mr. H. J. Peters, who has been chief dispatcher, has been transferred to division No. 2, where he will be superintendent, succeeding Mr. Wells. Mr. M. L. Masteller, who has been general freight and passenger agent, retains this position, but he adds to his duties the charge of the funeral service of the company, with headquarters at Indianilla, succeeding in the funeral service Mr. J. H. Gaffney, who has resigned. Mr. E. J. Peirce, former night foreman at Indianilla, has been placed in charge of the Indianilla car houses as chief dispatcher.

TABLE OF OPERATING STATISTICS

Notice.—These statistics will be carefully revised from month to month, upon information received from the companies direct, or from official sources. The table should be used in connection with our Financial Supplement "American Street Railway Investments," which contains the annual operating reports to the ends of the various financial years. Similar statistics in regard to roads not reporting are solicited by the editors. * Including taxes. † Deficit.

Company.	Period.	Total Gross Earnings.	Operating Expenses.	Net Earnings.	Deductions From Income.	Net Income, Amount Available for Dividends.
AKRON, O. Northern Ohio Tr. & Light Co.	1 m., Dec., '06	141,709	82,277	59,432	41,012	18,420
	1 " " '05	129,806	81,622	48,184	39,641	8,543
	12 " " '06	1,703,340	1,006,842	696,498	483,174	213,324
	12 " " '05	1,552,970	898,830	654,140	471,503	182,637
BINGHAMTON, N. Y. Binghamton Railway Co.	1 m., Dec., '06	24,523	11,901	12,622	7,731	4,892
	1 " " '05	22,465	11,808	10,657	7,261	3,396
	6 " " '06	163,002	83,289	79,712	46,287	33,426
	6 " " '05	153,536	75,734	77,803	43,389	34,414
CHAMPAIGN, ILL. Illinois Traction Co.	1 m., Jan. '07	280,039	*165,694	114,345	......	......
	1 " " '06	237,048	*126,689	110,359	......	......
CHARLESTON, S. C. Charleston Consolidated Ry., Gas & Elec. Co.	1 m., Jan., '07	55,334	37,727	17,607	13,349	4,258
	1 " " '06	53,513	35,095	18,419	13,117	5,302
	11 " " '07	601,913	379,365	222,548	143,698	78,850
	11 " " '06	564,170	339,985	224,186	144,333	79,852
CHICAGO, ILL. Aurora, Elgin & Chicago Ry. Co.	1 m., Dec., '06	100,547	56,913	43,634	26,186	17,448
	1 " " '05	91,308	51,126	40,181	24,450	15,731
	6 " " '06	700,090	363,801	336,289	156,695	179,594
	6 " " '05	632,193	324,792	307,401	146,643	160,758
Chicago & Milwaukee Elec. R.R. Co.	1 m., Jan., '07	62,632	33,492	29,140	......	......
	1 " " '06	43,443	22,694	20,750	......	......
CLEVELAND, O. Cleveland, Painesville & Eastern R.R. Co.	1 m., Dec., '06	20,155	9,949	10,206	7,192	3,015
	1 " " '05	19,841	10,144	9,698	6,799	2,899
	12 " " '06	271,100	143,993	127,107	83,939	43,168
	12 " " '05	245,089	141,270	103,819	80,830	22,989
Cleveland & Southwestern Traction Co.	1 m., Jan., '07	49,558	29,604	19,954	......	......
	1 " " '06	46,567	27,550	19,018	......	......
Lake Shore Electric	1 m., Dec., '06	64,592	39,452	25,140	20,200	4,940
	1 " " '05	66,558	34,758	31,799	20,404	11,395
	12 " " '06	866,970	476,258	390,712	254,198	136,514
	12 " " '05	788,268	428,588	359,680	244,850	114,830
DALLAS, TEX. Dallas Elec. Corp'n	1 m., Dec., '06	89,439	*72,159	17,280	16,255	1,055
	1 " " '05	84,735	*49,511	35,224	15,250	19,974
	12 " " '06	1,023,136	*699,143	323,993	185,646	138,347
	12 " " '05	934,707	*572,228	362,478	182,668	179,811
DULUTH, MINN. Duluth St. Ry. Co.	1 m., Dec., '06	66,590	41,621	24,969	16,727	8,242
	1 " " '05	61,090	28,737	32,353	17,429	14,924
	12 " " '06	768,875	418,820	350,054	261,892	88,162
	12 " " '05	663,424	368,049	295,374	268,278	27,096
EL PASO, TEX. El Paso Electric Co.	1 m., Dec., '06	41,575	*31,004	10,572	4,188	6,384
	1 " " '05	28,104	*18,640	9,464	3,803	5,661
	12 " " '06	391,656	*276,403	115,253	47,216	68,037
	12 " " '05	288,943	*190,561	98,382	43,327	55,056
FT. WAYNE, IND. Ft. Wayne & Wabash Valley Tr. Co.	1 m., Dec., '06	101,380	57,897	43,482	......	......
	1 " " '05	87,327	50,329	36,998	......	......
	12 " " '06	1,109,193	676,846	432,347	......	......
	12 " " '05	949,498	580,832	368,665	......	......
FT. WORTH, TEX. Northern Texas Tr. Co	1 m., Dec., '06	78,750	*47,202	31,548	9,273	22,275
	1 " " '05	57,296	*35,758	21,538	9,938	11,601
	12 " " '06	854,136	*547,151	306,984	118,632	188,353
	12 " " '05	661,037	*391,863	269,174	118,127	151,047
GALVESTON, TEX. Galveston Elec. Co.	1 m., Dec., '06	27,258	*17,571	9,686	4,167	5,519
	1 " " '05	22,602	*14,061	8,541	4,167	4,374
	12 " " '06	315,135	*191,480	123,655	50,000	73,655
	12 " " '05	268,321	*181,398	86,923	43,333	43,590
HANCOCK, MICH. Houghton County St. Ry Co.	1 m., Dec., '06	19,973	*12,326	7,647	3,956	3,691
	1 " " '05	16,853	*12,139	4,713	3,786	927
	12 " " '06	229,245	*146,255	82,989	46,977	36,013
	12 " " '05	167,067	*168,643	†1,576	43,658	†45,234
HOUSTON, TEX. Houston Electric Co.	1 m., Dec., '06	54,118	*32,873	21,244	7,792	13,453
	1 " " '05	46,413	*29,794	16,619	8,749	7,871
	12 " " '06	591,351	*379,746	211,605	93,319	118,286
	12 " " '05	517,315	*313,525	203,791	105,504	98,286
KANSAS CITY, MO. Kansas City Ry. & Lt. Co.	1 m., Dec., '06	499,632	244,103	255,529	147,892	107,637
	1 " " '05	447,798	211,183	236,615	138,438	98,177
	7 " " '06	3,372,621	1,658,723	1,713,898	1,017,616	696,283
	7 " " '05	3,044,039	1,474,581	1,569,458	958,897	610,561
MANILA, P. I. Manila Elec. R.R. & Ltg. Corp., Ry. Dept.	1 m., Dec., '06	46,500	23,250	23,250	......	......
	12 " " '06	513,801	267,674	246,127	......	......
All Depts.	1 " " '06	85,300	42,233	43,067	......	......
	12 " " '06	909,080	464,623	444,457	......	......
MILWAUKEE, WIS. Milwaukee Elec. Ry. & Lt. Co.	1 m., Jan., '07	309,508	163,078	146,429	94,050	52,380
	1 " " '06	278,152	139,617	138,534	84,217	54,318
Milwaukee Lt., Ht. & Tr. Co.	1 m., Jan., '07	53,536	27,824	25,711	30,190	†4,479
	1 " " '06	44,915	19,842	25,073	21,737	3,336
MINNEAPOLIS, MINN. Twin City R. T. Co.	1 m., Dec., '06	495,092	222,924	272,168	......	......
	1 " " '05	438,375	157,697	280,677	......	......
	12 " " '06	5,644,988	2,625,379	3,019,609	1,137,427	1882182
	12 " " '05	4,759,262	2,119,145	2,640,117	1,050,797	1589320
MONTREAL, CAN. Montreal St. Ry. Co.	1 m., Dec., '06	266,953	185,571	81,382	39,122	42,260
	1 " " '05	236,946	161,995	74,950	22,611	52,340
	3 " " '06	812,036	516,433	295,603	119,008	176,595
	3 " " '05	719,369	457,304	262,066	65,747	196,318
NEW YORK, N. Y. New York City Ry. Co	3 m., Dec., '06	4,823,744	2,559,657	2,264,087	2,871,807	†607720
	3 " " '05	4,767,831	2,471,462	2,296,369	2,812,000	†515631
	12 " " '06	18,808,977	9,558,287	9,250,690	11,347,788	†2097098
	12 " " '05	18,281,714	9,651,324	8,630,390	11,185,658	†2555268
NORFOLK, VA. Norfolk & Portsmouth Tr. Co.	1 m., Dec., '06	137,273	83,632	53,641	......	......
	1 " " '05	126,627	72,506	54,121	......	......
	12 " " '06	1,513,846	926,646	587,200	......	......
	12 " " '05	1,386,713	829,012	557,701	......	......
PHILADELPHIA, PA. American Rys. Co.	1 m., Jan., '07	210,731	......	......	......	......
	1 " " '06	200,438	......	......	......	......
	7 " " '07	1,701,447	......	......	......	......
	7 " " '06	1,559,657	......	......	......	......
PLYMOUTH, MASS. Brockton & Plymouth St. Ry. Co.	1 m., Dec., '06	6,944	*5,336	1,608	1,802	†194
	1 " " '05	6,278	*4,891	1,387	1,792	†404
	12 " " '06	111,775	*70,894	40,881	21,855	19,026
	12 " " '05	102,143	*70,665	31,478	21,291	10,187
ST. LOUIS, MO. United Railways Co. of St. Louis	1 m., Jan., '07	826,337	*577,870	248,467	231,541	16,926
	1 " " '06	781,788	*491,368	290,420	232,055	58,365
SAVANNAH, GA. Savannah Electric Co.	1 m., Dec., '06	48,656	*32,836	15,820	11,300	4,520
	1 " " '05	54,146	*37,525	16,621	10,904	5,717
	12 " " '06	611,215	*379,046	232,169	134,461	97,708
	12 " " '05	586,236	*348,027	238,209	127,694	110,515
TAMPA, FLA. Tampa Elec. Co.	1 m., Dec., '06	41,161	*28,967	12,194	681	11,513
	1 " " '05	37,353	*20,830	16,523	953	15,570
	12 " " '06	469,222	*279,958	189,264	1,423	187,841
	12 " " '05	411,763	*237,153	174,610	21,766	152,844
TERRE HAUTE, IND. Terre Haute Tr. & Lt. Co.	1 m., Dec., '06	83,271	*43,854	39,417	14,041	25,376
	1 " " '05	61,063	*39,678	21,385	10,988	10,398
	12 " " '06	823,163	*468,873	354,290	160,211	194,078
	12 " " '05	629,760	*414,518	215,243	122,418	92,825
TOLEDO, O. Toledo Rys. & Lt. Co.	1 m., Dec., '06	186,848	*94,573	92,275	42,800	49,475
	1 " " '05	175,745	*84,698	91,047	42,461	48,586
	12 " " '06	2,047,610	*1,071,773	975,837	509,607	466,230
	12 " " '05	1,913,456	*972,994	940,462	510,307	430,155

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Changes of advertising copy should reach this office by 10 a. m. Monday preceding the date of publication, except the first issue of the month, for which changes of copy should be received two weeks prior to publication date. New advertisements for any issue will be accepted up to noon of Tuesday for the paper dated the following Saturday.

Of this issue of the Street Railway Journal 8000 *copies are printed. Total circulation for* 1907, *to date,* 81,650 *copies, an average of* 8165 *copies per week.*

Lessening Work in the Accounting Department

It is generally accepted that ingenuity is a very desirable quality in the electric railway repair shop employee, for there are always opportunities for a man with this faculty to devise labor-saving machines or inaugurate economical features with regard to practice. The accounting department, however, is not usually considered as possessing the same opportunities for the practical inventor. Nevertheless, there is need for labor-saving machines in the accounting rooms, and to a certain extent there is an even greater opportunity to devise time-saving methods of carrying out the accounting work. At one time a large part of the accountant's duties consisted of routine in which accuracy and rapidity in mental calculations on the part of the accountant or his assistants was the primary requisite. Conditions are rapidly changing, however. Calculating and adding machines of all kinds now take the place of the human brain, so far as mere mechanical processes are concerned. Because of the large amount of small change taken in by electric railways, the adoption of mechanical coin-counters often results in a great saving of labor. Where long lists of names are to be written as on pay rolls and pay envelopes, the addressograph can often be used to advantage. When these machines are once installed, an ingenious man can usually devise forms or probably alter the machines themselves or add attachments to them, so that they can be used in a number of ways to lessen the work.

But this is not the only direction in which the accounting work is susceptible of improvement by ingenuity. Freed from mental routine by machinery, the accountant can devote his attention to other short cuts in methods. Upon this subject a wealth of literature has appeared during the past few years. It is contained in the columns of the technical press, in periodicals devoted exclusively to accounting and in the proceedings of Accountants' Conventions, all showing that a little time spent in devising new methods is exceedingly remunerative. Sometimes whole systems can be replaced by others which enable the same results to be obtained with a minimum amount of work. The labor-saving systems are, of course, devised so as to avoid as far as possible transferring result from one form to another and needless additions of sums. They thus afford a wide field to the "accounting-engineer."

The Status of the Semi-Convertible Car

There is no questioning the fact that car design is one of the most vitally important matters now under consideration by electric railway managers. The rising standards of speed and comfort required by modern rapid transit conditions are directly responsible for the evolution of striking modifications in the rolling stock of urban systems no less than in interurban cars. In the latest designs can be observed so much consideration of the passenger's safety and comfort that it is becoming increasingly difficult to suggest further radical improvements.

The attitude of the public toward changes in car design is in the long run the principal factor which settles the continuance or abandonment of any special type of car.

In many cities the open car with cross seats is regarded with so much favor that considerable hostility has arisen on the part of the public at the suggestion by operating companies that open cars with cross seats and running boards shall be gradually superseded by semi-convertibles. There has been a failure to appreciate the numerous good points of the semi-convertible car with respect to the passenger's standpoint, and the passing of the so-called open car has sometimes resulted in at least a threatened loss of revenue. It is of great importance, therefore, that managers of roads which intend gradually to replace their open cars of the older type with semi-convertibles should do all in their power to emphasize the advantages of the latter. This should be done also in such a way that the public will realize that the companies are mindful of the public's best interests no less than anxious to eliminate the anomalous condition of maintaining two sets of bodies throughout the year, with all the inconvenience and expense of changing trucks and motors to fit the summer and winter seasons separately.

Of course, the time is probably far distant when the old style of open cars will be entirely superseded, and in some cities the requirements of the service may not be favorable to the use of anything else. The open car is in general much less expensive in first cost than any type of heavy semi-convertible car on the market; it is exceeding convenient for the public and is well suited to slow or moderate speed traffic. But speed must be reduced lower than is otherwise desirable, on account of the accident problems; time is lost in stops whenever the passenger on the left-hand end of the seat has to crowd by three or four others—in a recent case this feat had to be performed by a couple with two dress suit cases and six bundles, with no little resulting discomfiture and delay—and when women passengers run back and forth outside the running board trying to make up their minds which of half a dozen available seats to take. It has been well said that the arrival of a sudden shower transforms the open car into a leaky tent, not particularly pleasant to ride in, and again, when two sets of cars are operated on the same system, one for summer and the other for winter, a quarrel generally arises whenever there is room for a difference of opinion among the patrons as to the proper time to operate open cars. The semi-convertible car obviously can be adapted to all weathers and at the same time affords greater comfort and safety to the passengers. Its carrying capacity usually equals if it does not exceed that of the old open type. For all practical purposes it admits as much fresh air in summer as the open car, and owing to its greater weight and consequent inertia it starts with less jerk.

Taking the case as a whole, it is evident that the semi-convertible car is able to supply almost any satisfaction to the public which was possible in the old open vehicle, with the exception of the "adventurous and beatific front seat," as a writer in one of the daily papers put it last summer. Neither is there any provision for the wants of the "end seat hog." But the gains in speed, space allowance per passenger and safety ought to offset these considerations. It is fortunate that the introduction of new types of rolling stock on large systems must be gradual—for to replace say a hundred open cars with new semi-convertibles could easily cost from $600,000 to $800,000. The public thus has the opportunity of becoming slowly accustomed to these changes, which means less trouble all around.

Aspects of Car Testing

The study of the best methods of car testing on electric railways raises an interesting question in the minds of some managers as to the actual value of such tests in the everyday work of a busy system. There is a feeling in some cases that the cost of fitting up a car with instruments and the expense of keeping it out of service for a few days plus the wages or salaries of observers, possible delay to regular traffic and cost of power are too large to warrant the undertaking. Another pertinent matter is the usefulness of the results after they have been secured—the question often comes up in some such form as this: "What shall we do with all these data now that we have gone to the trouble of getting them?"

Some suggestive answers to these queries are furnished by Professor A. S. Richey's New England Street Railway Club paper on "Car Testing," which is abstracted in this issue. Without disparaging the value of shop or stand tests, Prof. Richey shows that the solution of many practical problems depends closely upon the results derived from actual tests of the complete car equipment under service conditions. The indefiniteness of the train resistance factor and the influence of air resistance in items of car shape, size and speed can best be settled by an appeal to experiment, unless the conditions are unusually well known. The determination of constants for use in working up stand tests, for settling the train resistance characteristics of definite curves or grades, the comparison of locomotive train, multiple-unit train, single car, double or four-motor equipment energy consumption for a given schedule, the actual acceleration and braking rate determination, coasting rate, heating values of the motor and train resistance all bear upon the question of operating economy. The efficiency of power-house production depends so intimately upon the variations and volume of the load upon individual machines, and the economical performance of the schedule upon a certain elasticity secured by coasting that the careful interpretation of test results is well worth any reasonable cost, if it can be applied to the betterment of existing conditions.

The use of engineering students as observers in extensive car tests is doubly advantageous, provided the work is given expert supervision. The students gain knowledge of the most practical kind, and under the trying conditions of movement at high rates of speed over an actual roadbed. There is no question that the minor difficulties of observation on a moving car tend to sharpen the faculties of the observers. If students can be employed in car testing with the reward of increased practical knowledge and stimulating training, the cost to the railway company can be greatly reduced, and in some cases made almost nominal. A hundred dollars will bring in rich returns if a little ingenuity and forethought be used, though the cost may run up to perhaps $1,000 if elaborate recording equipment be designed and organized and many days spent in getting autographic test records and figuring up the results. Prof. Richey did

not bring out these particular features of the problem, but did cite two or three cases from practice where the cost to the railway was so slight as not to be underbalanced for a moment by the value of the tests.

Interference with regular traffic ought not to occur with good operating, and if the car be partly stripped of moldings and paneling inside where instruments are screwed in—such as wattmeters for recording work—there should be no injury to the appearance of the rolling stock. In some cases passengers can be carried during tests, though a loss in the earning capacity of the car is inevitable. The service capacity of railway motors can now be pretty closely predicted by the manufacturers, but the value of experimental data under operating conditions is still high, for the regular stops per mile assigned on the factory track are seldom exactly duplicated in the irregular stopping of commercial service. As a basis of specifications covering equipment for service on a large division the car test is particularly satisfying.

Rating of Railway Motors

Electrical machinery at present is almost universally rated in terms of kilowatts or horse-power output with a stated temperature rise after a twenty-four-hour run or practically continuous duty. The output of a machine in service is never absolutely uniform, but is approximately so for generators in central station work where the momentary fluctuations are comparatively small, and are, furthermore, superimposed upon a minimum load line that bears a respectable ratio to the rated capacity of the generators. With electric motors the load is bound to be much more fluctuating, ranging from a practically uniform output at nearly full load in the case of motors driving mill machinery to the extremely ragged load curve met with in motors used to propel cars, operate hoists, rolling mills, etc. As the output of nearly all generators and of many stationary motors is of a practically uniform character, it suffices to rate such machines upon continuous output with a specified temperature rise, as this form of rating closely indicates the suitability of such apparatus for commercial operation. With railway motors and stationary motors adapted for hoist, rolling mill and similar work of intermittent character, it is more difficult to select a rating which can be expressed in simple terms of kilowatts input or horse-power output, and at the same time show the suitability of a motor for a given piece of work or indicate a true comparison between motors of different capacity.

The question of determining whether a better form of rating of railway motors can be prepared than that now used is now occupying the attention of the standardization committee of the A. I. E. E., and in the meetings of the committee there has been a spirited interchange of opinions on this subject by representative railway motor men.

The present method of designating railway motors, the so-called "commercial rating," consists in fixing the horse-power output of the motor which will raise the temperature of the hottest part 75 degs. C. after a stand test of one hour with covers removed. This rating of railway motors has been handed down from the early days of electric railroading, and its strongest advocates have urged its continuance only on the ground of its serving the purpose of an excellent commercial test of both the electrical and mechanical qualities of the motor. They admit that the one-hour rating is not a definite indication of the fitness of a motor for a given service, nor is it a true comparison between motors of different capacities, but they claim that it does have the advantage of expressing in a single simple term an approximate comparison of the electrical and mechanical qualities of motors of different capacities.

Owing to the complicated nature of the calculations involving the selection of a railway motor and the different methods in use by the different manufacturing companies and outside engineers in arriving at its selection, the time may not yet be ripe to settle upon any one method of railway motor determination. To complicate the matter still further, any expression indicating the true service capacity of a motor can probably not be reduced to a single term, but must be put in the form of several terms, or, better still, in curve form. As a method of "rating" railway motors a curve would seem impossible, although it would be extremely useful as indicating the service capacity of the motor. It seems a very wise suggestion, therefore, to continue the one-hour rating of railway motors and not to demand at the present time any universal adoption of the several service determinations offered, owing to the very apparent lack of agreement among authorities. At the same time, and to compensate consulting engineers for the non-adoption of a more satisfactory service rating of railway motors it appears proper to include under the head of "desirable information to be furnished" such data in regard to thermal capacity of the motors, core losses, copper losses and other internal losses, together with continuous current carrying capacity at different voltages with 75 degs. rise, and such other data as would enable a consulting engineer to make as many service calculations as he may desire.

At present the selection of railway motors rests largely in the hands of the manufacturers, a decision which has been rather forced upon them, owing partly to their desire to ensure satisfactory service operation of their apparatus and partly owing to the unpreparedness of the outside engineering profession to act in this matter. The determination of the service capacity of a railway motor is a matter involving elaborate tests and considerable expense, and it is proper that such tests should be made by the manufacturer. There seems to be no reason, however, why results of these tests should not be more widely distributed so as to be available to the consulting engineer who may have the experience and inclination to apply the experimental thermal characteristics of the various motors to a concrete problem. The consulting engineer if thoroughly informed of the requirements of a projected road, and having the thermal characteristics of the various motors as determined by the manufacturers, can then make fully as intelligent a selection as the latter, provided he is willing to give the time necessary for perhaps rather long and tedious calculations. It makes little difference to the consulting engineer whether this additional information about railway motors is presented in the form of a "rating" or not. The main point is to ventilate more widely the conditions governing the operation of railway motors and to be in possession of sufficient test data to simplify the solution of this very perplexing question.

THE ELEVATED SHOPS AND TERMINALS OF THE BROOKLYN RAPID TRANSIT COMPANY—THE THIRTY SIXTH STREET INSPECTION PLANT

Unlike the elevated railway installation of the Brooklyn Rapid Transit Company, at East New York*, where the car storage and manufacturing features are so prominent, the Fifth Avenue Elevated line between Thirty-Sixth and Thirty-Seventh Streets. The brick building here, which formerly served as the terminal station of the Prospect Park and Coney Island Railroad, has been entirely remodeled and enlarged, so to-day little remains of the original structure except the outside framing.

The upper or track-level floor of this building is

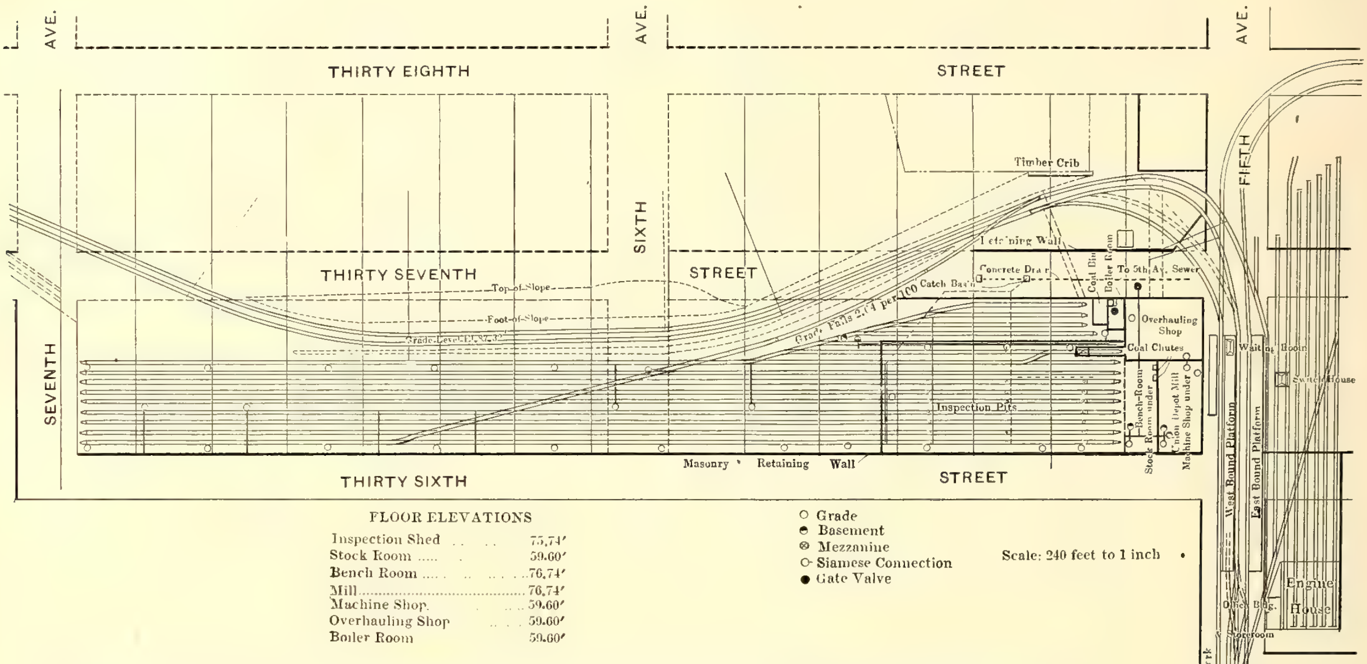


FIG. 1.—GENERAL PLAN OF THE STORAGE YARD AND BUILDINGS OF THE BROOKLYN RAPID TRANSIT COMPANY, AT THIRTY-SIXTH STREET AND FIFTH AVENUE, BROOKLYN

FIG. 2.—GENERAL VIEW OF THE THIRTY-SIXTH STREET INSPECTION PLANT, TAKEN FROM THE STORAGE YARD

Thirty-Sixth Street plant was laid out purely for the inspection and overhauling of elevated rolling stock. The equipment, therefore, is intended to include only such apparatus as is actually required to fulfil those purposes. The plant is conveniently located along the South Brooklyn or occupied by the offices of the foreman, timekeeper and clerical help, in addition to an employees' dining room, lockers and lavatories. The remaining level of the track-level floor is taken up by the mill room, which is separated from the offices by a steel lath and plaster partition. Above this is a mezzanine floor used by the operating department as a club room and for company purposes. The bench

* See STREET RAILWAY JOURNAL, Feb. 9, Feb. 16 and March 2, 1907.

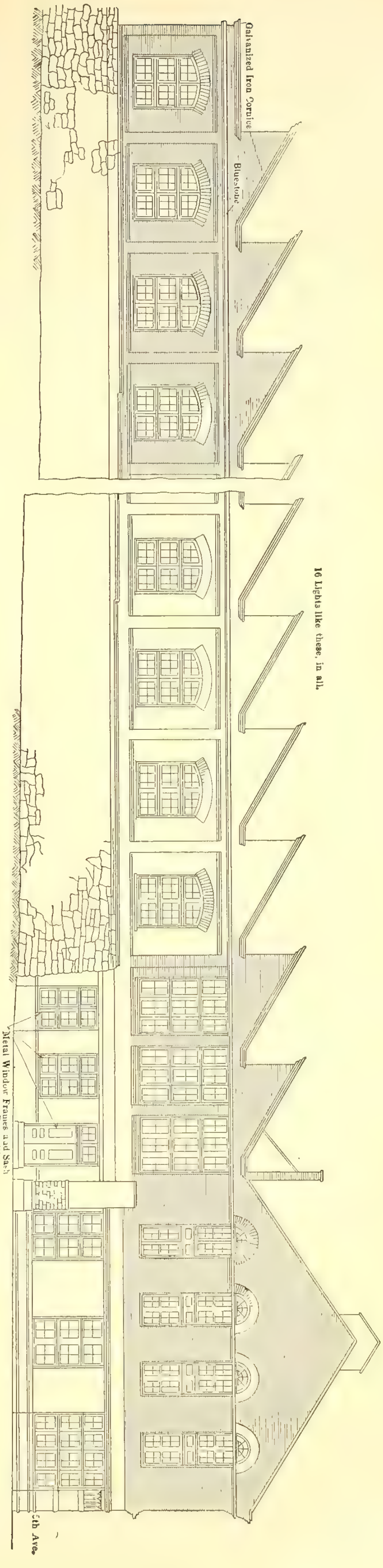


FIG. 3.—LONGITUDINAL ELEVATION OF THE THIRTY-SIXTH STREET INSTALLATION, SHOWING THE OFFICE BUILDING AND INSPECTION STRUCTURES

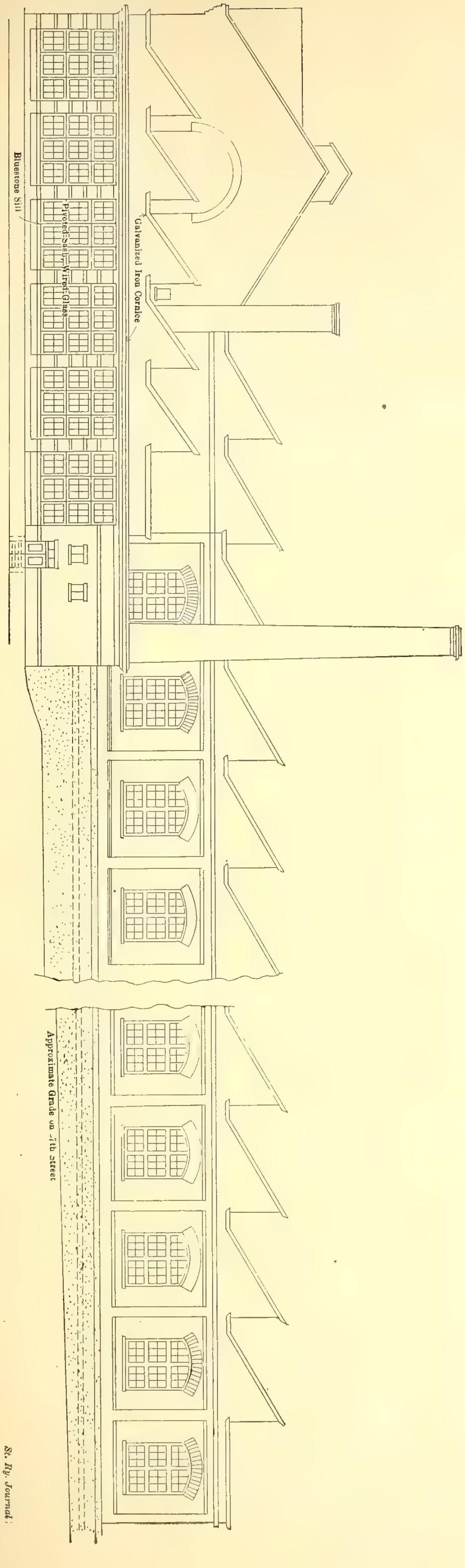


FIG. 4.—LONGITUDINAL ELEVATION OF THE THIRTY-SIXTH STREET INSTALLATION ON THE THIRTY-SEVENTH STREET SIDE, SHOWING MACHINE SHOPS (OFFICE BUILDING IN BACKGROUND), STEAM-HEATING PLANT AND THE INSPECTION STRUCTURE

room adjoining the mill room is directly behind the inspection tracks and forms a part of the inspection shed proper.

The overhauling shop is a new structure on the Thirty-Seventh Street side of the remodeled building, with its floor about 17 ft. below the track floor which corresponds to the upper floor of the remodeled building. By examining the plan drawing Fig. 6 it will be noted that the blacksmith and machine shops as well as the stock room are flush with the truck overhauling shop, but extend under the track floor of the office building. The location of the boiler house is shown in elevation and plan in Figs. 4 and 6, respectively.

The balance of the ground at this point is taken up by the inspection sheds, which will be described later in detail, and by a large storage yard on the east containing nine tracks extending to Seventh Avenue. The plan of the general layout also shows that there are four car-washing and storage tracks on the south side of the inspection shed. The innermost track of this set is used for unloading coal to the top of the concrete coal bunkers supplying the boiler house.

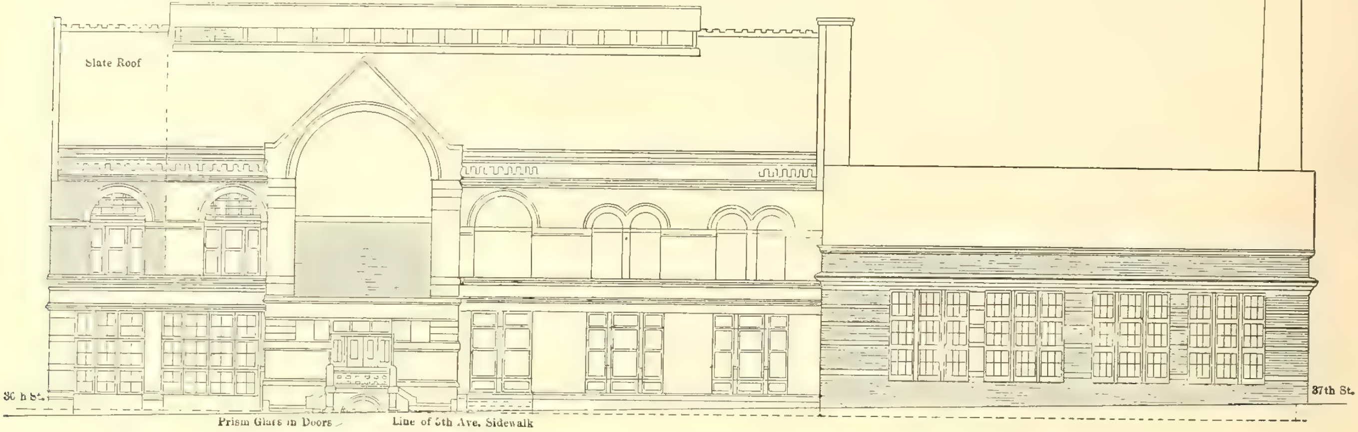


FIG. 5.—ELEVATION ON FIFTH AVENUE, SHOWING OFFICE BUILDING AND END OF MACHINE SHOP

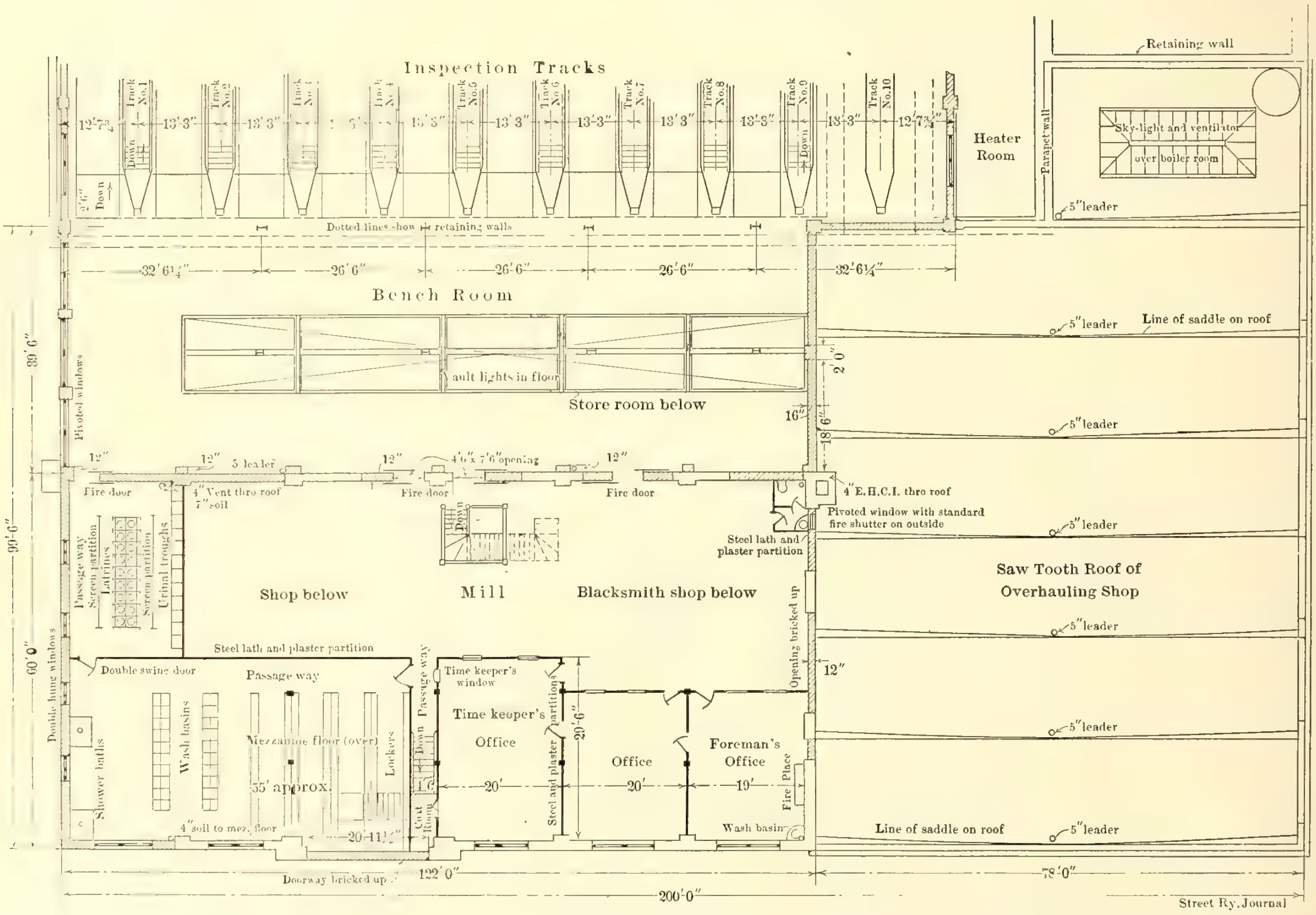


FIG. 6.—GENERAL PLAN OF TRACK-LEVEL FLOOR, SHOWING ALSO THE ROOF OF OVERHAULING SHOP AND HEATING PLANT

FIRE PROTECTION

Owing to the peculiar conditions involved at the Thirty-Sixth Street plant, due to the remodeling of the terminal building and the entirely different construction adopted for the machine shop and inspection shed, it was found necessary by the fire underwriters to divide the layout into three separate fire risks. The first risk covers the reconstructed building which is separated by a fire wall from the inspection shed, this wall extending from the street level

to 3 ft. above the highest point of the saw-tooth roof of the inspection shed, as indicated in the side elevation, Fig. 3; risk No. 2 comprises the overhauling shop; risk No. 3 the bench room and inspection shed with the stock room underneath.

In compliance with the specifications of the fire under-

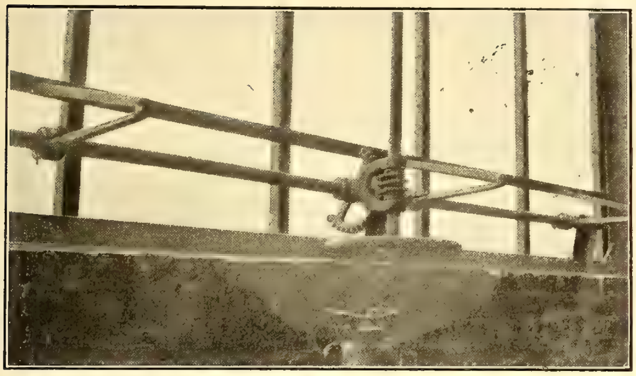


FIG. 8.—DETAIL OF WINDOW-OPENING MECHANISM

writers all openings leading from one room to another are protected by standard fire doors. The locations of these doors will be mentioned when referring to the different parts of the remodeled building. Chemical fire extinguishers are also installed in the latter. In addition there is a shop fire brigade. At present, the start of a fire would be indicated by the blowing of a steam whistle, but the company is now thinking of improving on this scheme by installing a Gamewell inside fire-alarm circuit in addition to one of the same type now installed but which communicates only with the city fire-alarm system.

HEATING SYSTEM

For supplying heat to the offices, shops and inspection pits in connection with the blower system, a steam plant was built adjacent to and level with the machine shop. It is also adjacent to the upper end of the inspection shop, but being on a lower level, the parapet wall of the inspection building serves for the rear wall of the steam plant. The south wall is a portion of the concrete retaining wall as shown on Fig. 10, while the other two, which were especially built, are of brick. Abundant light is furnished by an 8-ft. x 22-ft. skylight and the front windows. The floor is composed of 6-in. concrete. The steam generating equipment consists of two horizontal return boilers which supply steam for the heater coils in the blower room and mill room.

As also shown in Fig. 10, the main blower room is between the upper end of the tenth track in the inspection shop and the steam plant. The latter, of course, is at a

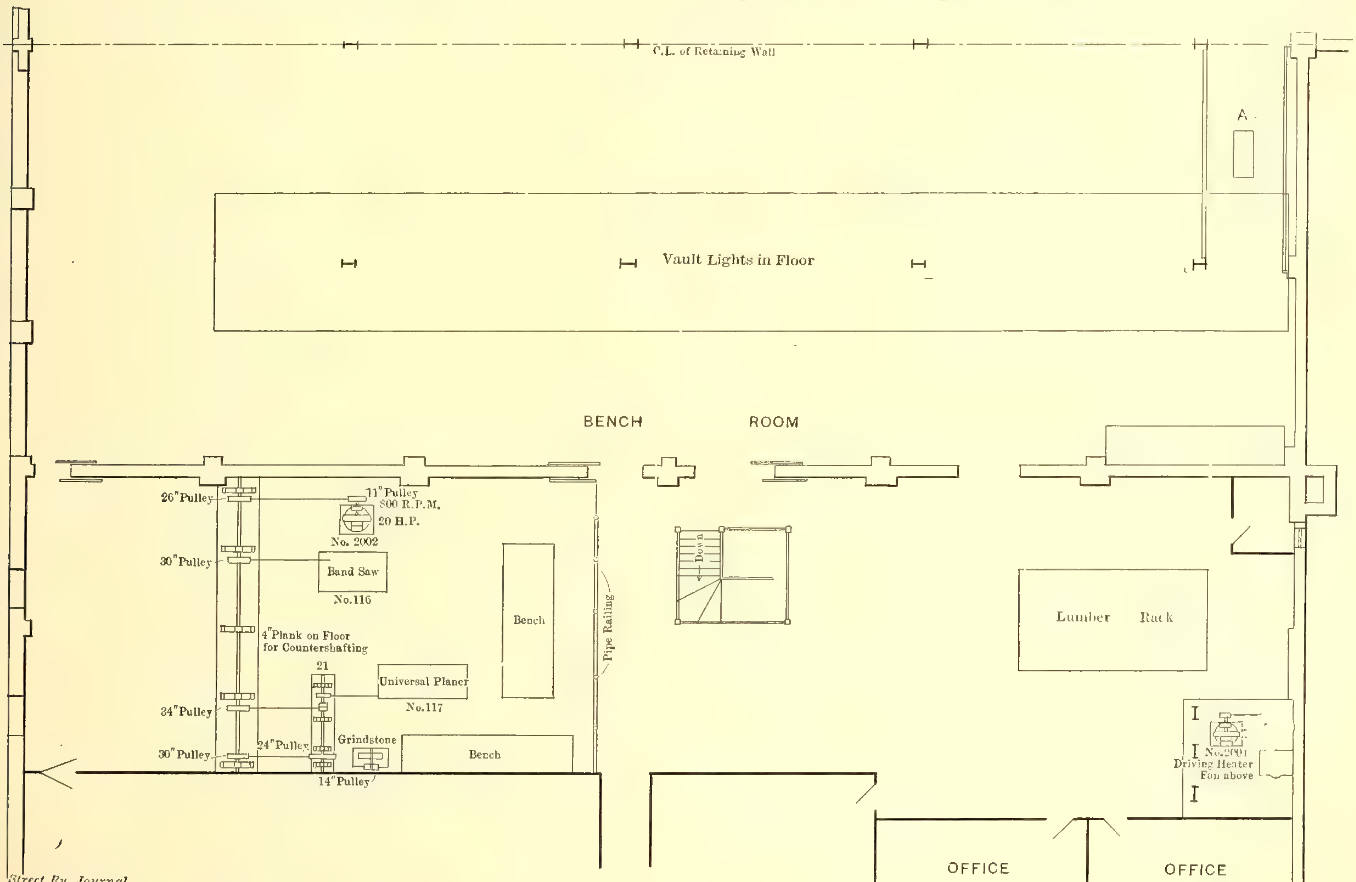


FIG. 7.—REBUILT PART PLAN OF SECOND FLOOR OF THE THIRTY-SIXTH STREET TERMINAL, SHOWING LOCATION OF BENCH AND MILL ROOMS, BLOWER, OFFICES, ETC.

departments. The fire-protective means throughout the inspection shed and storage yard consist of frost-proof hydrants, each furnished with 100 ft. of 3½-in. standard fire hose. In addition to this equipment there are also in the inspection shed a number of salt-water fire pails suspended from columns between the tracks. Similar equipments of fire pails, standpipes and hose will be found in the track-overhauling shop, the mill room, bench rooms and other lower level but is separated from the blower room only by the parapet wall. Hence there are no leakage or other losses in conveying the steam, nor is there any necessity of maintaining a long line of piping. The main blower outfit consists of ten heater coils and a Buffalo blower driven by a 30-hp motor; the other heater installation, which is mounted on a platform in the mill room, has five heater coils and a blower driven by a 12½-hp motor. Both mo-

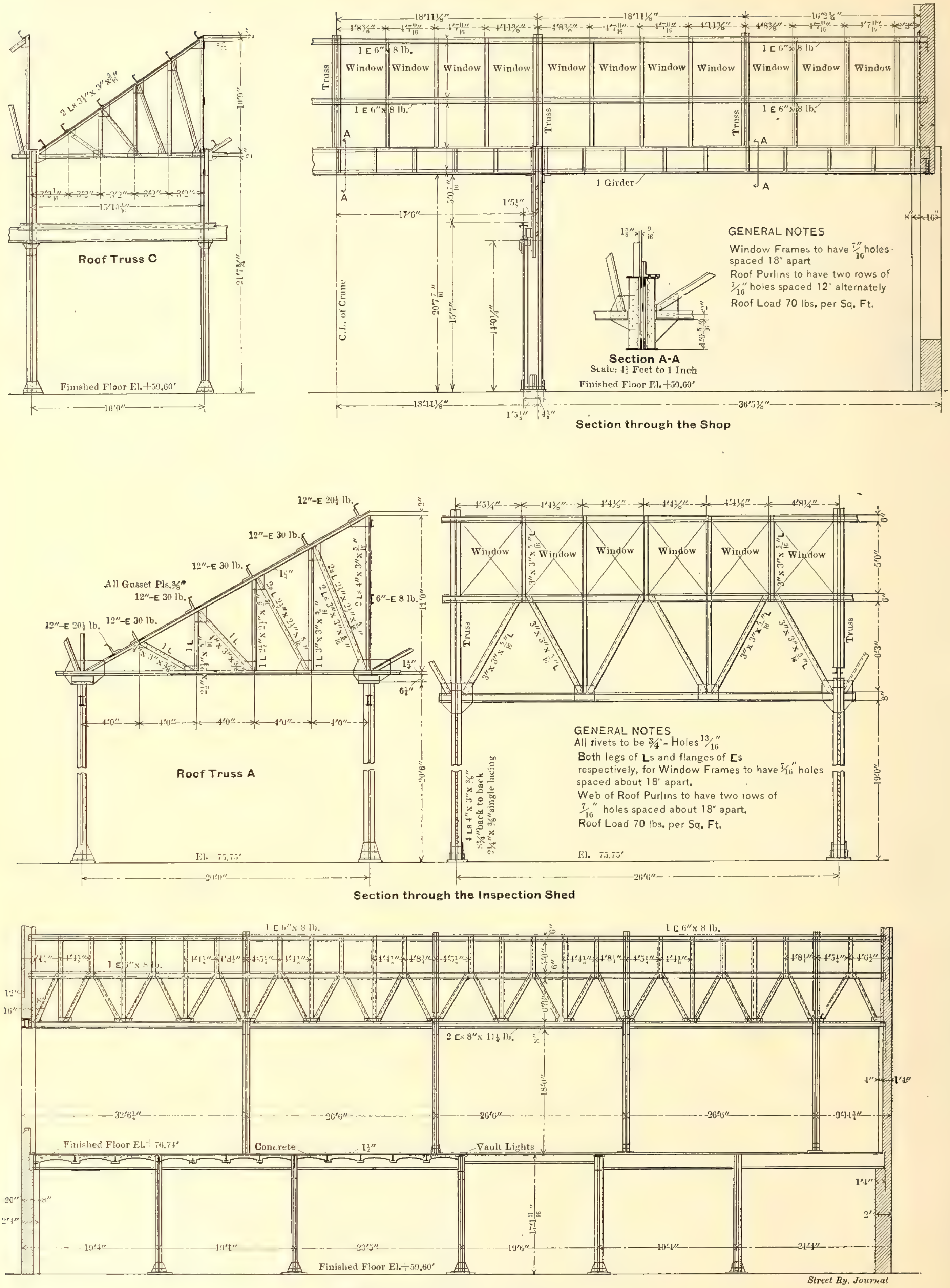


FIG. 9.—TYPICAL SECTIONS OF THE STEEL SAW-TOOTH CONSTRUCTION AT THE THIRTY-SIXTH STREET PLANT OF THE BROOKLYN RAPID TRANSIT COMPANY

tors are of Northern manufacture designed for variation in speed to correspond to heating conditions. Air to be heated is usually taken from the inspection shop, but there is an 8-

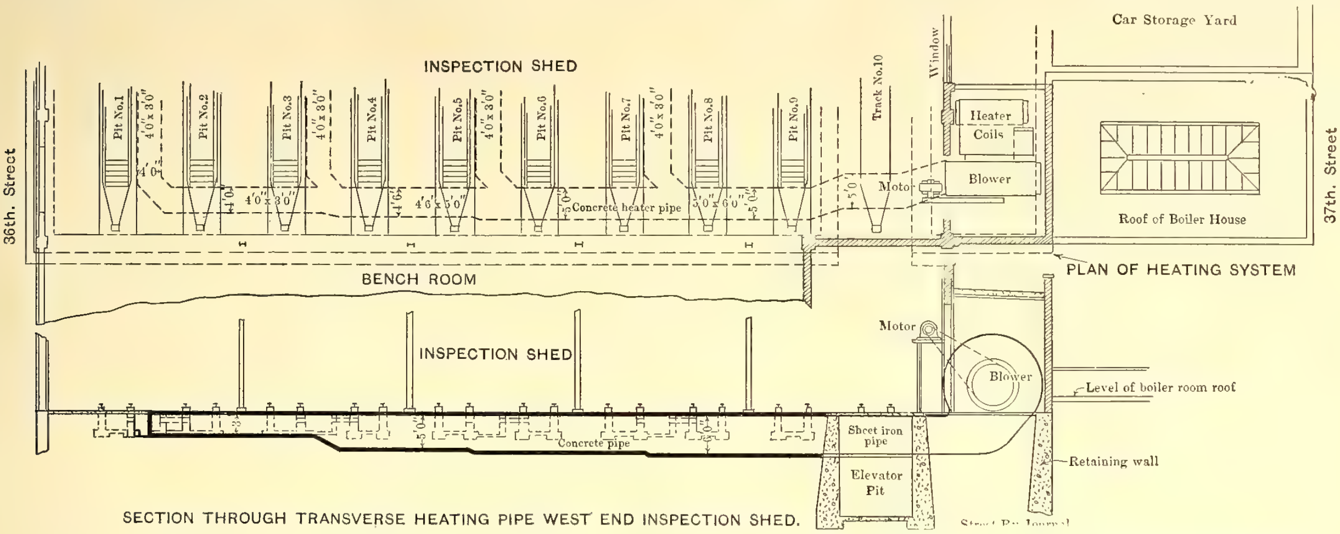


FIG. 10.—DETAILS OF THE HEATING SYSTEM AT THIRTY-SIXTH STREET, SHOWING PARTICULARLY THE MANNER OF HEATING THE PITS

in. air inlet on the Fifth Avenue side which can be used in summer for distributing cold air. The main blower forces the hot air through pipes leading to the different parts of the buildings as well as to the pits. Details of the pit heating are shown in Fig. 10, from which it will be noted that the air is sent through a concrete conduit which gradually decreases from 5 ft. x 6 ft. to 4 ft. x 3 ft., as branches of the latter dimension are led between the pairs of pits. Along these branches at intervals of 24 ft. are tile conduits with 12-in. openings leading to the pits on each side. These openings are controlled by dampers. The advantages of this method of pit heating have already been pointed out in the article covering this feature at East New York.

THE THIRTY-SIXTH STREET INSPECTION SHED

The inspection shed is 320 ft. to 350 ft. long and 144 ft. 6½ ins. wide. It consists of five bays, the outer ones being

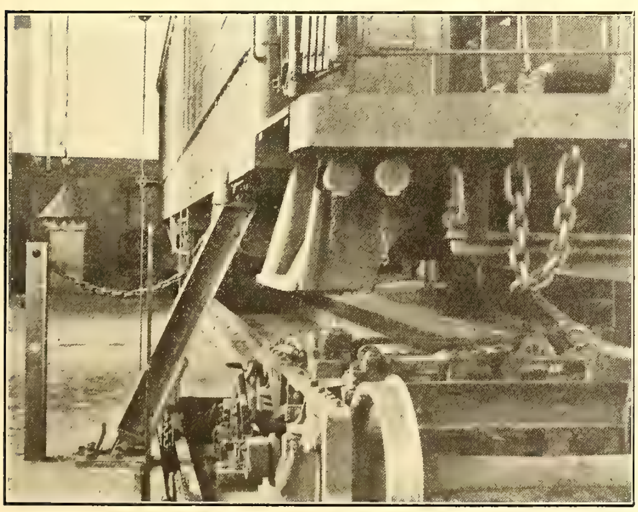


FIG. 11.—STEEL SUPPORTS HOLDING UP CAR AS TRUCK IS LOWERED

31 ft. 8¼ ins. and the remainder 26 ft. 6 ins. wide between rows of columns. The roof is carried on lattice girder posts spaced 20 ft. centers, between which are carried the triangular trusses of the saw-tooth construction. These trusses are located for a clear headroom of 20 ft. 6 ins. They are of simple construction with purlins of 12-in. channels spaced 4½ ft. apart, upon which H. W. Johns asbestos roof covering is carried. All of the windows and the saw-tooth lights of the inspection shed are of metal framing and wire glass, according to the A. E. Rendle Company's "Paradign" system, instead of wood framing as at East New York. Owing

FIG. 12.—BLOWER AND HEATER COILS MOUNTED ON PLATFORM

to the absence of adjoining buildings and outside fire walls both sides of the inspection structure are furnished with the same style of pivoted window sash which gives such excellent light at the East New York shops. The opening mechanism of this sash is shown in Fig. 8.

The entering end of the inspection shed can be closed by Kinnear steel rolling doors having insulated trolley jumpers. It might be noted here that in connection with elevated car operation in steel truss inspection sheds considerable difficulty was experienced in the past with multiple-unit trains in cases where the pole of the first car of a train would be taking current from the wire inside the building at the same time that the pole of a following car was in contact with the metal parts above the entrance, thus causing injurious short-circuits. This trouble has been overcome by placing on the bottom chords of all trusses 2-in. x 4-in. wooden strips, thereby effectually preventing such short-circuits.

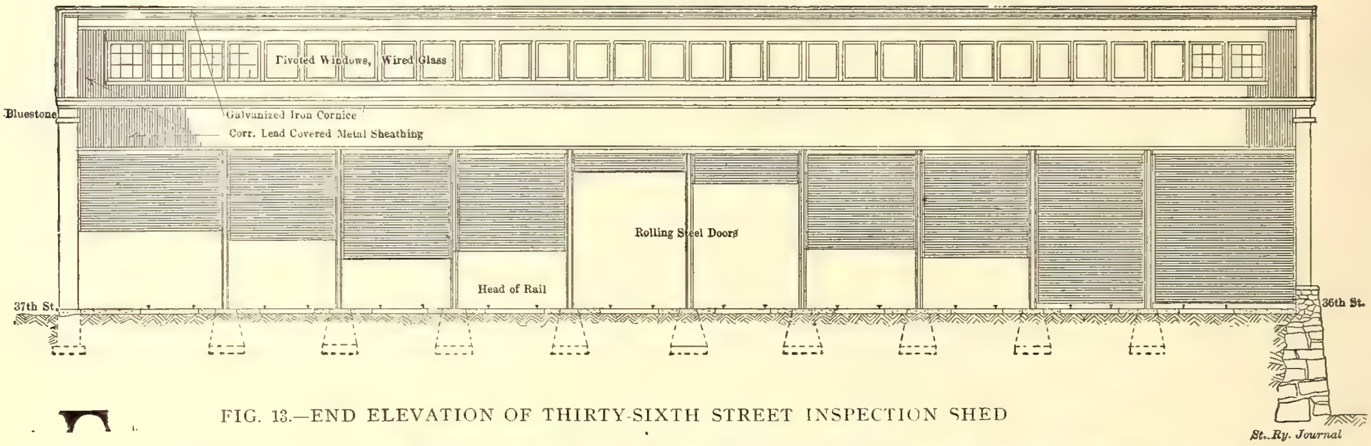


FIG. 13.—END ELEVATION OF THIRTY-SIXTH STREET INSPECTION SHED

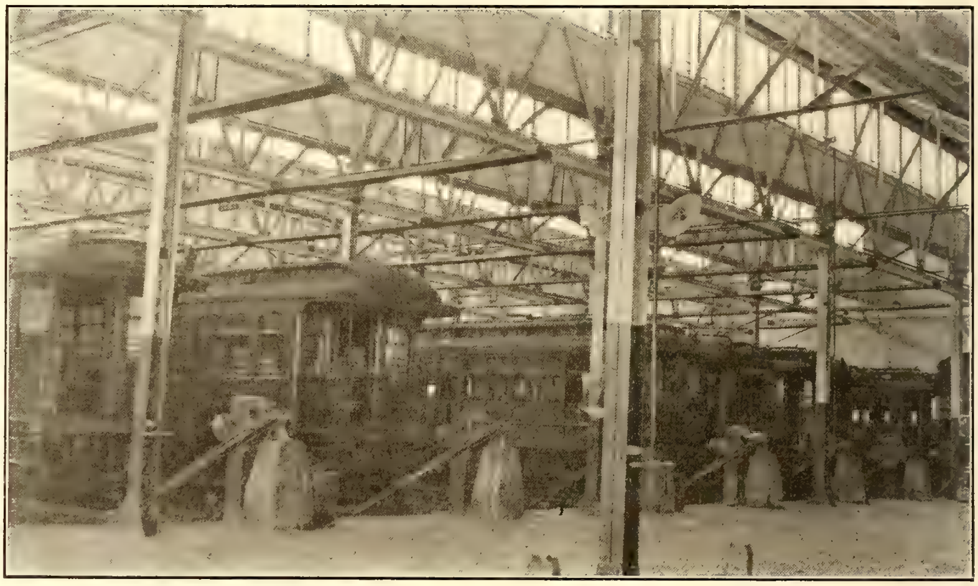


FIG. 14.—UPPER END OF THE INSPECTION SHED

The ten tracks in this shed, spaced 13 ft. 3 ins. center to center, have a total capacity of sixty standard elevated motor cars. Nine of the tracks are furnished with pits similar to those at East New York, but the track nearest Thirty-Seventh Street is reserved for cars which are run to the elevator to have their trucks removed for overhauling in the shop below. To secure additional capacity for such cars the adjoining track is now being adapted for that purpose by the installation of a cross-over.

To carry on minor repairs a hard maple work table has been placed along the Thirty-Sixth Street side. On the opposite side are racks for controller drums and for car headlights. The headlight rack is shown in detail in Fig. 15. There is also a testing and charging track for the storage batteries required in connection with the Westinghouse

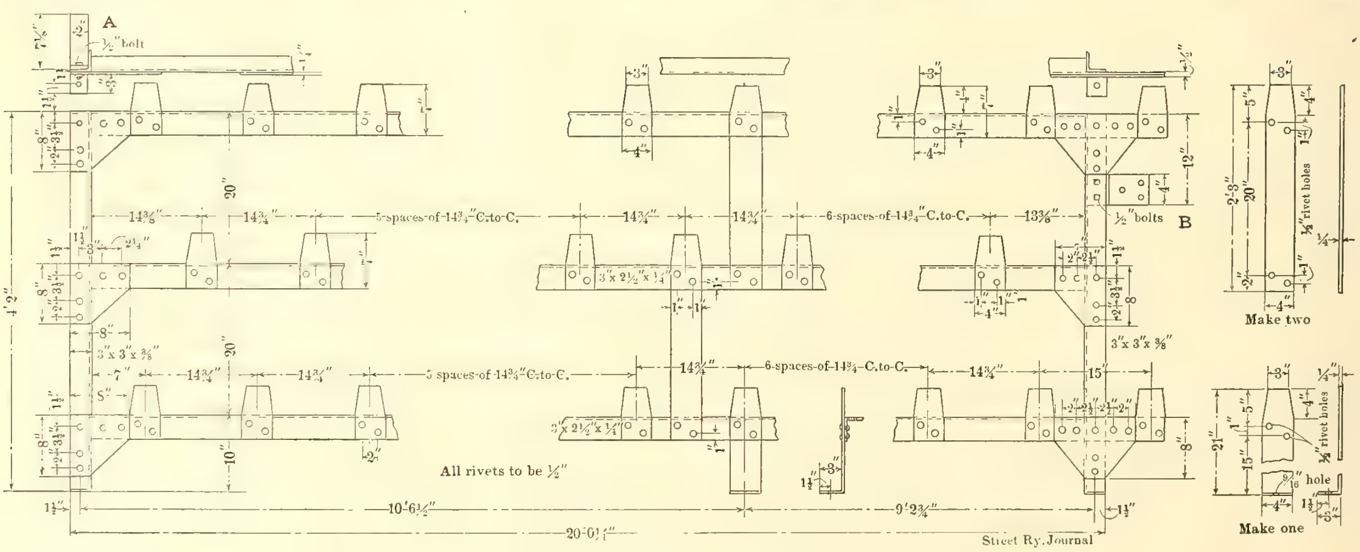


FIG. 15.—CONSTRUCTION DETAILS OF HEADLIGHT RACK

unit switch control system. The interesting type of wooden boxes used for taking the armatures of compressor motors to the company's Fifty-Second Street shop deserve some

are placed one upon another they are completely protected from injury. Iron handles are attached to the sides for convenience in carrying. The illustration showing these

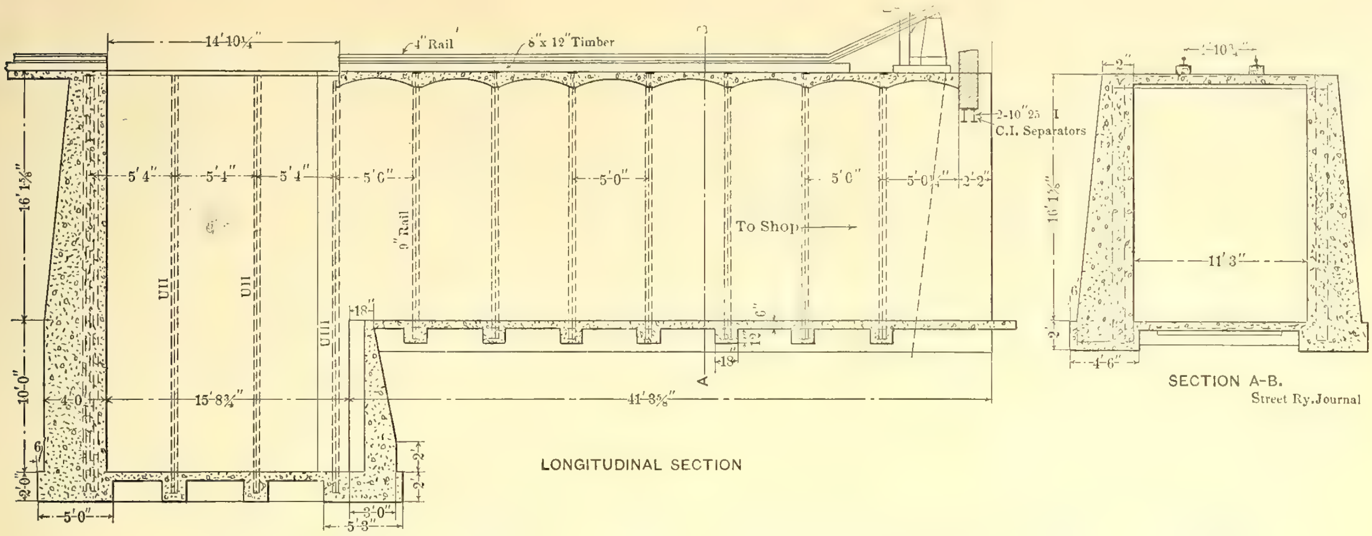


FIG. 16.—LONGITUDINAL AND CROSS-SECTIONS OF THE TUNNEL UNDER THE ELEVATOR TRACK OF INSPECTION SHED AT THIRTY-SIXTH STREET, USED FOR CONVEYING TRUCKS TO THE OVERHAULING SHOP

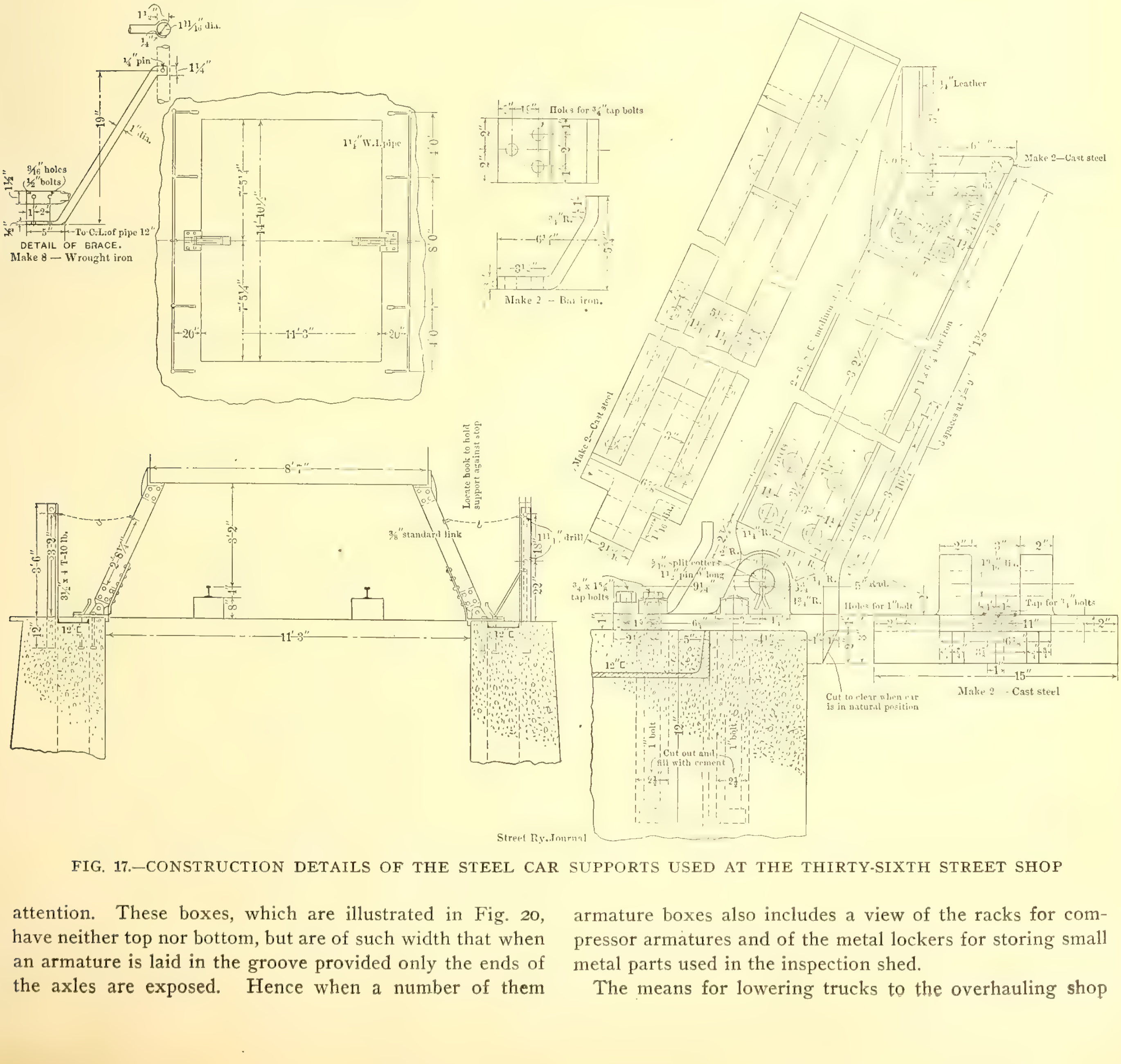


FIG. 17.—CONSTRUCTION DETAILS OF THE STEEL CAR SUPPORTS USED AT THE THIRTY-SIXTH STREET SHOP

attention. These boxes, which are illustrated in Fig. 20, have neither top nor bottom, but are of such width that when an armature is laid in the groove provided only the ends of the axles are exposed. Hence when a number of them

armature boxes also includes a view of the racks for compressor armatures and of the metal lockers for storing small metal parts used in the inspection shed.

The means for lowering trucks to the overhauling shop

differ somewhat from the procedure at East New York, in using steel instead of wooden struts to support the car during the time a truck is being lowered and a dummy substituted. It will be noted from the accompanying detail drawing, Fig. 17, that these pivoted supports are made of two 6-in. medium steel channels, each fitted at the end with an irregular shaped casting having a rectangular top to

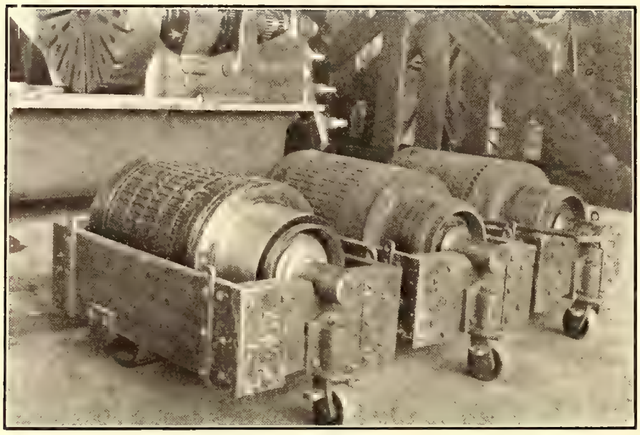


FIG. 18.—ARMATURE TRUCKS USED IN THE MACHINE SHOP

fit the corners of the car. To avoid scratching the side of the car these end rests are padded with ¼-in. leather.

Owing to the layout of the grounds at Thirty-Sixth Street the overhauling shop, while lower than, is not directly beneath, the inspection building. The trucks to be overhauled are lowered about 16 ft. on an Otis plunger elevator driven by a 55-hp Northern motor. The trucks are then taken to the overhauling shop through a concrete tunnel 41 ft. ⅝ ins. long and 11 ft. 3 ins. wide. As at East New York,

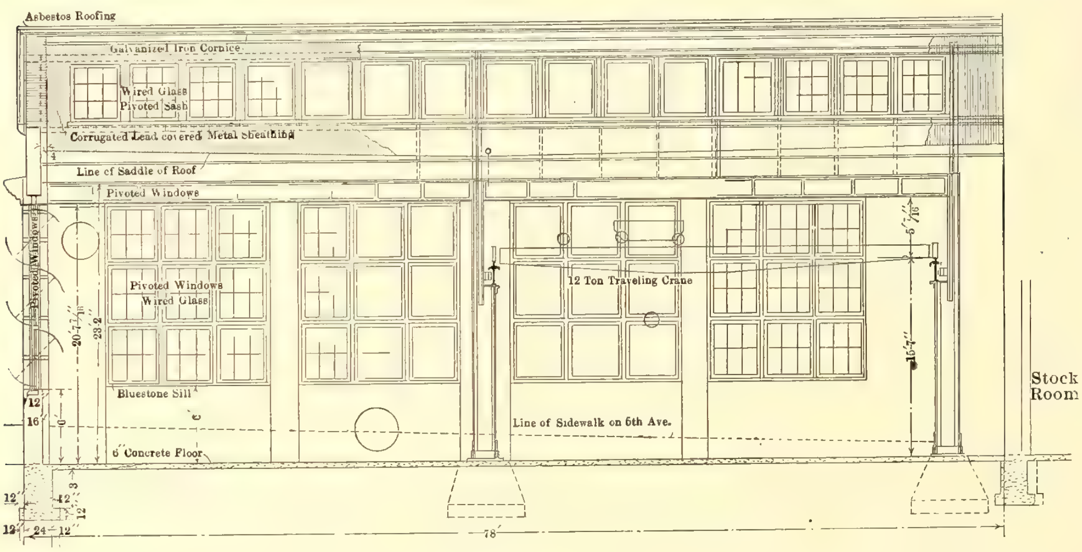


FIG. 19.—TRANSVERSE SECTION OF MACHINE SHOP, SHOWING THE LIGHTING ARRANGEMENTS

these trucks are moved along the track by their own motors through power obtained by a controller and resistance outfit placed in the overhauling shop.

TRUCK OVERHAULING AND MACHINE SHOP

The general location of the truck overhauling and machine shop will be noted in Figs. 3 and 4, which are respectively the Fifth Avenue and Thirty-Seventh Street elevations. The floor of the shop is at a lower level than the offices, and the foreman's headquarters are so located that he can look down into the shop without leaving his desk.

Like the inspection structure, the shop building is furnished with a roof of the saw-tooth type covered with asbestos. Additional light is secured through the pivoted window sash on the Thirty-Seventh Street and Fifth Avenue side, opposite which the work benches are placed. The

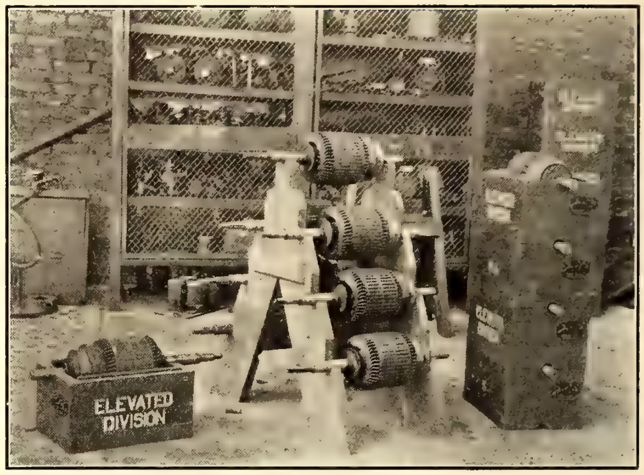


FIG. 20.—ARMATURE RACKS AND BOXES, SHOWING ALSO THE METAL LOCKERS

shop is divided by steel columns into six bays. The first bay starting from Fifth Avenue is 18 ft. wide; the next four, 16 ft. each, and the one adjoining the steam plant, 17 ft. 2 ins.; its width is 78 ft. All of the bays are 21 ft. 7¾ ins. high except the sixth, which is 22 ft. 1 15-16 ins. The floor is of concrete. All openings to adjoining rooms are protected by standard fire doors.

When a truck is brought into the shop from the tunnel previously mentioned, it is carried to one of the seven stub overhauling tracks by a 15-ton box crane which has a span of 35 ft. There are also four swinging air hoists attached to the posts. These are very convenient for picking up wheels and other parts on the overhauling tracks or taking a piece from one tool to another within reach without calling upon the larger crane.

The tool equipment in this shop is not intended for manufacturing purposes as at East New York, and hence is not so elaborate. All of the tools and motors are numbered for the sake of convenient reference at the office of the superintendent of equipment. Of the machine tool equipment in the shop, the following are group-driven by a 10-hp motor as shown in Fig. 24: No. 101, one emery grinder; No. 102, one 18-in. Place drill press; No. 103, one No. 1 Robertson hack saw; No. 109, one 14-in. Washburn sensitive drill; and No. 110, one bolt cutter. The independent-driven tools are made up as follows: No. 107, one 42-in. Pond wheel

lathe driven by a 15-hp motor; Nos. 108 and 104, one 36-in. and one 24-in. Putnam engine lathe driven by 10-hp and 5-hp motors, respectively; No: 105, one 54-in. Dresses radial drill of the simplex type, driven by a 2½-hp motor; and No. 106, one 24-in. Cincinnati shaper driven by a 5-hp motor. All of the motors were manufactured by the Northern Electric Company except those used on the crane which were supplied by the General Electric Company, and the 4½-hp motor used in the blacksmith shop.

WHEEL STORAGE, BLACKSMITH SHOP AND TOOL ROOM

The wheel storage tracks and blacksmith shop are under the office building and adjoin the truck overhauling shop, from which they are separated by a brick wall with standard fire doors. At the Fifth Avenue side, however, there is a gap of 4 ft. 6 ins. (closed by a double fire door) for a 2-ft. gage transfer track used for bringing car wheels to the five sets of storage tracks. The latter are of the double-rail type as installed at East New York.

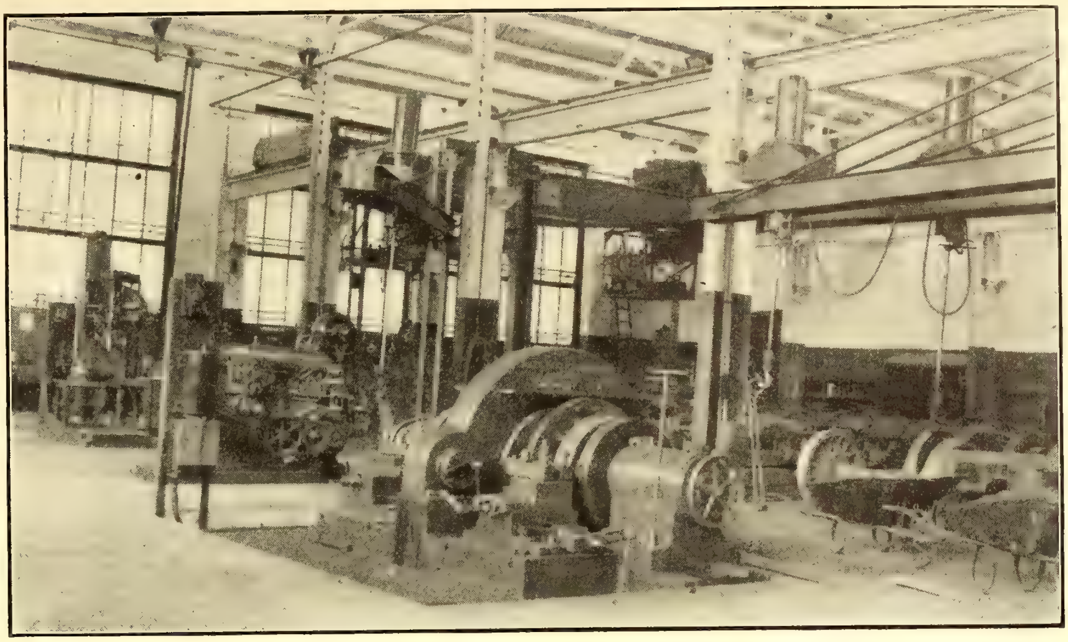


FIG. 22.—VIEW IN MACHINE SHOP, WITH THE TRUCK-OVERHAULING TRACKS ON THE RIGHT

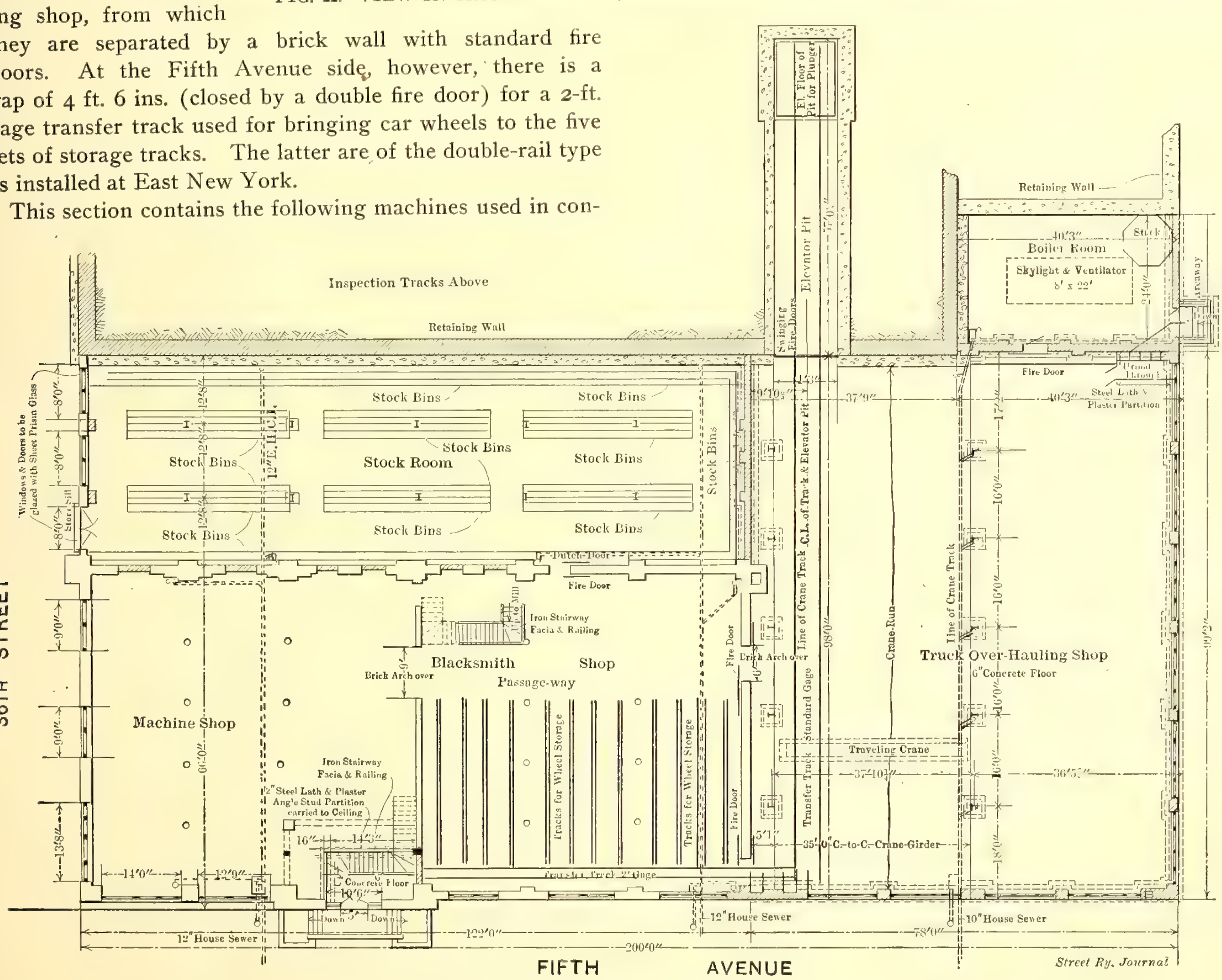


FIG. 21.—PLAN OF TRUCK-OVERHAULING SHOP AND OF THE DEPARTMENTS UNDER THE MAIN FLOOR OF THE TERMINAL BUILDING

This section contains the following machines used in connection with wheel work, besides five 4000-lb air hoists for carrying the wheels over each storage track; No. 113, one Ingersoll-Sergeant Class E air compressor driven by 45-hp motor for supplying air to the hoists, air hammer, armature cleaner, etc.; No. 114, one Watson-Stillman 150-ton wheel press driven by a 7½-hp motor; and No. 115, one No. 1 Springfield wheel grinder driven by a 10-hp motor. This grinder is used for flat wheels.

The blacksmith shop proper is directly opposite the stor-

age tracks and contains the following: Three Buffalo down-draft forges with 4½-hp Western Electric motor; an armature blower of the type used in East New York; and

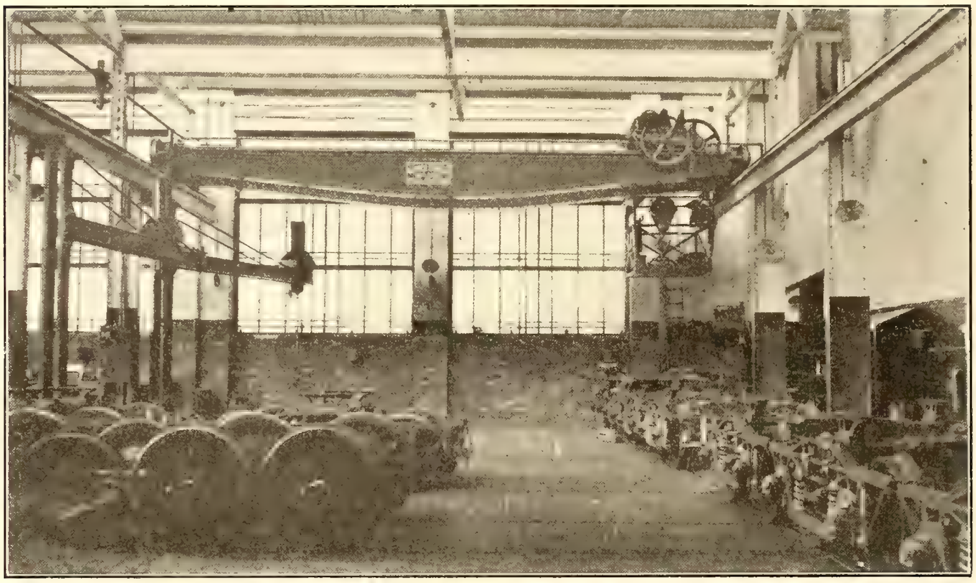


FIG. 23.—CRANE TRAVELER IN SHOP OVER THE TRUCK-OVERHAULING TRACKS

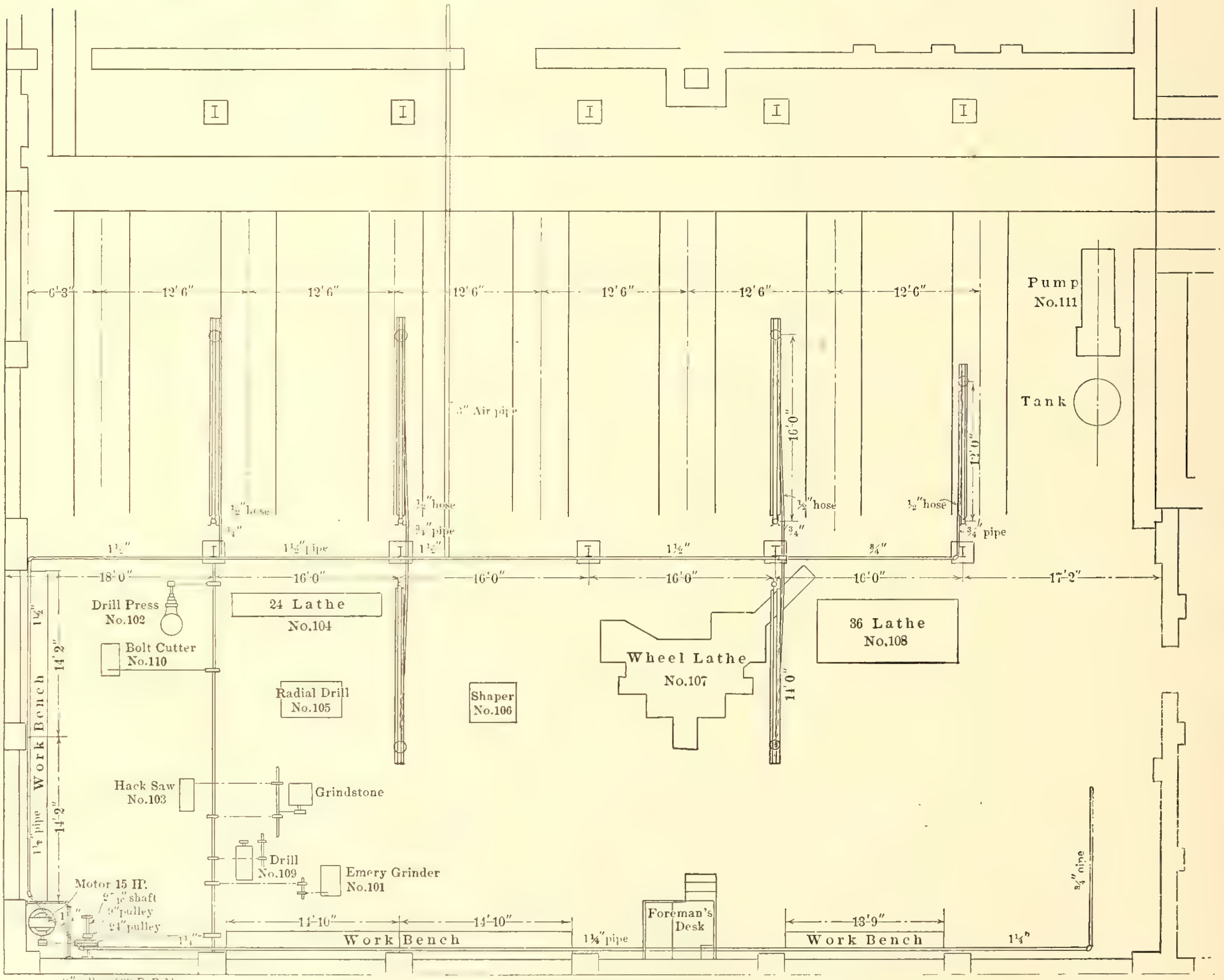


FIG. 24.—GENERAL PLAN OF OVERHAULING SHOP, SHOWING LOCATION OF OVERHAULING TRACKS, TOOLS, ETC.

No. 112, a 250-lb. Billings post air hammer. The forges are supplied with soft coal through chutes from the inspection shop floor which leads to an intermediate 5-ton bin.

As shown in Fig. 25, the tool room is located just outside the wheel storage and blacksmith shops. It is in most respects like the one in East New York except that the vertical tools such as drills and the like will be placed in grooves instead of being mounted upright. This will make it more convenient to put the tool check in the place of the tool taken. The balance of this part of the building which receives light from the Thirty-Sixth Street side is unoccupied at the present time except for miscellaneous job work.

The stock room shown in Fig. 21 is isolated from the overhauling shop by a solid 16-in. brick wall, and from the other departments on the same floor by a similar wall with fire doors. This room is illuminated by drop lamps. It is 119 ft. long and about 37 ft. wide. Like the rest of the divisions on this level it has a concrete floor 6 ins thick.

Most of the material is stored in bins which are num-

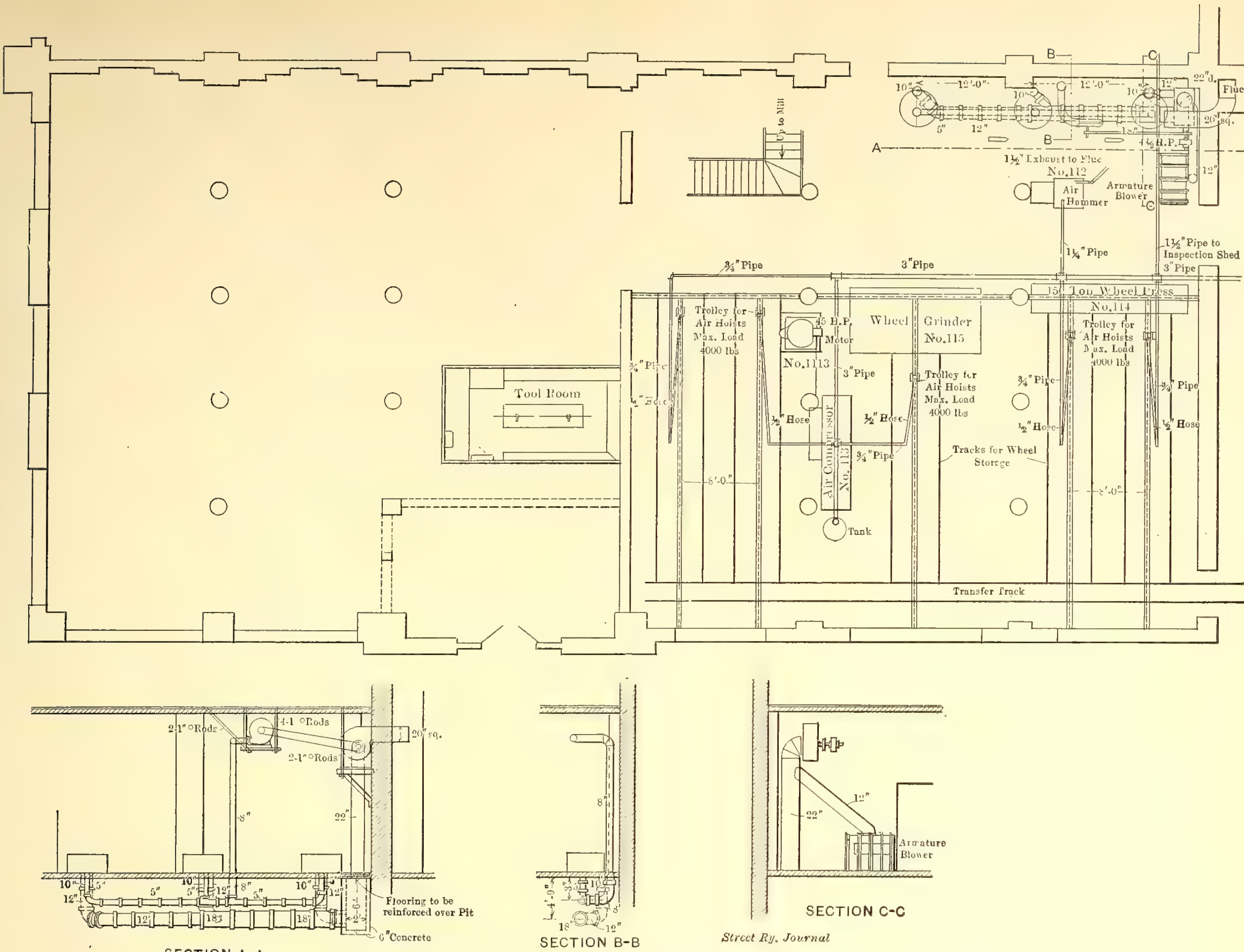


FIG. 25.—DETAIL PLAN AND SECTIONS OF BLACKSMITH SHOP AT THIRTY-SIXTH STREET

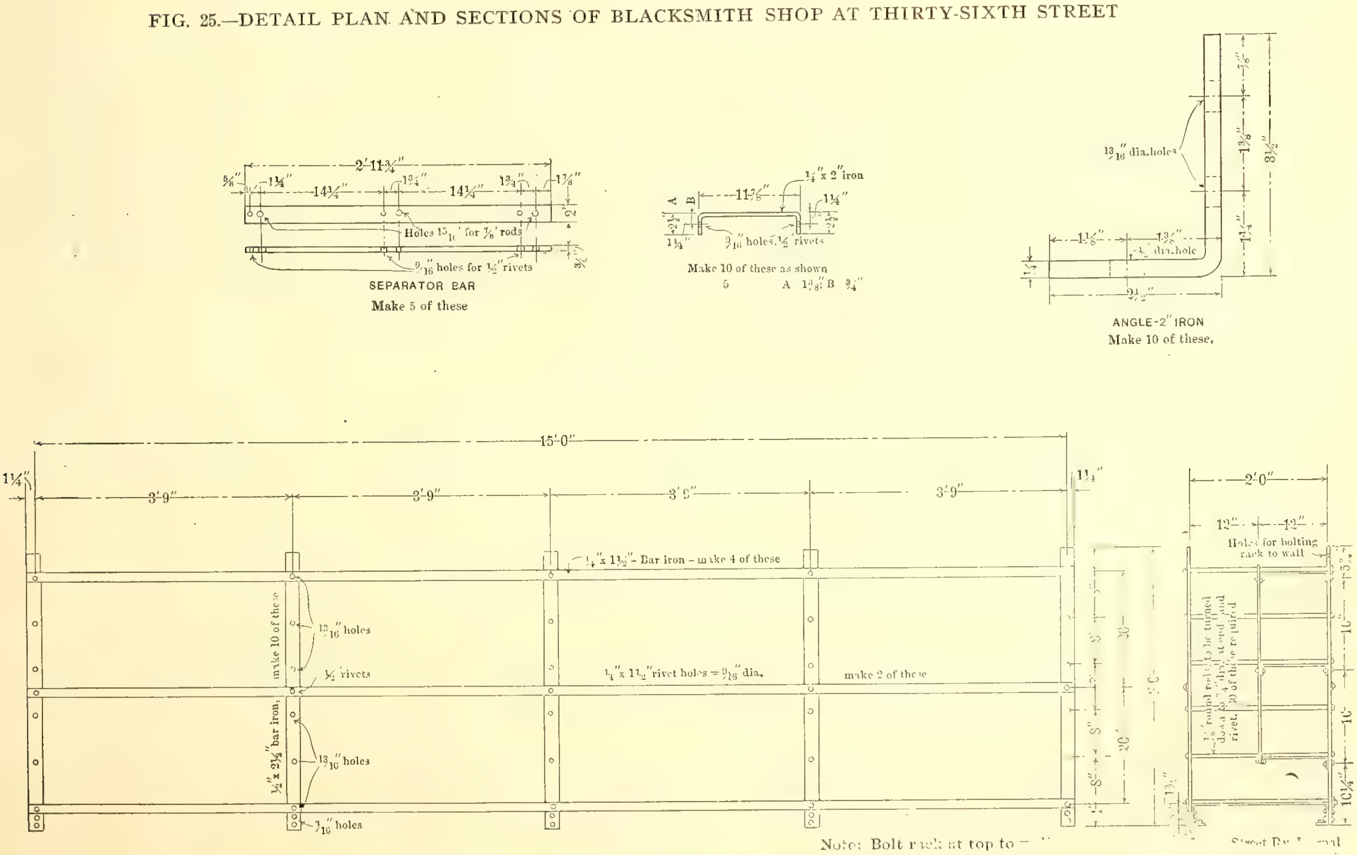


FIG. 26.—CONSTRUCTION DETAILS OF IRON RACK USED AT THE THIRTY-SIXTH STREET SHOP FOR STORING TROLLEY-POLE TUBING AND THE LIKE

bered serially, each number corresponding to some particular item. An interesting feature of the stock room is the wall rack built for storing trolley-pole tubing, piping or other long pieces of metal. It is 15 ft. long, 4 ft. wide and 2 ft. high, and, as shown in the construction drawing, Fig. 26, is divided into sections by separator bars and rods. The use of this rack secures more systematic storage and naturally makes it possible to handle the material with greater ease than if it were lying scattered on the floor.

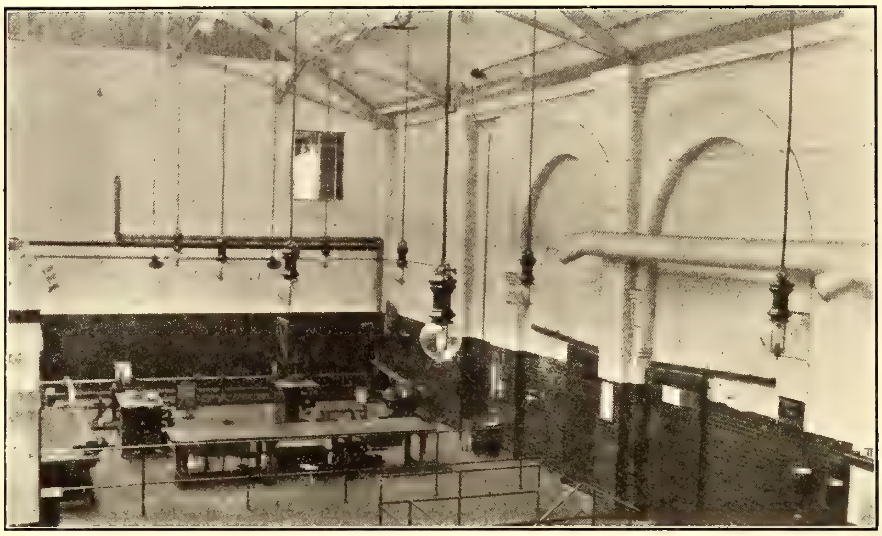


FIG. 27.—VIEW OF MILL ROOM

The oil room is enclosed by a brick wall, the only openings being the standard fire doors to the overhauling shop. To comply with the standard fire underwriters' requirements, the floor is pitched toward a center drain to prevent the accumulation of oil resulting from possible leakage from barrels and tanks.

MILL ROOM, BENCH ROOM, EMPLOYEES, ETC.

The mill room is in the remodeled terminal building, being located between the offices and bench room, as shown in Fig. 6. It is separated from the offices by a steel lath and plaster partition and from the bench room by a 12-in. brick wall and fire doors. This shop is well illuminated by means of a vault light, arc lamps and five-light clusters. The tools in this room are all driven from one countershaft. They consist of No. 116, which is a No. 50 Fay & Egan scroll saw, and No. 117, a Fay & Egan Universal planer. The countershaft is connected to a 20-hp motor. There is also a fan in the mill room driven by a 12½-hp motor. An interesting point about the scroll saw is the application of a wooden guard to prevent injury to the workmen from contact with the blade.

The bench room is directly over the stock room and at the head of the inspection tracks. The benches are located along the walls. This room is also used for tool and material lockers and miscellaneous carpenter work.

The size of the installation at Thirty-Sixth Street did not warrant the company in going to heavy expense in fitting up a special building for the convenience of officers and employees as at East New York. However, the men at the smaller plant have not had their interests neglected either. A large, airy room opposite the office is set aside for clothes lockers, and near by there is located a comfortable toilet room with hot and cold water, porcelain sinks and shower baths.

RAIL CORRUGATION IN NEW YORK

Through the courtesy of Oren Root, Jr., vice-president and general manager of the New York City Railway Company, this paper is permitted to present some particulars as to the extent and character of rail corrugation in New York City. This information is embodied in a report to Mr. Root by W. T. Dougan, engineer of maintenance of way of the company, and was prepared to answer an inquiry which had been sent to the New York City Railway Company on this subject.

In comparison with other roads the New York City lines have experienced comparatively little trouble from rail corrugation. Where the corrugations have appeared the distance between crests is from 2½ ins. to 3 ins. in most cases and the spots are indicated by bright and dark places on the rail. On the four lines on which the trouble has been noticed the corrugations have appeared in the cases of three of them entirely on straight track, while on the fourth they have developed more frequently on the outside rails of long-radius curves. On all of the four lines the traffic is fairly heavy. As the corrugations have given no appreciable trouble no measures have been taken to overcome the difficulty.

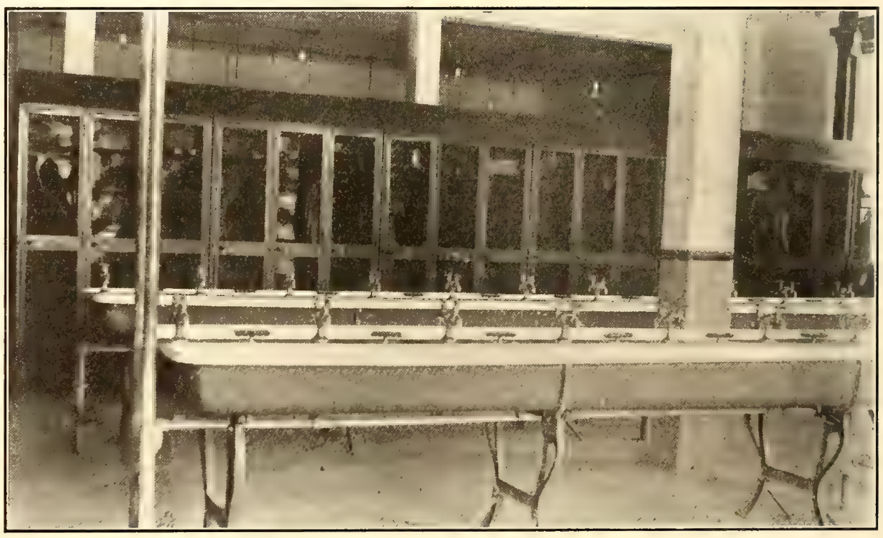


FIG. 28.—LOCKER AND WASH ROOM

It is also interesting to mention that the corrugations have occurred in almost all cases at the points where the cars begin to brake for a stop. This would indicate that the cause is to be found in the fact that the car wheel slips for a few inches, then revolves, then slides again. In one instance on Broadway, on a long-radius curve, where the track gage was from ⅜ in. to ½ in. wide and the rails were so worn that the flange of the inside wheel impinged against the tram of the rail so that the wheel must necessarily slip more or less on the outside rail, it was found that the outer rail was corrugated while the inner rail was not.

This indicates that the slipping of the car wheel may have been the cause of the corrugation. Other instances have occurred where one rail has become corrugated while the opposite rail on the same track, upon which the wheel must slip practically as much as on the first rail, has shown no corrugation.

Once started, the corrugations tend to multiply and grow deeper. They may be started by a hard or soft spot in the rail, and a tight track gage or a wide gage, if causing the wheel to slip, may be the cause of corrugation.

As an indication of the extent to which the presence of corrugation may be attributed to tight track gage it might be said that at Amsterdam Avenue and 181st Street, where the New York City Interborough Railway Company maintains a crossing over the tracks of the New York City Railway Company, the expansion of the rails of the first company, which took place last summer, resulted in the tightening of the track gage of the New York City tracks. Shortly after this, corrugation began to appear at the point referred to, although none had previously existed, leading one to believe in this case at least that tightened gage had much to do with causing the rail corrugation.

NEW HYDRO-ELECTRIC PLANT OF THE SPOKANE & INLAND EMPIRE RAILROAD COMPANY

Some two years ago or more Jay P. Graves and associates decided to enter the electric light, heat and power field in the city of Spokane in connection with their traction business, at that time in its infancy. Accordingly, they had all the important power sites near Spokane examined. The site selected is about 10 miles down the Spokane River from Spokane and at a point where the river cuts through a deep granite rock gorge. It so happens that at this point the surface of the river at high water is about 320 ft. wide, while at low water the channel is on the west side of the river about 100 ft. wide and approximately 20 ft. deep, while on the east side of the river there is a rock bottom approximately 200 ft. wide, which stands above the water at low water. This made an ideal location, inasmuch as the power house could be placed in the deep part of the stream and the dam, which would have to be about 225 ft. on the crest, could be built practically on dry rock. The canyon was deep enough so that a dam 60 ft. high could be built and at the highest water not overflow the rock contour. By building a dam of this height, a lake was created about 4½ miles long, having a superficial area of about 400 acres, the advantage of such a development, of course, being that with the storage capacity a peak load on the lower power plant can be handled at least twice as large as the normal flow of the river would admit without storage. Having acquired the necessary property, it was decided in April, 1906, to proceed with this development by transferring the property to the Spokane & Inland Empire Railroad Company. This company employed Sanderson & Porter to be the designing and constructing engineers, and made arrangements with Wm. F. Zimmerman to enter the employ of the Spokane & Inland Empire Railroad Company as consulting engineer. Plans were made and the work started about July 1, 1906.

The power house will be approximately 110 ft. across the stream, 87 ft. high from low-water mark and approximately 85 ft. from the up-stream walls of the power house to the down-stream walls. It is designed to accommodate four units of 5000 hp each, the initial installation being two such units. The wheel pits will be open flumes closed by head gates, each unit consisting of four 42-in. adjustable bucket wheels built by the Holyoke Machine Company, of Holyoke, Mass. The shaft of these wheels will run directly through the dam wall and be connected by a flange coupling to a 3750-kw, three-phase, 2200-volt, 60-cycle alternator, the shaft of which will carry an exciter of sufficient size to excite three units. The turbine speed regulator will be placed between the generator and the dam wall. The switchboard, electrically operated, to which nothing but the low-tension wires are to be connected, will be placed in the center of and on the down-stream side of the power house, so that the switchboard operator will have full view of each and every machine. A traveling crane, hand-operated, will cover the entire length of the dynamo floor. The height of the building will be such that the second floor, 30 ft. above the dynamo room floor, will be used for all the switchboard apparatus; both high and low-tension switches and their connections being made on this floor.

The dam wall will be so constructed that the space between each set of retaining piers may be used for the transformers, there being one set of raising transformers, raising the voltage from 2200, the machine voltage, to 60,000, the line voltage adopted. These transformer rooms will be built entirely of concrete, access to them being through fireproof iron doors.

The transformer rooms will drain directly to the tail-race and the transformers will have an oil drain with a valve which can be operated from the dynamo room, discharging the oil into the tail-race, and to be used at any time in case of fire. A gantry floor covered by a hand-traveling crane will extend over all the transformer rooms, also partly over the turbine pits, so that the turbine wheels, as well as the transformers, can be placed or raised out of their position by a single traveler and delivered to the gantry floor; the gantry floor will be on a level with the roadway leading to the power house. The main water gates will be double-leaf sliding gates, operated by rack and pinion hoist, motor driven. Each turbine chamber will be supplied with an auxiliary filling valve.

The power house building will be of steel construction, brick filled. The dynamo room floor and the switchboard floor, however, will be reinforced concrete. The dam extending from the power house to the east bank will be of cyclopean concrete work. There will be a water stop wall on the west side of the building to the west bank 85 ft. high from low-water mark in the tail-race to the west bank. It is expected that this plant will be in operation on or about Dec. 1, 1907.

The energy from this plant will furnish light, heat and power for the city of Spokane, the Inland Empire Company having a broad franchise in the city. It will also be used to develop the country through which the lines of the Inland Empire system operate, furnishing power as far south as Moscow and possibly farther. The Inland Empire Railway system owns other power sites which will be developed when the power from this development shall have been used. The work of construction is in direct charge of F. M. Sylvester, local manager for the constructing engineers.

The attempt made last week to rob the passenger depot of the Cincinnati, Dayton & Toledo Traction Company at Spring Grove and Linden Avenues, Cincinnati, resulted in the robbers getting about $80. They blew the safe open, and in so doing wrecked the office.

THE PASSENGER STATIONS OF THE HUDSON COMPANIES

Work on the equipment of the Hudson Companies is now so far advanced as to make possible an account of the plans for the passenger stations in New York, Jersey City and Hoboken. As will be remembered, the Hudson Companies are building a double-track underground electric railway from the corner of Cortlandt and Church Streets, New York, to the Jersey City station of the Pennsylvania Railroad, thence north to a point just above the present Erie Railroad station, thence under the Hudson River to Christopher Street, New York, thence via Christopher Street and Sixth Avenue to Thirty-Third Street. Spurs will be built from the corner of Sixth Avenue and Ninth Street to Astor Place, where connection will be made with the present subway; from the main line in Jersey City to a point adjoining the present station of the Delaware, Lackawanna & Western Railroad, and from the Jersey City station of the Pennsylvania Railroad south to the station of the Central Railroad of New Jersey, in Communipaw. In addition, the company has leased the present tracks of the Pennsylvania Railroad from Jersey City to Newark, and will conduct a through business over these tracks via its tunnel to both of its main terminals in New York. A map of the entire route appeared in the Street Railway Journal for Nov. 25, 1905.

The Cortlandt, or downtown, terminal station in New York will be the largest of any. Here the company has secured on Cortlandt, Dey, Fulton and Church Streets two plots, one measuring about 230 ft. x 210 ft., the other about 180 ft. x 190 ft., on which it is erecting two twenty-two-story buildings. All the floors of these two buildings except the ground floor and basement will be leased for office purposes, and the company is guaranteeing occupancy by May 1, 1908. The convenience of these offices to the railway station, it is thought, will appeal especially to manufacturers who desire offices in New York and who have factories or

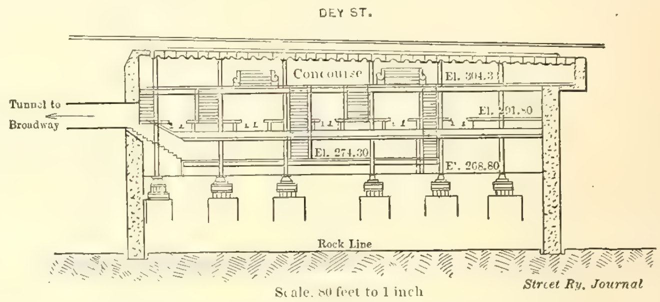


FIG. 1.—CROSS SECTION OF CORTLANDT STREET STATION

warehouses in Jersey City and Newark, or in their neighborhood.

Electric railway interest in the building centers principally in the arrangement of the floors on and below the street level devoted to railway purposes. As shown in the longitudinal and cross sections (Figs. 1 and 2), entrance to

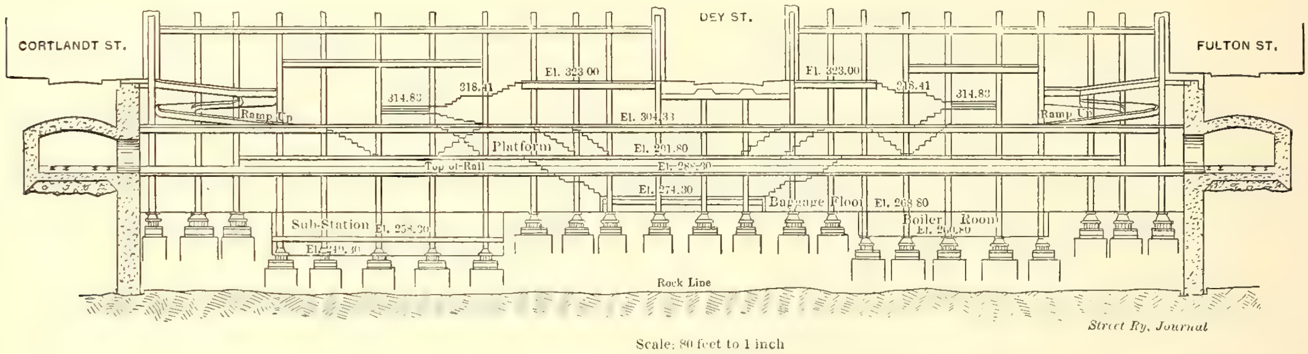


FIG. 2.—LONGITUDINAL SECTION OF CORTLANDT STREET STATION

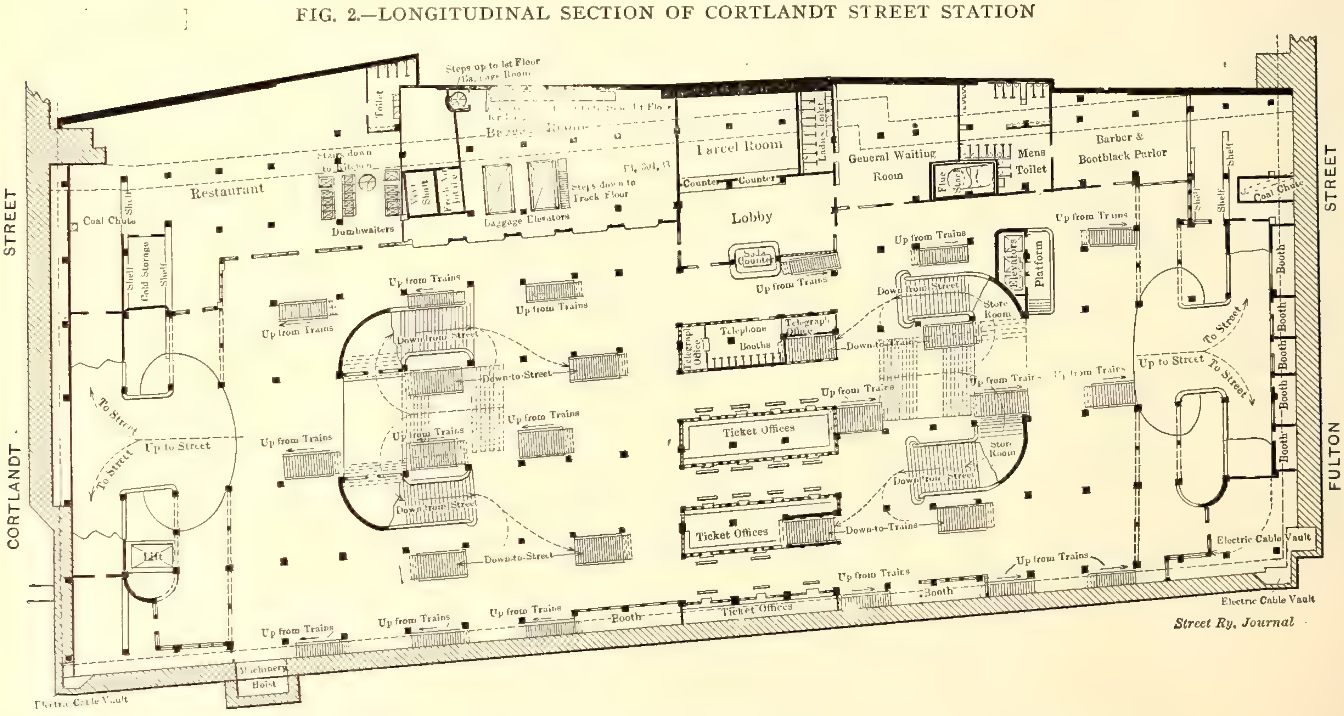


FIG. 3.—PLAN OF CONCOURSE FLOOR, WITH WAITING ROOM, TICKET OFFICES, ETC.

the Cortlandt Street station is provided from Fulton, Cortlandt and Dey Streets, and by a tunnel connecting with the Fulton Street station of the present subway. From Fulton and Cortlandt Streets the passengers descend by inclined planes or ramps, and from Dey Street by stairs to the concourse floor, a plan of which is shown in Fig. 3. This floor contains the usual waiting rooms with ticket offices, baggage rooms, restaurant, etc., and is connected by stairs with the platform level shown in Fig. 4. Here there are five loops which enter on the Cortlandt side and leave on the Fulton Street side with 90-ft. radius curves. A novel feature of this station is the separation of inbound and outbound passengers. As has already been described, the cars are provided with center and end entrances on each side, and incoming passengers will be discharged on to the inbound platform on one side of the car before outbound passengers are admitted from the outbound platform on the other side of the car. The length of the platforms is 370 ft., allowing accommodation for eight-passenger-car trains, which it is expected can be dispatched on a headway of 1½ minutes. Underneath the five passenger platforms is a mezzanine passageway, connecting with the Dey Street tunnel to the Fulton Street subway station of the Interborough Rapid Transit Company.

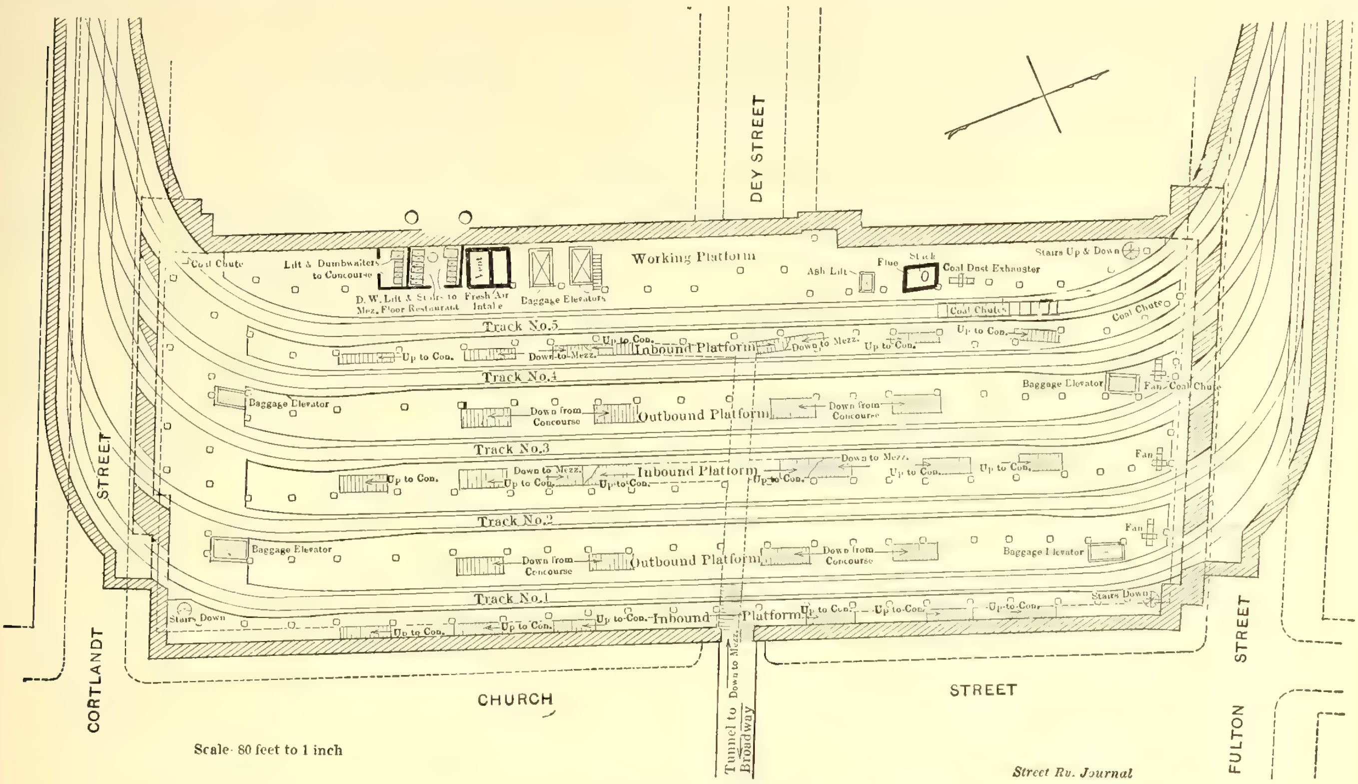


FIG. 4.—PLAN OF STATION AT CORTLANDT STREET

Figs. 5 to 8 illustrate the Hoboken sub-terminal, which is particularly interesting on account of the arrangement made for connecting at this place with the passenger station of the Lackawanna (steam) Railroad, the surface trolley cars of the Public Service Corporation and the elevated cars of the latter which use the North Hudson viaduct to reach Jersey City Heights. Fig. 5 is a plan at this point of the Public Service loop and terminal, which is directly above the Hudson Companies' terminal. As will be noticed, the elevated cars are brought in from the west, and after discharging passengers are carried around a loop to three outbound platforms. The surface cars are also brought in from the west and discharge on a platform about 250 ft. in length, separated by a barrier from the inbound platform of the elevated cars. They then traverse a second loop and can load passengers from the Hudson Companies' lines on two other tracks or from Hoboken on three tracks. Connection with the Lackawanna Railroad station is made through a passageway leading to a concourse directly under the surface track. The Hudson Companies' station proper at this point

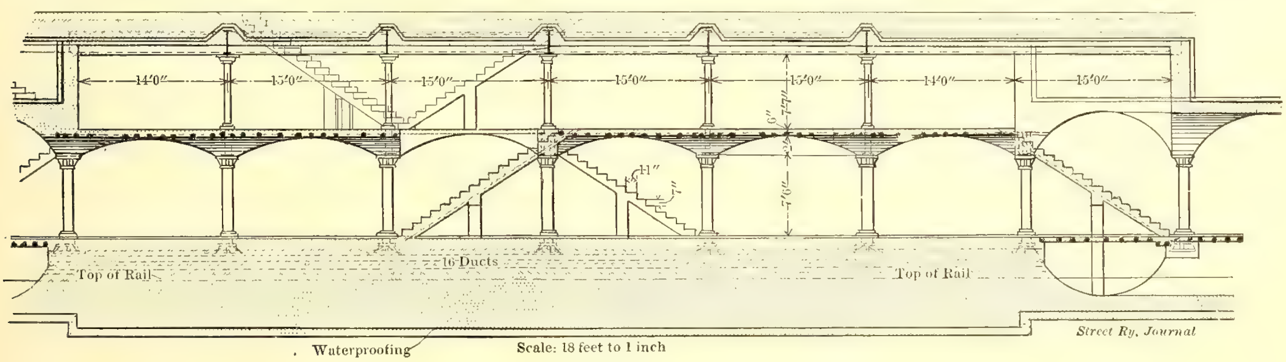


FIG. 7.—LONGITUDINAL SECTION AT HOBOKEN TERMINAL

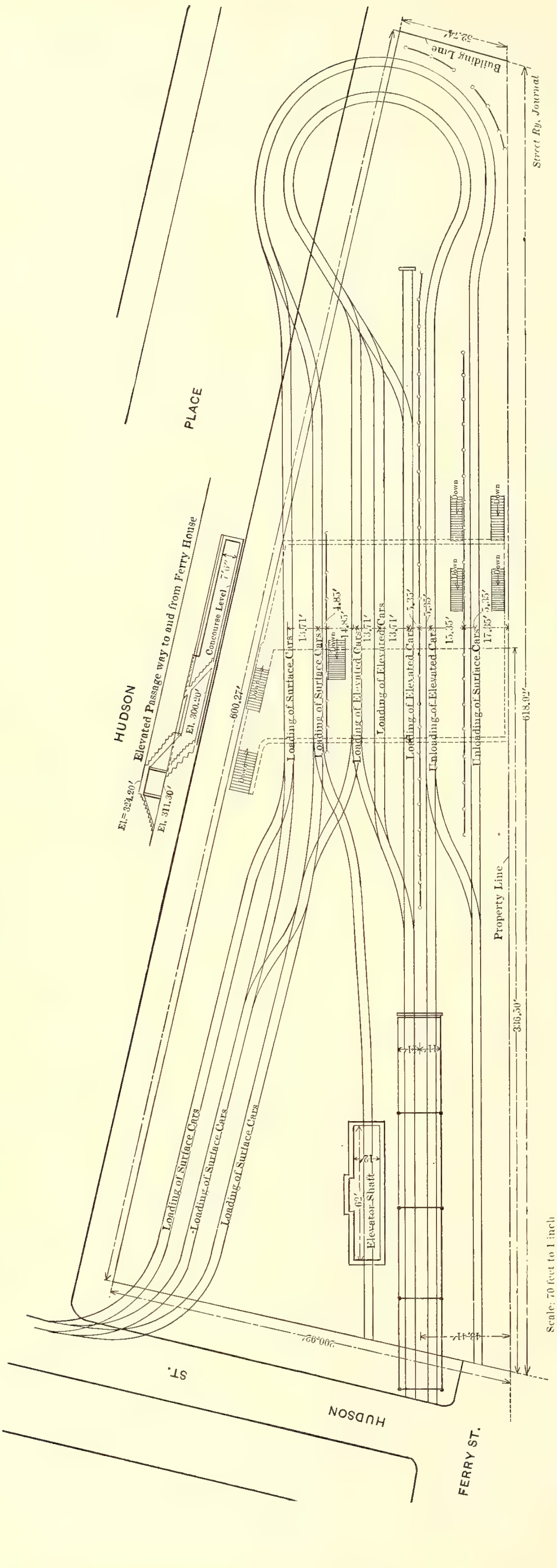


FIG. 5.—PLAN OF SURFACE TRACKS AND STAIRWAYS TO CONCOURSE AT THE HOBOKEN TERMINAL

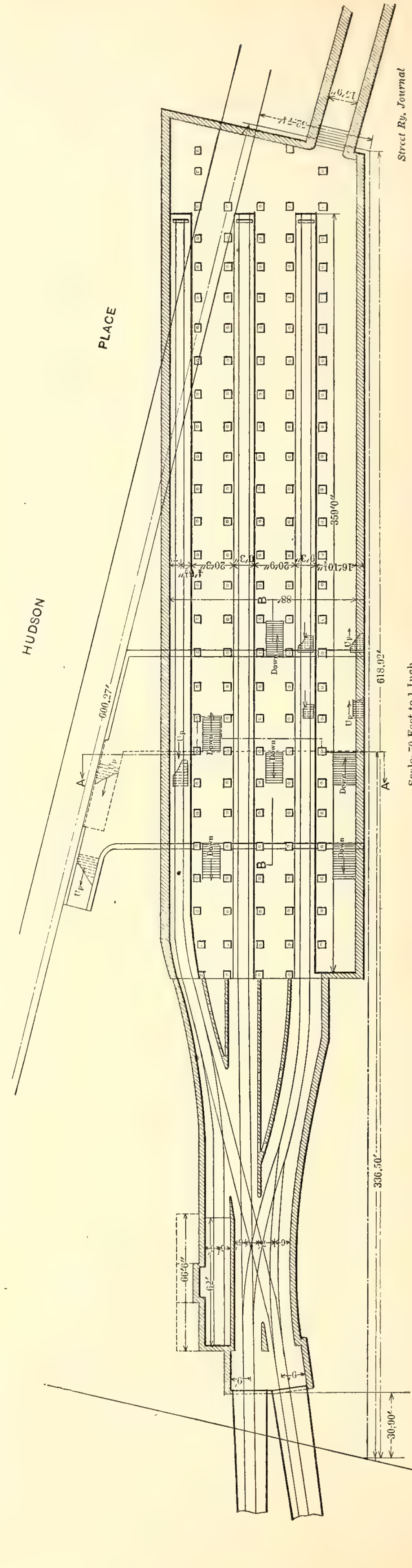


FIG. 6.—PLAN OF SUBWAY LEVEL, HOBOKEN TERMINAL

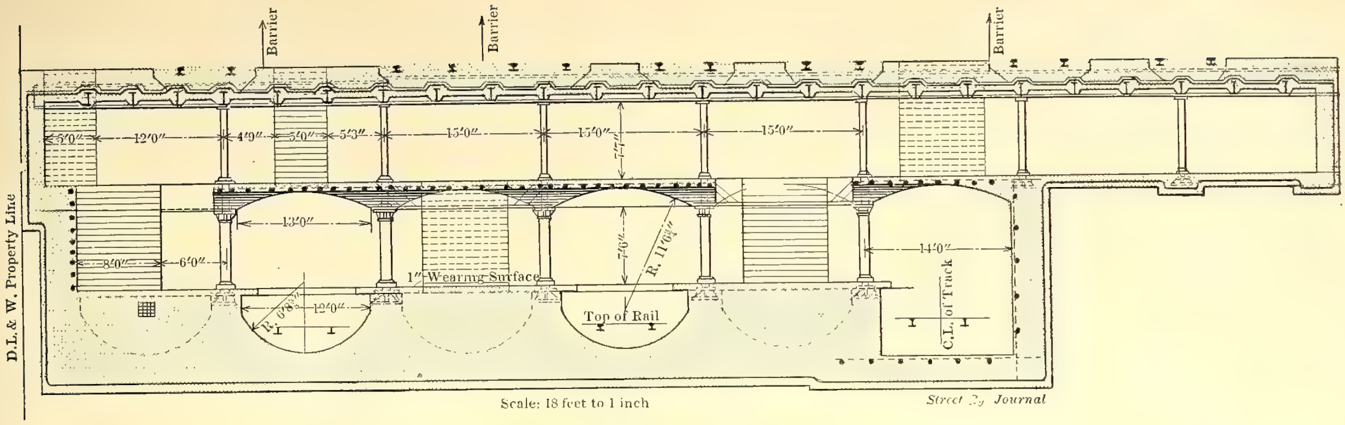


FIG. 8.—CROSS SECTION AT HOBOKEN TERMINAL

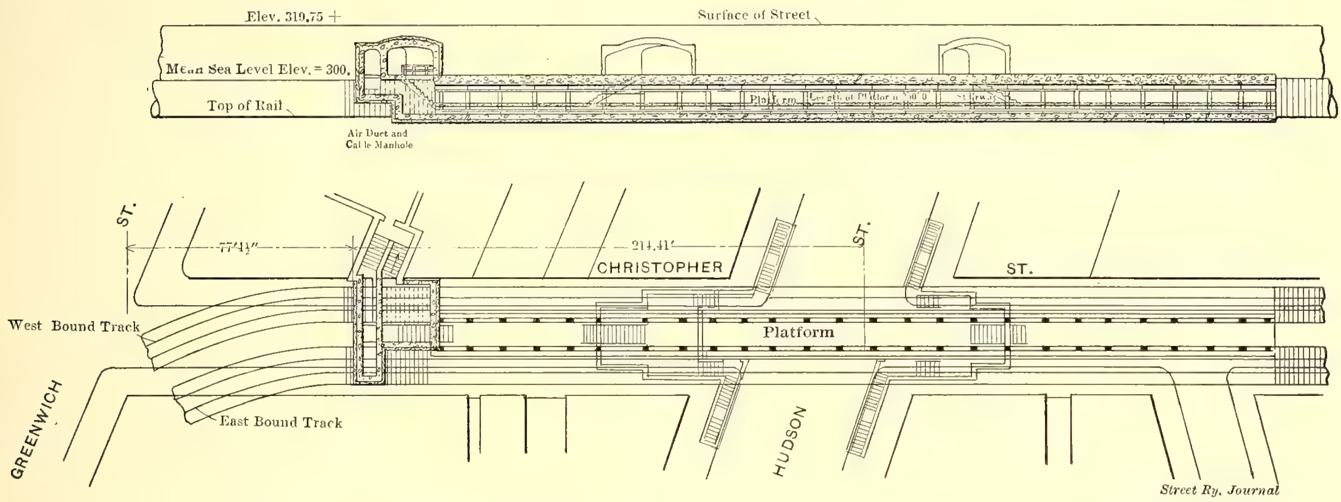


FIG. 9.—PLAN AND LONGITUDINAL SECTION OF THE HUDSON STREET STATION, NEW YORK

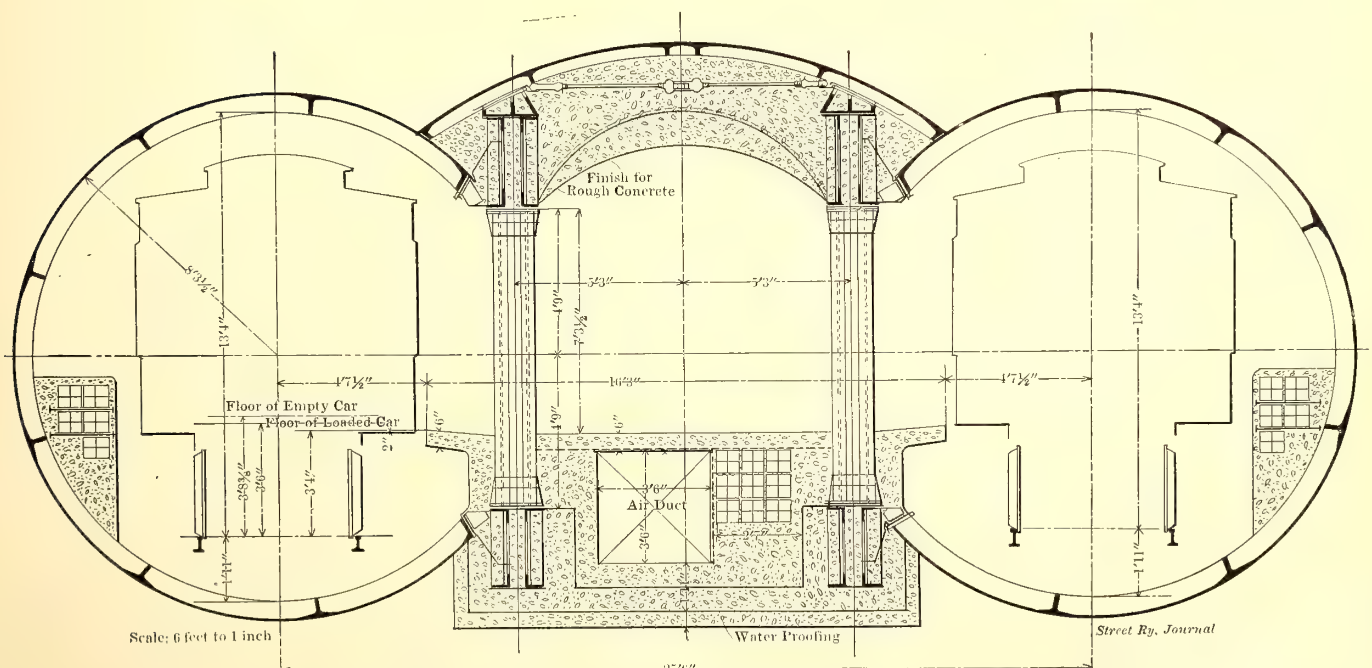


FIG. 10.—CROSS-SECTION THROUGH THE HUDSON STREET STATION, NEW YORK

consists of three stub tracks 359 ft. in length, two of which have separate inbound and outbound platforms.

Two other typical stations are illustrated. One is that at the corner of Hudson and Christopher Streets, which is the first station in New York City after leaving Hoboken. A plan and longitudinal section of this station is given in Fig. 9, and a cross section in Fig. 10. As will be seen, this station has an island platform 350 ft. in length, with an entrance through private property on Christopher Street.

A typical Sixth Avenue station is that at Nineteenth Street and Sixth Avenue, which has separate eastbound and west-bound platforms, each 350 ft. in length. In this case also the exits and entrances have been provided through private property.

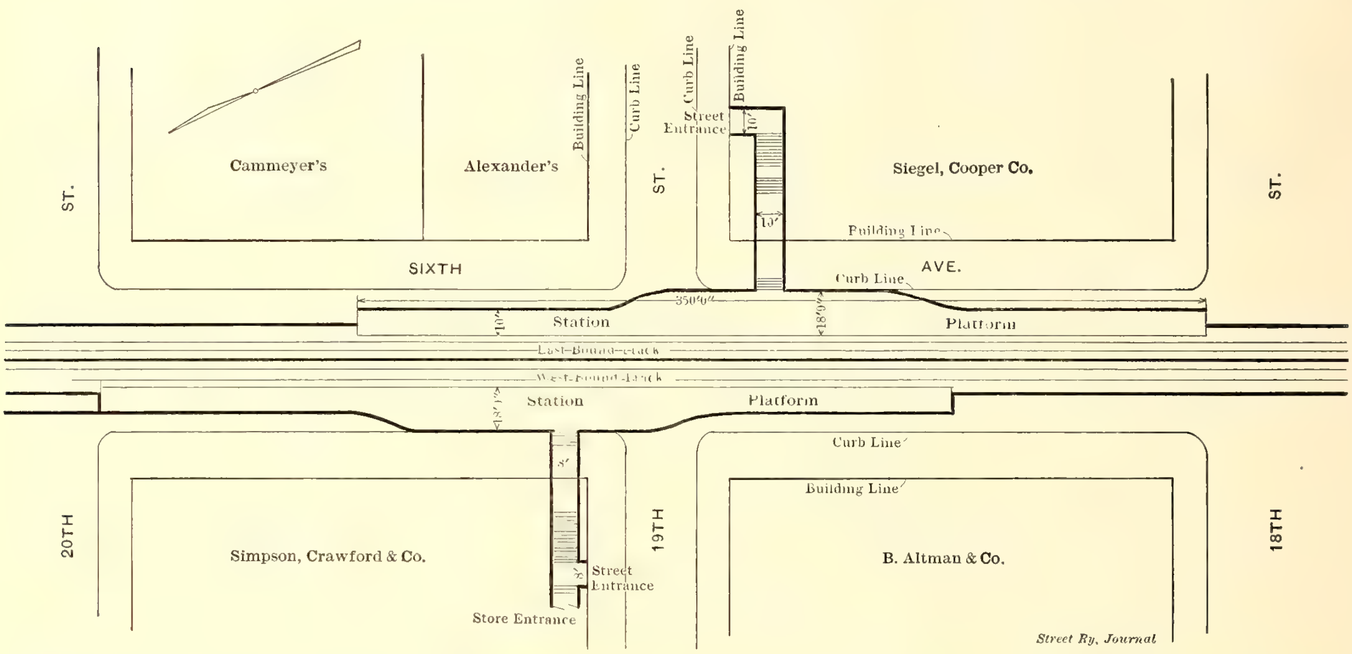


FIG. 11.—STATION ON THE SIXTH AVENUE EXTENSION OF THE NEW YORK & JERSEY RAILROAD, AT NINETEENTH ST.

FIRE INSURANCE RESERVE FUND IN MILWAUKEE

As is generally known, the Milwaukee Electric Railway & Light Company has made a practice for a number of years of charging off a certain amount of its gross receipts for different reserve accounts, and the president of the company, John I. Beggs, has always been an advocate of this policy. Among the funds thus provided for is one known as the fire insurance reserve fund. In view of the general interest now taken in fire insurance questions, particulars of the method of handling this fund and its amount at present will be of interest.

Up to within a year or two the company transferred 1½ per cent of its gross receipts to this fund. Out of it all fire insurance premiums were paid, also any small losses which were too small to make claim for, or which were not covered by the policies of the company. The balance was accumulated and was invested to build up a fire insurance reserve fund which now consists of $400,000 par value of 5 per cent bonds. For a year or two past the company has found it possible to reduce the percentage charged off for this purpose, and now carries only 1 per cent of its gross receipts to the fund. The fund is of course also credited with the interest received on the investments to the credit of the fund, and at present is increasing at the rate of about $25,000 to $30,000 per annum. The property of the Milwaukee Electric Railway & Light Company is quite fully covered by insurance, as it has been Mr. Beggs' policy not to assume the risk until there is at least $500,000 of invested securities in the company's fire insurance reserve fund. What may be done at that time would depend upon how low a rate of insurance the company was able to obtain from the companies.

The company pursues practically the same course with its injuries and damage account, charging a percentage of its gross receipts monthly to a fund. As this credit has always exceeded the amount paid out on this account the company has now in the fund $350,000 of 5 per cent bonds.

It requires a patient and persistent policy to build up reserve funds on this method, but the policy of the Milwaukee company since it has been under the management of Mr. Beggs has been that such a plan is the cheapest method possible for protecting railway property against fire loss. There is no cost of administering the fund or of maintaining a field organization such as is necessary in any mutual company, even though that may be very small, as it has been with the New England Mutuals.

ELECTRIC FREIGHT SERVICE TO BE ESTABLISHED BETWEEN ZANESVILLE, COLUMBUS AND INDIANAPOLIS

The Indiana, Columbus & Eastern Traction Company has ordered a number of freight and express trailers, and when these arrive the through freight service between Zanesville, Columbus and Indianapolis will be established. This service has not been put on heretofore on account of the lack of necessary equipment. The through trailers, when put on, will be locked on leaving Zanesville, and en route will be unlocked in Columbus, Springfield, Dayton and Richmond to receive through freight to Indianapolis. In like manner they will bring through freight to Columbus and Zanesville on the return trip.

SHOP KINKS AND PRACTICE AT MUSKOGEE, INDIAN TERRITORY

In those regions where electric railway properties are at considerable distances apart and the opportunities for the men of different systems to mingle with each other are limited, it is a very noticeable fact that there is more originality in operating features in general and shop practice in particular than is to be found in those sections where the men of different systems have frequent opportunities to exchange ideas.

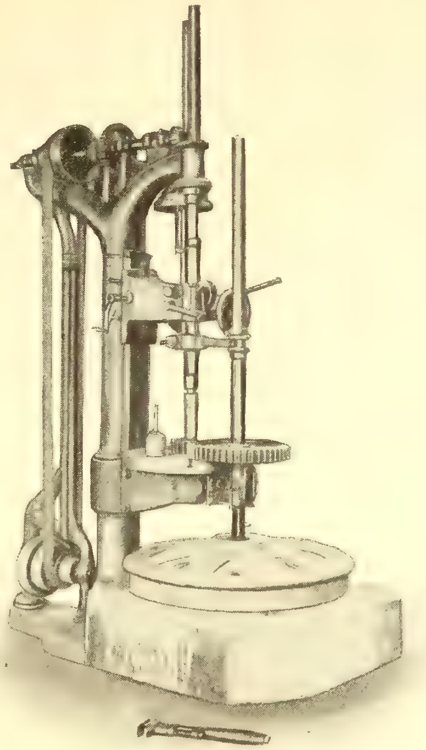
Practice in the shops of the Muskogee Electric Traction Company, of Muskogee, Indian Territory, bears out this statement. Several interesting devices have been made, and in several features practice is radically different from that found in the shops of Eastern companies. The different devices have practically all been gotten up by R. D. Long, manager of the system, and it is through his courtesy that this publication is able to give an account of them.

The shops for the system are located at the east limits of the city. One brick building measuring 36 ft. x 120 ft. contains an inspection shed in the front portion, a machine and paint shop immediately behind this shed, and a store room and office in the rear. The machine shop is equipped with an 18-in. lathe having a 12-ft. bed, an 18-in. drill press, and an emery grinder, all driven by a 5-hp motor. There is also a hand-operated wheel press. These few tools, together with several original devices, are all that are required to maintain the equipment in good condition.

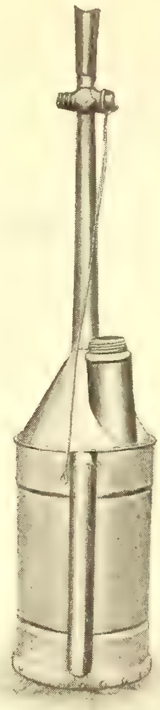
By means of a rather ingenious attachment the 18-in. drill press is made to serve as a wheel lathe. The attachment consists of an additional spindle, or boring bar, operated by means of a gear and pinion from the main spindle.

A PRACTICAL FORGE MADE FROM OLD BOILER IRON AND OTHER SCRAP

The wheel rests on a concrete slab, the surface of which is at right angles to the axis of the boring bar. It was of course essential that this surface be at right angles to the boring bar, for otherwise the bores would not be true. To get this surface true the boring bar was first put in place, and then while the concrete was soft it was surfaced by swinging around the bar a board placed at right angles to it. The boring bar extends through the concrete block and an adjustable bearing in the block keeps it in position. Expansion bolts are employed to hold the wheel in place. An extending arm from the feeding mechanism of the drill press, which works between collars on the boring bar, enables the boring bar to be fed by the feeding mechanism of the drill press. The wheels are obtained from the foundry with a rough cut already made. Usually a wheel is placed on the block, fastened in position, and two cuts are made in about twenty minutes. The accuracy of the machine may be judged from the fact that the wheels always go on the axles at a pressure between 35 tons and 40 tons.



ADAPTATION OF A DRILL PRESS MADE TO SERVE AS A WHEEL LATHE



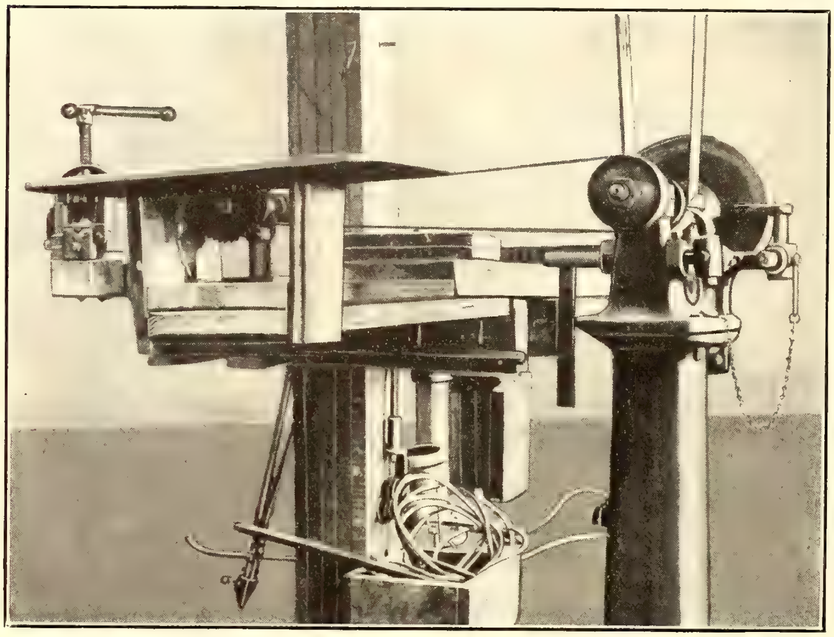
A 3-GAL. CAN FOR OILING TRACK

Before this method of boring wheels was devised the work was done on the 18-in. lathe. The tail stock of the lathe was removed. A frame extending over the end of the bed carried the wheel in such a position that when the carrier was moved the wheel was fed up against a tool wedged in a long shaft which extended from the head stock, and held in position by the steady rest placed near the end of the bed.

Chilled cast-iron wheels with flanges 1-in. high and treads with a 3-in. tread are employed. Practically no trouble at all is experienced with breaking of flanges and rims. This is due largely to the fact that T-rail is used exclusively in track construction. For a time, however, more or less wheel trouble was caused by the grease used on the track curves getting hard and filling special work. Crude oil has since been substituted for grease, and this is not only found much more satisfactory but it is obtained at a much less initial cost and is much easier applied.

The can shown in one of the illustrations is employed in oiling the track. It holds about three gallons, and the spout is provided with a spring valve, opened by pressing with the thumb a small lever near the handle of the can. The end of the spout is provided with a guide which fits against the side of the rail. The idea of such a can was originally obtained from one used in Oklahoma City.

The forge used in the shop for heating axles or heavy parts is a suggestion that might be of benefit to others. It is made of a section of an old boiler that was obtained at a very low cost. The boiler shell extends about 4 ft. under ground and is left unfilled up to the fireplace. The brick forming this are held up by cross bars supported from the rim of the forge. The grate is formed of the perforated plate of a Providence fender. A motor-driven blower placed overhead and originally used in a cotton gin supplies air to the forge through a square wood pipe.



HOME-MADE CIRCULAR SAW BUILT FOR SAWING OUT ARMATURE STICKS

FIRST SEATING POSITION OF REVERSIBLE SEAT

INTERMEDIATE POSITION OF REVERSIBLE CAR SEAT

SECOND SEATING POSITION OF REVERSIBLE SEAT

Another illustration shows a small circular saw belted to an emery wheel. The shop contains no wood-working tools, and this saw was built especially for the purpose of sawing out the armature sticks for the G. E.-800 armatures. It was filed out of a portion of an old hand saw, and has been found well suited for the use for which it was constructed.

Armatures and field coils are wound in the shop but the armature coils are purchased. One peculiar practice in the winding of armatures is that the leads are not soldered into the commutator bars; instead they are simply driven in tightly. This practice has been followed by Mr. Long for about three years, and practically no trouble at all has been experienced by leads coming out. The argument for the practice is that the time consumed in soldering the leads is wasted. Little armature trouble has been experienced, in fact but one armature has been lost in the last year. This is largely due to the rigid inspection of bearings and care in oiling.

The efficiency of choke coils on the cars and a proper installation of lightning arresters was rather effectively demonstrated on this system. With lightning arresters every twenty poles and no choke coils on the cars, burn-outs from lightning were frequent sources of inconvenience. On one occasion a generator in the power house and five cars were burned out. This incident resulted in placing arresters all over the system at intervals of five poles, or ten arresters to the mile. In addition choke coils 4 ins. in diameter and 4 ft. long were placed on the cars. An arrester consisting of a number of cotton-covered wires lying across a ground and a trolley terminal was also placed in the power house. Since these installations have been made not an armature has been lost by lightning. At the present time all of the arresters are given a thorough inspection at intervals of a few months and also after storms.

Inspection of motors on most of the cars is very much facilitated by lamps installed permanently over the motors. When arc headlights were substituted for incandescent lamps the cars were rewired so as to place the extra incandescent lamps in an extra circuit and over the motors.

Wood pins substituted for the steel dowel pins in the feet of the controller have been the means of preventing many controller backs being broken. As these pins simply hold the controller in position and take no side strain under ordinary conditions wood pins answer very well. In the event of a collision or undue stress on the controller back the wood pins break and relieve the stress before the back

is fractured. The controller is of course always held up by the angle on the back near the top.

No sand is carried on the cars and at only one place on the line is sand used on the track. This is at a viaduct over the yards of the Missouri, Kansas & Texas Railway system.

The final three illustrations show a reversible car seat gotten up by and patented by Mr. Long. How the seat is reversed may be gathered from the three illustrations, which show it in the two positions and also in an intermediate position when being reversed. The seat and back are constructed similar, and that which is the seat in one position serves as the back in the other. The design is such that the only way the seat can be reversed is by pulling up on the lower portion. Pushing on the rear will not cause it to move. As the weight of the body holds the lower portion down there is no tendency for the seat to tip. The seat has the desirable qualities of simplicity, of being comfortable, and of taking up very little room. There is plenty of space under it for a broom to be inserted in order to sweep the floor.

By reference to the illustrations it may be seen that the top of the back is lowered in almost a straight line when the seat is reversed. Two seats can therefore be thrown facing each other without their being uncomfortably close. A car provided with seats of this design has more the appearance of roominess than one with seats having thick backs. The seat has been in service for several years and no objections to its use have developed.

The consideration which determines whether or not shop practice is good or bad or whether the many original devices in a shop really save time is of course the amount of work necessary to maintain the cars. In this connection it might be stated that all the cars of the system are kept up by the personal work of A. G. Corey, master mechanic, during the day, and by one night man, who also cleans and inspects the cars. This of course does not include the painting or the carpenter work. In the summer season eight passenger cars and one freight car are regularly operated, and in winter five passenger cars and a freight car are kept in service. During the entire year, however, extra cars are frequently put on for special runs.

NOTES ON EUROPEAN TRACK CONSTRUCTION

At the 1906 meeting of the Internationaler Strassenbahn-und-Kleinbahn-Verein (International Street and Interurban Railway Association) a voluminous report on track construction was presented by Arthur Busse, Oberingenieur of the Grosse Berliner Strassenbahn. While Mr. Busse's report was confined almost entirely to Continental practice, he made several suggestions which should prove of interest to American companies.

One well-known obstacle to rapid tramway service abroad is the preponderance of narrow and crooked streets in the older portions of the cities. Mr. Busse proposes that this handicap be minimized by having the authorities permit the location of the track on a reservation either close to the curb or else in the middle of the modern wider streets, with which most of the suburbs are provided. This would confine the slow schedule to the business sections. This arrangement, of course, has other advantages besides speed, such as freedom from collision with trucks, lessened danger to passengers and pedestrians, lower paving costs, etc. Mr. Busse's company already has such routes in the Berlin suburbs, Friedenau, Steglitz, Tempelhof and Mariendorf, where a single-track right of way runs along each curb and the vehicle traffic is confined to a center road 10 m (32 ft. 10 ins.) wide. In Charlottenburg, another Berlin suburb, such a right of way was reserved for the company in widening an old street.

The report contains the interesting statement that experiments are now under way in Germany to manufacture rails weighing 120 lbs. per yard of two compositions—hard steel for the head and softer ingot steel for the web and base. While these rails are intended primarily for steam railroad service, they may find application on electric railways with heavy traffic.

In discussing the subject of rail joints, Mr. Busse describes almost every type of mechanical and welded joint now in use. It is interesting to note that of joints of American origin the Falk cast-weld is still used quite extensively in Europe. Mr. Busse says that it is giving excellent results in Antwerp, Bologna, Bordeaux and Brussels, and that the companies in those cities report few breaks and commend the high conductivity given to the return circuit. In Vienna, where the Falk weld was applied to old rails, good results were secured, but it is more difficult to keep in good condition the pavement around the joints. The Falk joint has not been so successful in Berlin, where 10,000 welds were made on old grooved rails. Mr. Busse also speaks favorably about the Lorain electric welding system, but calls attention to the complex equipment required; the same criticism is applied to the Nichols zinc joint developed in Philadelphia.

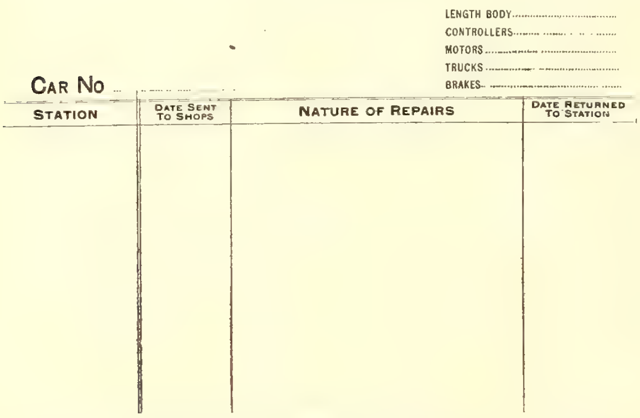
It would appear that the thermit joint has been successful in most of the Continental cities where it has been applied. The breaks in Berlin which came under the author's personal attention are ascribed more to careless application than to the thermit welding principle. Through the ignorance of workmen the rails may be heated too high, the clamps may be badly applied, or poor tools may be used. On the other hand the joints have been installed on some of the busiest lines in Berlin with excellent results. The convenient application of the thermit method has resulted in its rapid adoption abroad, over 80,000 joints having been installed on the Continent between the time that it was introduced in 1899 and the end of 1905.

The report mentions a new acetylene welding method brought out by the Società Anonima per Imprese de Illuminacione of Rome, described briefly in the paper by Mr. de Burlet on page 434 of the STREET RAILWAY JOURNAL for Sept. 22, 1906. This joint has not yet been applied to rails in practice, but experiments made by the Royal Technical School in Rome have shown favorable results. The gas is applied at a pressure of 1½ atmospheres and gives a welding temperature of about 2550 degs. C., or 450 degs. less than thermit.

The Bolivia Railway Company, of Hartford, Conn., has filed articles of incorporation and organization. It has broad powers, including operating railroad lines, telephones, telegraph lines, vessels, maintaining water powers, running gas or electric plants, and many others, but these do not apply to Connecticut. The capital is $10,000,000 and the company paid a fee of $300 to the State. Business is to be begun on $3,500. The incorporators are Edward W. Burdick, of Englewood, N. J.; Aloysius C. Gahan, of New York; Jacob G. Metcalfe, of Lakewood, N. J.; Arthur Starke, of New York; Frank L. Sullivan, of New York. Mr. Metcalfe is president, Mr. Burdick is vice-president and H. Starr Giddings, of New York, is secretary and treasurer. The incorporators are the directors.

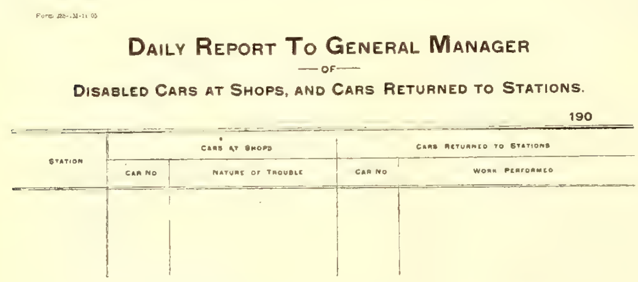
CAR EQUIPMENT RECORDS AT BUFFALO

In the STREET RAILWAY JOURNAL for July 7, 1906, an article was published on the constructional features and equipment of the new car house and rebuilt shops at Cold Spring of the International Railway Company, at Buffalo, N. Y. This depot is the most important one of the company for, in addition to car storage and inspection, it is used for almost every class of surface railway work, including the rebuilding of cars and the manufacture of supplies. Yet in spite of the large number (about 1200) of cars handled there, the record system is so simple that only one man is required to keep track of all the data filed in addition to other work. The idea in mind is that the forms should contain only the essential facts regarding the behavior of equipment, thus imposing little clerical labor on the employee filling them out. It will be noted later, however, that when taken together they contain enough information to enable the auditing department to work out life records, costs, etc.


CAR No ......
LENGTH BODY ......
CONTROLLERS ......
MOTORS ......
TRUCKS ......
BRAKES ......

STATION	DATE SENT TO SHOPS	NATURE OF REPAIRS	DATE RETURNED TO STATION

FIG. 1.—FAC-SIMILE OF CARD USED IN CAR LOCATION RECORD SYSTEM


DAILY REPORT TO GENERAL MANAGER
—OF—
DISABLED CARS AT SHOPS, AND CARS RETURNED TO STATIONS.
190

STATION	CARS AT SHOPS		CARS RETURNED TO STATIONS	
	CAR NO	NATURE OF TROUBLE	CAR NO	WORK PERFORMED

FIG. 3.—DAILY REPORT TO GENERAL MANAGER ON CONDITION OF ROLLING STOCK

Perhaps one of the most interesting methods used is the car location record system. Cards 6 ins. x 4 ins. of the type illustrated in Fig. 1 are filed numerically in the several drawers of a cabinet, one drawer for each operating division of the company. Every card contains the name of the station or car house, when it was sent to the shops, for what purpose and when returned. The upper right-hand corner of the card briefly mentions the length of the car body, together with the type of the electrical equipment, trucks and brakes. The data given in the upper part of the card are practically permanent, but a new line is added to the card every time the car returns for repairs. Thus this system makes it very easy to compare the service given by a number of cars operating under like conditions.

The records upon which these cards are based are made up from the form shown in Fig. 2. This is filled out by the station foreman, who must forward it to the shops with every car sent in for repairs. On the back of this form the inspector reports when the car was returned for service. These slips are kept on file in the master mechanic's office where they are examined the next morning and the data transferred later to the cards mentioned. As long as a car is in the shop undergoing repairs, the corresponding record card is kept in a special drawer of the cabinet. This enables the master mechanic or his assistant to look over the records of disabled cars in a few minutes to see if such cars are remaining in the shops for any unusual time. The card is not returned to its station drawer until the inspector advises that the car is ready for service. Fig. 3 is a facsimile of the report sent every day to the general manager, to show briefly the number and origin of disabled cars received, repaired and when returned, as well as a statement regarding the character of the work done.

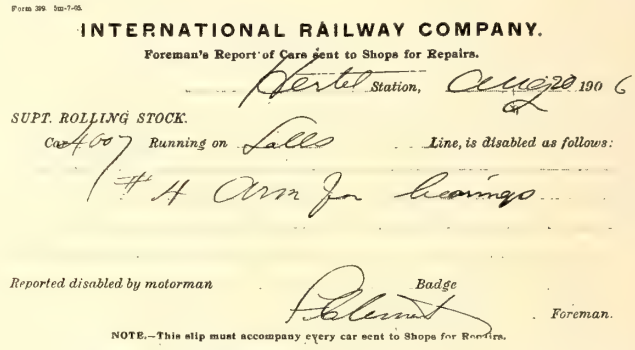

INTERNATIONAL RAILWAY COMPANY.
Foreman's Report of Cars sent to Shops for Repairs.
Station, 190
SUPT. ROLLING STOCK.
Car Running on Line, is disabled as follows:
Reported disabled by motorman Badge
Foreman.
NOTE.—This slip must accompany every car sent to Shops for Repairs.

FIG. 2.—STATION FOREMAN'S REPORT OF CARS SENT TO SHOPS FOR REPAIRS

Class 700.....	0	1	2	3	4	5	6	7	8	9
0..........										
1..........										
2..........										
3..........										
4..........										
5..........										
6..........										
7..........										
8..........										
9..........										

FIG. 4.—CAR INDEX

FILE No.	CAR No.	DATE DISABLED	STATION	REPORTED CONDITION

RECEIVED AT SHOPS.	RETURNED TO SERVICE	COST OF REPAIRS	INSPECTED BY.	REMARKS.

FIG. 5.—HEADINGS OF LEFT AND RIGHT-HAND PAGES OF CAR MAINTENANCE RECORD BOOKS

On the International Railway Company's system, as on many others, the cars are numbered in groups according to type, such as "700" class, "4000" class, etc. Since any one station is sure to have several different classes of cars, some other method of filing must be used in addition to the

Date Applied	New	Car No.	Wheel No.	Axle No.	Date Removed	Cause	Miles	Date Applied	Rgd. or Old	Car No.	Axle No.	Date Removed	Cause	Miles	Date Applied	Rgd. or Old

Car No	Axle No.	Date Removed	Cause	Miles	Date Applied	Rge. or Old	Car No.	Axle No.	Date Removed	Cause	Miles	Total Mileage	REMARKS

FIG. 7.—HEADINGS OF LEFT AND RIGHT-HAND PAGES OF WHEEL AND AXLE RECORD BOOK

Form 213 3m. 3-06.

INTERNATIONAL RAILWAY COMPANY

SHOP ORDER

Req. No. ....

Order No. .... Date..................

Foreman ....

Do the following work..................

Ordered by .... Approved by ....

Charge to ....

To be completed ....

SUPT. SHOPS.

Completed ....

MATERIAL USED	TIME HOURS	RATE

FOREMAN

THIS ORDER MUST BE RETURNED TO OFFICE ON COMPLETION OF WORK

FIG. 9.—ORDER FOR SUPPLIES WANTED FROM COLD SPRING SHOPS

Form 381-1 M-1-06

INTERNATIONAL RAILWAY COMPANY.

WHEELS CHANGED MONTH ENDING 190

Car No.	Wheel Nos.	Axle No.	Applied	Removed	Cause of Removal	Maker	Miles	Remarks

FIG. 8.—MONTHLY REPORT COVERING WHEELS CHANGED

Form 438 3M.

INTERNATIONAL RAILWAY COMPANY

WHEEL CHANGER'S REPORT

Buffalo, N. Y.

REMOVED								APPLIED					
Date	Wheel No.	Axle No.	Car No.	Maker	Maker's Date	Maker's No.	Cause of Removal	Date	Wheel No.	Axle No.	Maker	Maker's Date	Maker's No

Foreman.

FIG. 6.—WHEEL CHANGER'S REPORT

Form 325. 10M-8-06.

INTERNATIONAL RAILWAY COMPANY

..................190......

Name ....

Occupation ....

CLASSIFICATION OF SERVICES	RATE	HOURS
TOTAL		

FIG. 10.—FRONT OF EMPLOYEES' TIME SLIP

Employes to charge the hours worked to account numbers as heretofore, with the addition of the letter, showing proper sub-division of accounts 6, 7, 20 and 21. These accounts are sub divided as follows:—

% 6 A—AXLES—Includes cost of labor and material in making ready for use.
" 6 B—BRAKE SHOES—Material only
" 6 C—JOURNAL BEARINGS—Cost of making ready for use.
" 6 D—PAINTING—Cost of labor and material
" 6 E—CAR SIGNS—Making ready for use.
" 6 F—CAST WHEELS—Labor and material ready for use.
" 6 G—GRINDING CAST WHEELS—Labor only ready for use.
" 6 H—STEEL WHEELS—Labor and material ready for use.
" 6 I—TURNING STEEL WHEELS—Labor ready for installation.
" 6 J—DAMAGED CARS—Labor and material.
" 6 K—Car Body repairs, except damaged work and painting.

% 7 A—ARMATURES—Labor and material per type of armature, armature shop charge only.
" 7 B—FIELD COILS—Labor and material per type of field, armature shop charge only.
" 7 C—COMMUTATORS—Material only.
" 7 D—BRUSHES—Material only.
" 7 E—BRUSH HOLDERS—Labor and material ready for use.
" 7 F—ARMATURE BEARINGS—Labor and material ready for use.
" 7 G—MOTOR AXLE BEARINGS—Labor and material ready for use.
" 7 H—TOTAL MOTOR REPAIRS—Charge all labor and material not specified in list.
" 7 I—CONTROLLERS—Labor and material per type, armature shop only.
" 7 J—GEARS—Material cost only.
" 7 K—PINIONS—Material cost only.
" 7 L—TROLLEY WHEELS—Material cost only.

% 20 and 21.
Material for car cleaning.
Labor of car cleaning.
Lubrication.
Car inspection, including minor repairs in Car Houses. All labor and material excepting oils etc.

FIG. 11.—BACK OF EMPLOYEES' TIME SLIP, SHOWING CLASSIFICATION OF SERVICES

car location record when it is desirable to look up a car without knowing its station. This is accomplished by using a book record with the ingenious type of index shown in Fig. 4.

It will be noted on inspecting this index that it is divided into ten intervals down and across, the vertical column representing the tens and the horizontal column the units. In the squares thus formed are written the page numbers of the cars corresponding to them. Thus, to find the data relative to any car, say 723, it is only necessary to go down to 2 in the vertical column and then move along horizontally until column 3 is searched, where the reference page number or numbers will be found. Similar indexes, of course, are constructed for other group numbers. The data referred to in this fashion are illustrated by the reproductions from book headings in Fig. 5.

The International Railway Company uses cast-iron wheels generally on all of its city divisions, and as they are purchased on a 40,000-mile guarantee, careful records are kept of their performance. The company in buying its wheels simply pays a certain price for their manufacture, guaranteeing to return the same weight in scrap or the difference in money. The company employs self-truing brake-shoes for easy flats—but for this a mileage allowance must be made to the car wheel manufacturer of 2900 miles. Similarly, an allowance of 5000 miles is made every time a wheel is ground. Data regarding wheels changed are first given on the wheel changers' report, Fig. 6, and then transferred to a book, the cross-page headings of which are given in Fig. 7. This gives a continuous record of the wheels (and axles) from the time installed until scrapped. The exact mileage records can be deduced from the conductors' trip sheets. A monthly report on wheels changed is made up on the form reproduced in Fig. 8.

Fig. 9 illustrates the form of order for material from the shop. The upper part of the form covers the work wanted; name of party ordering; by whom approved; the account number (put on by foreman receiving order); desired date of completion, and actual date of completion. This form is made out in duplicate, the original going to the foreman who does the work and the copy being placed on file. On completion of the work, the foreman returns the requisition to the office after noting the cost of labor and material. All of these orders are numbered consecutively as received. Telephone rush orders must be confirmed in writing.

Figs. 10 and 11 illustrate the two sides of a shop employee's time slip. The front shows the class of service and the time spent, while the back gives the proper account numbers for use in making up costs.

CORRESPONDENCE

THE BOW TROLLEY IN GERMANY

Schenectady, N. Y., March 1, 1907.

Editors Street Railway Journal:

I believe that "German Engineer" in his letter in your issue of Feb. 9 overlooked the three essential points which caused me to write my first letter. They were to bring out the limited current-carrying capacity of the bow; that it possessed fewer advantages than the trolley wheel for heavy electric street railway service, and the fact that the most common form of lightning arresters in Germany is the magnetic blow-out type. I still consider the Charlottenburg road an exception to "German Engineer's" statement that no company in Germany has changed from the bow to the trolley wheel. As an example in Switzerland I might cite the St. Gallen municipal railway, which has also changed from the bow to the trolley wheel. None of the roads mentioned by him in his letter of Feb. 9, as using horn lightning arresters, is a Thomson-Houston road, but all of them were built by other concerns, particularly by the Schuckert Company. His statement that the government of Saxony demands the use of the bow collector on all the roads in that kingdom also requires explanation. There is no law to this effect in Saxony, but since the bow collector was developed for practical use in Dresden, and since it gives satisfaction on low-speed, small-power railways, the commissioner for street railways in Saxony, who has the right to decide in each case what kind of collector shall be used by a street railway applying for a franchise, has so far given the preference to the child of local ingenuity.

As regards wear of the conductor, I beg to refer to the reference list and pamphlet on its railways issued by the Schuckert Company prior to its merger with Siemens & Halske. This pamphlet states that in one installation a trolley wire 8 mm in diameter was worn 0.8 mm with the bow after nine months of service, and that a wear of 1.9 mm was noticed on places where heavy current had to be collected. The trolley wire must be staggered when using the bow collector, as otherwise the saw effect of the sharp trolley wire cuts the bow collector apart within a short time. The wire must be installed with special care on curves and on long spans with heavy sag, in order to avoid side slipping of the wire around the side of the bow collector frame. The soft aluminum bow has in addition a very disagreeable tendency to be melted apart if a heavy short-circuit takes place within the car equipment, and its wear is very heavy if the distance from the trolley wire to the head of the rail is frequently changing.

The references in "Elektrische Bahnen und Betriebe," quoted in my letter, were given to prove that the collecting capacity of one bow is practically limited to 50 amps. when running free and 150 amps at starting.

The following are some statistics of the number of bow collectors required for various car equipments and of the life of the bow and wheel collectors on various roads in Germany and the United States:

Railway.	Number and Type of Collector.	Total H.P. of Motors on Cars.	Maximum Speed, m.p.hr.	Average Mileage of One Collector.
Freiburg	One bow.	24	7.5	10,300
Dresden	One bow.	26	13.6	8,000–12,400
Filder (adhesion)	Two bows.	84	18.6	12,000*
Schenectady	One wheel.	80	30	12,000
Filder (rack)	Two double bows.	300	6.2–7.4	13,640
Toledo & Indiana	One wheel.	300	65	10,000–12,000
Rochester & Eastern	One wheel.	300	55-55	5,000–6,000

* Conservative assumption.

Owing to the size of current to which the bow collector is limited, it is easy to see that on the ordinary American street railway cars, and to a still greater extent on the high-speed lines mentioned, several bows would have been required if that system of collection had been used.

Eugen Eichel.

Six large cars have been purchased by the Everett-Moore syndicate for through service between Cleveland and Ashtabula over the Cleveland & Eastern and the Cleveland, Painesville & Ashtabula lines. The cars that were first put in use in this service were found to be too light and were taken off. They will be used in local service after the heavy cars are delivered.

ELECTRIC CAR TESTING

Prof. A. S. Richey, of the electric railway engineering department of the Worcester Polytechnic Institute, was the speaker at the regular meeting of the New England Street Railway Club in Boston on Feb. 28. The subject was "Electric Car Testing," and the paper was illustrated by views of car-testing equipment used on the Boston & Worcester, diagrams of test results on that road and views of the new electrical engineering laboratories at Worcester, which will contain when completed the most extensive and flexible arrangements for car testing in the world. The results of the car tests on the Boston & Worcester were printed in the STREET RAILWAY JOURNAL of July 28, 1906.

Two classes of car tests exist; tests on individual pieces of apparatus before assembly, for insulation and efficiency, including heating, torque and economy runs on motors on the stand in the works of the manufacturers, and tests on completed cars. In the case of tests to determine the heating characteristics of the motor, and hence its capacity, the stand tests cannot of themselves give a true knowledge of the later performance of the same motor in actual service, unless allowance is made for the difference in conditions arising from the variations in load in service and the larger freedom of ventilation. Some attempt has been made to reproduce these variable loads in the shop by gearing the motors to a shaft carrying friction brakes and fly-wheels. The fly-wheels are so proportioned as to imitate the inertia of the car, the brakes furnishing an imitation of train, curve and grade resistance. Starts and stops are made as in actual service, proper allowance being made for ventilation. The value of this test lies in the proper assumptions having been made as to train resistance and ventilation.

Car tests may be made to determine the proper constants for use in figuring the results of motor tests, for determining certain values pertaining to a given stretch of track, or to the shape, size and weight of the car or train under consideration. They may be made for the purpose of determining the relative value of locomotive train, multiple-unit train or single car operation, of double or quadruple motor equipments for a given service, rates of acceleration, coasting, braking, heating values or train resistance. If train resistance and the heating characteristics of the motors are known, speed-time-current-distance curves can be plotted, which will enable the engineer accurately to predetermine the speed and current consumption at any point along the line, to determine whether or not a certain motor equipment and train arrangement will make the required schedule without undue heating and with what consumption of power. The proper value for train resistance has not yet been satisfactorily determined in a manner which will enable it to be applied with certainty unless backed by experience or tests with the particular class of road under consideration. It is a value which varies with the size, shape, weight and number of cars composing the train, as well as with the speed. It is made up of the friction of bearings, the rolling friction between the car wheels and the rail, and the air resistance. A large number of formulæ have been proposed, giving results which, when several are applied to a particular case especially at higher speeds, vary widely. Herein lies one of the uses of car testing—to determine the values of train resistance for a particular class of equipment under consideration, that they may be used in plotting speed-time-current-distance curves, useful in solving many if not most of the problems of electric railway design. It may be necessary to resort to the car test in order to determine the heating capacity of the motors.

Car tests are also made for the purpose of determining the relative efficiency or operating costs of the various parts of the car equipment, such as controlling or braking apparatus, brake-shoes, wheels of various materials, trolley apparatus, different designs of trucks, springs, etc. Prof. Richey referred to the Berlin-Zossen tests, the extensive investigations of the electric railway test commission at St. Louis in 1904, the Boston & Worcester tests previously mentioned, and the tests made in 1902 on the lines of the Indiana Union Traction Company by the Westinghouse engineers and the students of Purdue University. The latter tests were made for the purpose of giving the Westinghouse Company general data upon the performance and requirements of motors for modern high-speed interurban service, by the Purdue men for thesis work, and by the railway company in order to secure information on train resistance and motor performance for use in specifying motors for a hundred-mile extension then in contemplation, and also to aid in a decision as to the adoption of two or four-motor equipments for that extension. Prof. Richey discussed at some length the importance of using autographic or semi-autographic instruments in car tests, urging the elimination as far as possible of long series of tedious observations made at intervals of two to ten seconds, with their resulting labor of transcription, plotting and interpretation. He described the Keiley method of following the variations of instrument needles by a pivoted disc and attached pen system. This method was fully described in the STREET RAILWAY JOURNAL of Dec. 27, 1902, and Sept. 8, 1906, as well as in an article on the "Car Test Recorder of the Boston Elevated Railway Company" in the issue of Jan. 14, 1905. Speed values are generally obtained by measuring the voltage of a small magneto generator, belted or geared to the car axle. All quantities should be plotted as ordinates against time. Recording wattmeters are generally provided for the total power input of the car, for one motor, and possibly for the control circuit or compressor motor circuit. The rise in temperature of the motors is usually measured both by the resistance method and by the thermometer. The time of passing certain landmarks and where possible the beginning and end of grades and curves are marked on the moving paper by a push button and magnet system. In some cases a specially calibrated wattmeter is used to give the square root mean square current per motor.

On some tests difficulty has occurred by the calibration of speed instruments changing during the run, but as the area under the speed-time curve equals distance, the scale may be readily calculated at any point on the record by this method. The rate of acceleration may be easily arrived at by measuring the slope of the speed-time curve.

In the new laboratories at Worcester a special car for tests will be a part of the equipment. The car body, being built by the Cincinnati Car Company, is 40 ft. in length, and externally closely resembles the interurban types of car, with baggage compartment. The interior will be devoid of the usual car furniture, leaving all space clear for testing apparatus and observers. The car will be carried on Baldwin M. C. B. trucks and will be equipped with four GE-80 motors, K-28 control and G. E. straight air brakes. All of the car wiring will be focussed on a slate panel board inside the car so that instruments may be included in any portion of the car circuit.

An important feature of the laboratory is the car testing stand, which is in some respects a similar arrangement to

the steam locomotive testing stand at Purdue University. A concrete foundation at the bottom of the car pit serves as a support for the bed plates of the apparatus, which are I-beams. Four bearing stands, which may be moved along the I-beams and fastened to them at any points, serve the wheel and truck base of any car. Each stand carries a shaft upon which is mounted a pair of supporting wheels, the periphery of which is of the shape of the head of a standard T-rail, the two wheels being mounted on the shaft just track gage distance apart. The shafts also carry fly-wheels built up of various thicknesses of boiler plates, so that the weight may be easily changed over a wide range. There is also mounted on each shaft a GE-57 railway motor arranged as a separately excited generator. A traveling crane serves the entire laboratory.

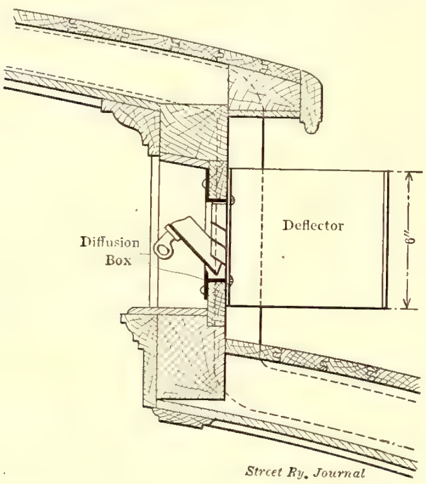
Any car may be run over the stand and let down upon the supporting wheels, each pair of car wheels resting upon a pair of supporting wheels. The car is kept from moving endwise by being fastened at one end to an anchor post. If the car be started it will as a whole and relative to the building stand still, but its motors and wheels will drive the supporting wheels, shafts and generators. This motion will be retarded by the inertia of the fly-wheels, which are of the proper weight to imitate correctly the inertia of the car itself, were it moving on a stationary track. The motion is also retarded by the expenditure of energy in the generators mounted on the supporting shafts, the amount of this energy being regulated by varying the load on the generators either through the field strength or the resistance of the rheostatic load. As the four generator armatures are in parallel, and their fields separately excited in series with one another, they also act to keep the speed of the four supporting shafts uniform with each other at all times.

Having the inertia of the car imitated by the fly-wheels and the train resistance and grade resistance imitated by the loading of the generator brakes, the car can be operated on the stand with the same energy consumption as regular operating conditions require, and the draw-bar pull can be measured with a traction dynamometer at any speed and current. Two complete systems of multiple-unit control apparatus, one a Westinghouse and the other a General Electric, are mounted on one side of the testing stand, and either may be connected with the panel board of the car to replace its K-28 control. Provision is also made for air brake testing, and the equipment includes, besides, a pair of G. E.-52 motors mounted for the regular factory floor test, and two motor generators.

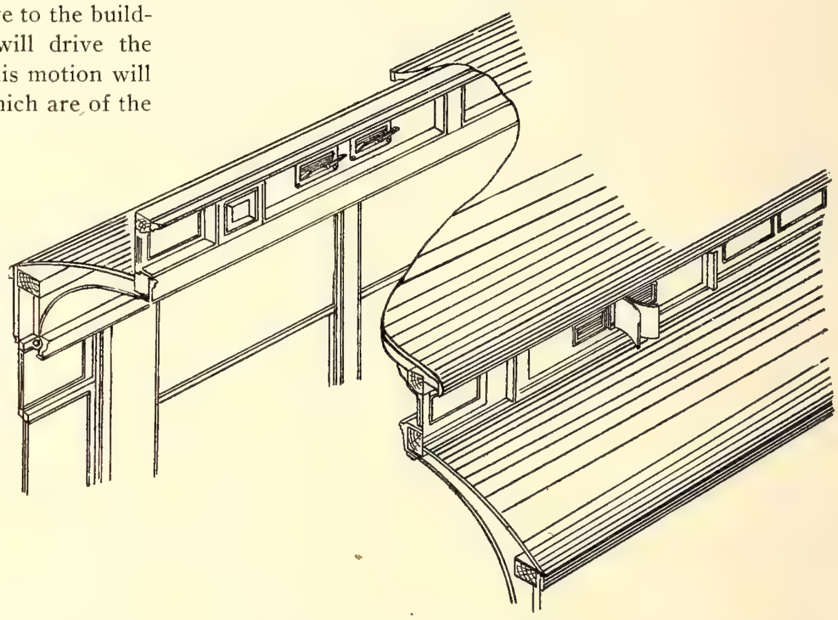
AUTOMATIC VENTILATOR FOR ELECTRIC CARS

Several articles in recent issues of this paper have called attention to the difficulty of ventilating railway cars, both steam and electric, and to the various methods which have been tried to introduce fresh air and remove foul air. As the subject is a live one at present, some particulars of the system of the Automatic Ventilator Company, of New York, would be of interest.

These ventilators have been applied quite extensively to steam railroad cars during the last few years, but the steam railroad business has proven so large that the company has, until recently, been unable to give due attention to the extension of its business on electric roads. Several hundred cars, however, have been equipped with the system, and among the companies using these ventilators are the Philadelphia Rapid Transit Company, Pittsburg Railways Company, Portland (Ore.) Railway, Grand Rapids Railway, and the forty new cars for the Hudson Companies, as well as the new electrical equipment, consisting of 180 cars, of the New York Central Lines.



SECTION THROUGH VENTILATOR


ISOMETRIC DRAWING, SHOWING CONSTRUCTION OF VENTILATOR

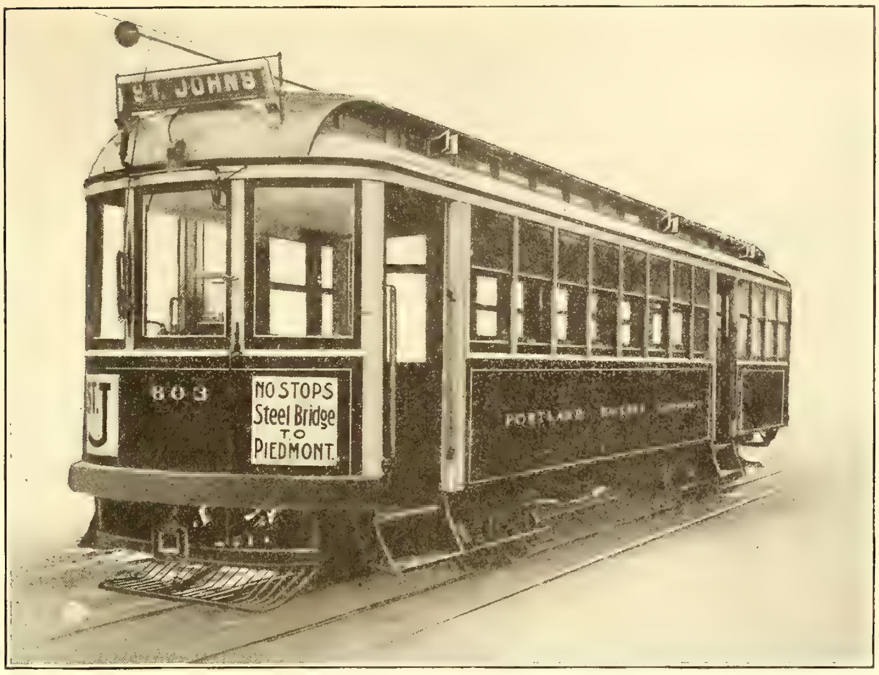
In the view of the Portland car published herewith the ventilating deflectors have been made more prominent than they really are. Actually an observer would hardly notice them unless his attention was called to them.

The system differs from most others from the fact that both inlets and outlets are in the monitor, where they are easily installed, being so compact that a set of ventilators can be placed in the space taken by an ordinary deck-sash panel. From four to eight sets are required, the number varying with the size and arrangement of the car. Deck-sash not occupied by the ventilators are permanently closed. The ventilator consists essentially of a deflector and is composed of two strips of sheet brass, bent outwardly, and located midway between openings into the car, which are protected by louvres and by an interior movable shutter, by means of which the air currents are controlled and deflected. All parts of this diffusion box are firmly held by surrounding frame, the whole equipment being substantially made of brass.

The progress of the car creates a pressure on the deflector by which the fresh air is forced through the forward openings of each set and, as shown, deflected against the ceiling,

from which it descends by gravity into the body of the car. This action is continuous and so gradual that the fresh, descending air has opportunity to absorb heat from the vitiated air through which it passes, in this manner renewing the air without loss of heat in the car in cold weather. At the same time the suction created in the rear of the deflector withdraws the foul air through the rear opening.

As the fresh air comes in from above its descent is so gradual that there is no perceptible draught on the passengers. At first thought it might appear that there would be an interference between the incoming and outgoing currents through openings placed so near together, but practically it can be easily demonstrated that such is not the case, temperature tests and laboratory analysis demonstrating the fact that while the incoming air is fresh air from outwise, the air that is discharged from the car is the breathed and vitiated air.



PORTLAND RAILWAY CAR EQUIPPED WITH VENTILATORS

THE CINCINNATI TRACTION COMPANY'S FLOOD CAR

The cars operated by the Cincinnati Traction Company during the recent flood, to which reference has been made before in the STREET RAILWAY JOURNAL, were built especially for the purpose. They were all single-truck, with the framing of the body raised 6 ft. from the rail by means of blocking. There were, however, six bolts in each side of the car, through the sills to the truck frame, sprocket chains being used from the motor pinions to the axle gears. Attached to this car was a trailer, which was raised the same height. The company successfully operated through 6 ft. of water, and by this method was enabled to prevent the section of the city which was affected from being isolated. It was required to operate the cars a distance of three blocks The accompanying photograph of the cars was made available by the courtesy of the "Cincinnati Enquirer."

CARS RAISED FOR OPERATING THROUGH FLOODED STREETS

OPENING OF THE PHILADELPHIA ELEVATED RAILWAY

On March 2 the Philadelphia Rapid Transit Company officially opened its elevated division extending from the present western terminus of the subway at the Schuylkill River to the magnificent terminal station located at about Seventieth Street. For the greater part of the distance the line extends out Market Street, but at about Sixty-Third Street branches off to its own right of way until it reaches the new union terminal station for the elevated cars and for the cars of the Philadelphia & West Chester Railway, and also for those of the Philadelphia & Western Railway, described in the STREET RAILWAY JOURNAL for Feb. 16.

About one thousand guests, including persons prominent in railroad, business, political and financial life, were present and made the tour of inspection. Trains of special cars were taken at the subway station at the corner of Fifteenth and Market Streets and were run without stop to the terminal station. President John B. Parsons, First Vice-President Geo. D. Widener, Second Vice-President Geo. O. Kruger, Chief Engineer William S. Twining, Assistant General Manager F. H. Lincoln, and other representatives of the Philadelphia Rapid Transit Company were present to receive the guests, and received many congratulations over the completion of the line. Great interest was taken in the arrangements for transferring passengers at the terminal station between the elevated trains and the two suburban lines which connect with the elevated system at that point. An elaborate luncheon was served on the second floor of the terminal building, where a large room has been provided, as in all of the Philadelphia Rapid Transit depots, for motormen and conductors. Among the guests present were Mayor Weaver, James F. Sullivan, William F. Har-

rity, George A. Huhn, J. J. Sullivan, William H. Shelmerdine, W. E. Harrington, C. L. S. Tingley and H. J. Crowley.

The line was opened to the public at 5 a. m. on March 4, but as several of the way stations are not entirely completed no cars will be run after 7:30 p. m. for several months. Transfers will be given between the surface cars and the elevated. An account of the construction of the line was published in the issue of this paper for Feb. 16.

NEW CARS FOR INTERURBAN AND LOCAL SERVICE IN DU BOIS, PA.

Among the shipments made last week by the J. G. Brill Company to Du Bois, Pa., were cars of the combination passenger and baggage type and single-truck cars. The former will, in conjunction with duplicate cars of this type shipped by the same builders about a year ago, be run over the interurban portion of the Du Bois Traction Company's system, which connects Du Bois with Falls Creek and Sykesville. These three towns have a combined population of about 12,000, to take care of which the company operates nineteen cars. The straight passenger type of car will be reserved for local service.

All the new cars have the Brill grooveless-post semi-convertible window system. The combination car has transverse seats of cane, but the single-truck car is provided

NEW CAR FOR DU BOIS

with longitudinal seats, an unusual feature for a car of this construction. The trucks under the combination car are the No. 27-G1 with a wheel base of 4 ft. 6 ins.; the single-truck car on the straight passenger type is the Brill No. 21-E with a wheel base of 7 ft.; all the cars are equipped with motors of 40 hp each. The combination cars, which have the usual baggage compartments with folding seats, measure 29 ft. over the end panels; over crown pieces and vestibules, 38 ft. 5 ins.; width over sills, including sheathing, 8 ft. 2 ins.; side sills, 4 ins. x 7¾ ins.; end sills, 5¼ ins. x 6⅞ ins.; sill plates, ⅜ in. x 12 ins. The chief dimensions of the single-truck cars are: Length over end panels, 20 ft.; over crown pieces and vestibules, 29 ft. 5 ins.; width over sills, including sheathing, 6 ft. 2 ins.; over posts at belt, 7 ft. 6 ins.; side sills, 3¾ ins. x 5¾ ins.; end sills, 4½ ins. x 5½ ins.

METHODS OF CREOSOTE ANALYSIS

The growing scarcity of lumber, with the consequent high prices, is making it imperative that more attention be paid to preservative processes whereby the time of service of timber may be lengthened. Coal-tar creosote is generally regarded as the most efficient of the wood preservatives. This product is very variable in composition, owing to differences in the coals used and in the methods employed in their distillation. Creosotes of different compositions are believed to have different values as wood preservatives, and an analysis of the oil used is, therefore, important. No very large amount of study has been directed to perfecting the methods of creosote analysis, and the Forest Service, believing the matter vitally important to the progress of wood preservation, is now carrying on an investigation of these methods.

The most important part of a creosote analysis is the fractional distillation, since by this operation an approximate determination is made of the relative proportions of the most important substances in tar oil. There has been considerable divergence of opinion as to the best way of carrying out the fractionation of tar oils, some recommending a retort as a distilling vessel and certain temperatures for taking fractions, others recommending a distilling flask and a different set of temperatures. Laboratory experiments carried on by the Service have shown that the difference in the weights of the fractions obtained when using different sorts of distilling vessels are not large, but that the composition of the fractions indicate a little better separation by the flask than by the retort. As regards the influence of the rate of distillation, variations of from one to three drops per second have but slight influence on the weights of the fractions, though the slower rate is more satisfactory.

It is commonly believed that the relative amounts of light oil, napthalene, and anthracene oil are the most important factors determining the value of creosote for wood preservation. A number of creosotes was very carefully fractioned and determinations made of the amounts of napthalene and solid anthracene oil distilling between various temperatures. The average of the results shows that at least 25 per cent of napthalene was present in the distillate between 205 degs. and 250 degs. C., and that over 25 per cent of anthracene oil solids are present in the distillate above 300 degs. C. Work on the specific gravity and the index of refraction of the distillates between different temperatures is now being carried on.

The desirability of getting the criticisms and suggestions of users of creosote has led to the publication of a detailed account of the methods employed in the experiments and the results which have been obtained. Those who desire the publication should ask for Circular 80, Fractional Distillation of Coal Tar Creosote. Request should be made to the Forester, Forest Service, Washington, D. C.

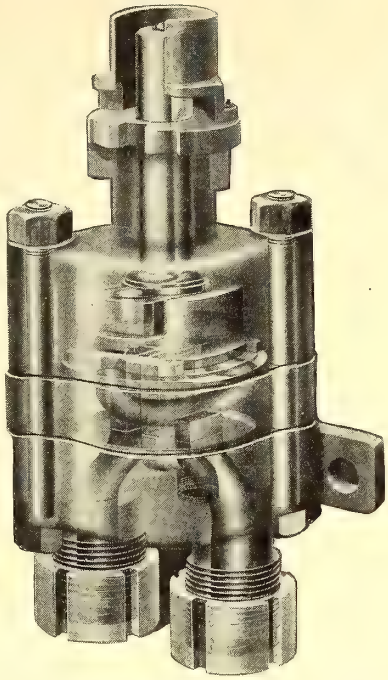
RAILWAY THESES AT UNIVERSITY OF ILLINOIS

The importance with which electric railway engineering work is regarded at the University of Illinois may be judged from the fact that out of twenty theses of the electrical engineering class of 1907, six of them are definitely concerned with electric railway problems. These are "Testing of Electric Railway Bonds," "Determination of Plate and Truck Friction in Railway Trucks," "Effect of Track Curvature in the Operation of Electric Cars," "Telephonic Communication over the Power House Circuit with an Electric Car," "Design, Construction and Operation of a Gradeomometer for Electric Test Cars," and "Induction Motors in Concatenation."

The Columbus Railway & Light Company has distributed over 600 dividend checks to its employees in accordance with its policy, adopted several years ago, of paying the employees dividends at the same rate paid the stockholders. The dividends are based upon the wages paid the men and the average amount received by each man this year is $75.

AN IMPROVED MOTORMAN'S VALVE

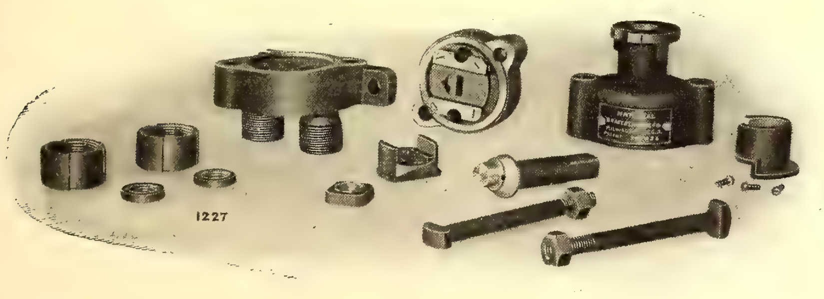
About two years ago the slide valve type of engineers' valve was substituted for the rotary type by the National Brake & Electric Company. The later type of valve has since given such satisfactory service that no improvements embodying changes in its general design have been deemed advisable. However, service has shown where minor improvements could be made, and such improvements are now embodied in the valves put out by the company. The improvements consist mainly in better oiling facilities and provision whereby the valve seat may be surfaced without difficulty if it should become necessary.



PHANTOM VIEW OF MOTORMAN'S VALVE

The design, it is stated, is such that over 150,000 applications of the valve can be made with one oiling. The slide valve is made with an oil reservoir in the upper side. Four small holes lead down from this reservoir to the valve face. These holes are located so that they are never uncovered by the ports, with the result that the oil is fed down from the reservoir only in a quantity sufficient to keep the valve seat well covered. To fill the reservoir a small hole is drilled through the entire length of the valve stem. Oil poured in at the top of the stem drops directly into the reservoir. The stem itself is oiled through an opening in the side of the casting enclosing it.

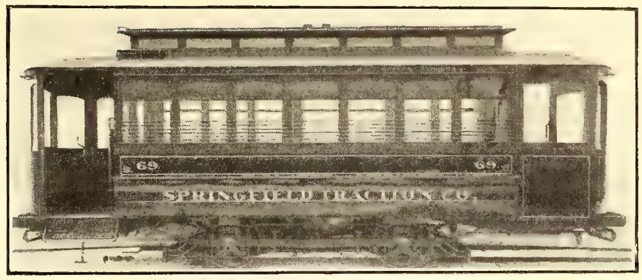
The difficulties of regrinding the seat, should it become necessary, are removed by screwing the guides to the seat casting instead of having them an integral part of this casting. On removing these guides the valve seat extends out beyond any other part of the casting and this permits the seat to be surfaced in a lathe. To prevent the valve being placed on the seat in a reverse position one of the guides is made slightly higher than the other so that the valve will not seat properly unless placed in the right position.



THE VALVE DISSEMBLED

IMPROVEMENTS AT SPRINGFIELD—NEW CARS

The Springfield Railway & Light Company, which operates about 20 miles of line in and about Springfield, Mo., has under way extensions and improvements extending to a number of branches of the service. Perhaps the most important work under way, however, is the extension of the power house by the installation of a 1000-hp engine and a 600-kw direct-connected alternator. Two motor generator sets of 200-kw and 400-kw capacity respectively have been purchased, and also steam-driven exciters direct connected to marine engines. Other improvements to the plant consist of two 350-hp boilers and the erection of a reinforced concrete chimney, 8 ft. in diameter by 150 ft. high. Another innovation is a system of exhaust steam heating installation which runs to the business part of the town. When the new machinery is put in the company will remodel the entire power house, putting in reinforced concrete floors and generally improving the entire plant.



NEW CAR FOR SPRINGFIELD

The rolling stock has also been improved by the addition of new cars. The cars just purchased are of a standard character throughout. They have stationary round end vestibules closed at diagonal opposite corners. The window system provides for the top sash to be stationary; lower to drop into pockets. The interiors, which are of cherry, are provided with push-buttons. The truck is the Brill No. 21-E. Chief dimensions are: Length over end panels, 18 ft. 3 ins.; over crown pieces, 28 ft. 3 ins.; width over sills, including sheathing, 7 ft. 2½ ins.; the sills and sill plates are of standard dimensions.

SYRACUSE & SOUTH BAY ROAD SOLD

Clifford D. Beebe, acting for a Syracuse syndicate, purchased the Syracuse & South Bay Railway property at mortgage foreclosure sale, Feb. 21, for $251,000. Mr. Beebe states that the road will be pushed to completion and it is expected that it can be operated some time this summer. The property sold to Mr. Beebe includes the whole of the railway already built from north of the city to South Bay, about 13 miles, and the real estate constituting the right of way. It is said that the Beebe syndicate has received assurances that the Rapid Transit Company would renew the traffic agreement which expired Jan. 1 and which provided for running South Bay cars into the city on Rapid Transit tracks.

The Worcester Consolidated Street Railway Company is replacing the cast-iron wheels of its cars operated on suburban lines with steel-tired wheels.

FINANCIAL INTELLIGENCE

WALL STREET, March 6, 1907.

The Stock Market

The stock market during the past week has been under heavy selling pressure, and at times this approached the point of demoralization, with prices declining in a sensational manner, a number of the active issues selling at the lowest levels recorded for over a year. Considerable pressure was directed against the so-called Hill stocks, and the large decline in Great Northern preferred and Northern Pacific was one of the most unfavorable features, and tended to increase the almost general pessimism. The weakness in the Pacific stocks and the copper shares was the basis for the impression that a certain very important interest was antagonistic to the market and disposed to bring about an average lower level of prices for the entire list. All favorable features were ignored. The passage of the Aldrich financial bill, and its approval by the President, would ordinarily have had a stimulating influence, as this measure goes a long way in the direction of currency reform, and later on this should be reflected favorably in the money market. The adjournment of Congress removes an element of uncertainty, and with the assurance that we will have no bad news from Washington, the temper of speculation is likely to improve. The really bad feature of the situation, and the one most influential in the direction of lower prices, has been the investigation by the Interstate Commerce Commission of the charges against the Pacific railroads controlled by the Harriman interests, and by the disclosures made during the investigation. The iron and steel situation continues highly satisfactory. There is also complaint by railroads of a shortage of equipment to handle the business, and the greatest difficulty apears to be in the inadequacy of terminal facilities, while the high cost of labor and materials is now being reflected in smaller net earnings. The speculation in the copper stocks is perhaps the most general of that in the entire market, and it is not confined to the shares listed on the New York Stock Exchange, but embraces some of the outside issues of the better class, especially those having an active market in Boston. The mere fact that Amalgamated Copper has not moved in sympathy with other copper shares does not possess any particular significance, for the reason that the copper metal position is now stronger than ever before, and only recently one of the largest producers closed a contract for an enormous amount of copper for July delivery upon the basis of 26½ cents a pound. The monetary situation remains practically unchanged, except that a somewhat firmer tone prevails, especially in the matter of time loans.

The traction stocks have been demoralized, and prices for all of them have declined very sharply, the weakness in Interborough-Metropolitan having been influenced by rumors that the dividend on the preferred might be reduced or passed. These adverse rumors were authoritatively denied. The break in Brooklyn Rapid Transit to the lowest price for years, was the result of the appearance of the Public Utility reform bills.

The Money Market

A decidedly firmer tendency developed in the local money market during the past week, rates for all class of accommodation ruling somewhat higher than those heretofore prevailing, despite the heavy liquidation in the stock market. Money on call loaned at from 2 to 6 per cent, the latter rate being maintained for three consecutive days, which is a very unusual occurrence. In the time loan department asking rates rule fully ¼ to ½ per cent higher, at 6 per cent for sixty days and 5¾ per cent for three to six months. Borrowers generally have confined their operations to day-to-day money, rather than to pay the prevailing rates for time accommodation, but despite this fact the banks and other large lenders are not disposed to make any concessions in rates or to offer with any degree of freedom. The present firmness is accounted for by the heavy March 1 disbursements, which were estimated at upwards of $70,000,000, and which have not yet been redeposited in the banks. Corporate borrowings continue, but upon a somewhat smaller scale, and indications are that the bulk of this demand has been about satisfied, at least for the present. During the week announcement was made that the Atlantic Coast Line had disposed of $5,000,000 three-year 5 per cent notes and also of the placing by the same company of $5,000,000 4 per cent equipment trust bonds. The Louisville & Nashville also placed $6,500,000 three-year 5 per cent notes. Rumors were current that the Lehigh Valley contemplated the issuance of short time notes, but these reports were emphatically denied. The local banks again suffered losses in cash as a result of their operations with the Sub-Treasury, and it is expected that a further loss will be sustained during the present week. The enactment of the Aldrich Financial bill into a law was regarded very favorably by the financial community, as it will enable the Secretary of the Treasury to deposit customs collections in the national banks the same as internal revenue collections, and will also permit the splitting up of currency into bills of small denominations. Heretofore the banks have been hampered at the crop moving period by the scarcity of small bills, and the measure just enacted will do away with this inconvenience. So far, however, the new law has not had any effect upon the market. Foreign exchange has ruled at the gold import point, but our bankers have refrained from disturbing the foreign money markets by withdrawing gold from the principal European centers. The Bank of England has absorbed practically all of the gold arriving from South Africa, but these gains have been partly offset by heavy shipments of the yellow metal to Egypt and South America. At the close of the week the London market showed firmness, and there was renewed fear at that center that the present firmness of money at New York will result in a liberal movement of gold to this side. It is expected that the Japanese Government will announce a new loan within the next few days. The amount of the loan will be $115,000,000, bearing 5 per cent interest, and probably will be issued at around par. These bonds will be used to redeem $110,000,000 6 per cent bonds now outstanding, and will be taken in London, Paris and New York. This operation will, it is expected, greatly benefit the local money situation.

The bank statement published on last Saturday was rather better than expected. Loans decreased $4,274,800. Cash decreased $2,098,400, or $1,000,000 less than was indicated by the preliminary estimate. Deposits were smaller by $6,589,900, thus reducing the reserve required by $1,647,475. The surplus reserve decreased only $450,925. The surplus now stands at $3,858,650, as against $5,008,750 in the corresponding week of 1906; $8,389,700 in 1905, $29,943,300 in 1904, $666,975 in 1903, $2,958,425 in 1902, $10,717,275 in 1901 and $13,641,550 in 1900.

Philadelphia

The local market for traction issues reflected to a great extent the conditions prevailing in the general securities markets. Trading was comparatively light and prices generally were inclined to a lower level. Philadelphia Rapid Transit was about the only stock to display animation, upwards of 11,000 shares changing hands. In the early dealings there was some good buying, which advanced the price from 20½ to 21¼, but in the late trading all of the early improvement was lost. Union Traction advanced on light purchases from 56¼ to 57½ and then reacted to 57. Consolidated Traction was a shade firmer, with sales at 74 and 74¼, and Philadelphia Traction held steady at 94. United Companies of New Jersey lost 2¼ points from 253 to 250¾. Other sales included United Traction of Pittsburg preferred at 47½ and 47; American Railways at 50⅛ and 49¾, ex-dividend; Lehigh Valley Transportation preferred at 21½; Philadelphia Company common at 46 and 45½; Philadelphia Company preferred at 47.

Baltimore

Trading in the tractions at Baltimore was extremely quiet during the past week and prices generally ruled somewhat below those prevailing at the close of last week. United Railway income bonds declined from 90 to 87¾, on light sales, and the

incomes ran off from 56 to 55¼. Norfolk Railway & Light 5s were steady at 98. City & Suburban 5s brought 108¼ for a small amount, and Charleston Consolidated Electric 5s sold at 91½.

Other Traction Securities

Very little activity developed in the market for traction issues at Boston, but prices displayed decided irregularity. Boston & Worcester common, after declining from 26½ to 25, recovered practically all of the loss, and the preferred sold at 77. Massachusetts Electric common and preferred lost a point each, the first named declining from 19 to 18 and the latter from 68 to 67. West end stocks showed greater activity than for some time past. The common, after selling at 93, advanced to 94⅝, but subsequently reacted a point, while the preferred after rising from 109 to 110, ran off to 109¼. Boston Elevated was very quiet, with sales at 149 and 148½. Trading in the Chicago market was practically at a standstill, there being a general disposition to await the result of the election to be held on April 2. Metropolitan Elevated preferred sold at 65¼, and South Side Elevated 4½s sold at 99½ for $73,000, a decline of ¼.

Security Quotations

The following table shows the present bid quotations for the leading traction stocks, and the active bonds, as compared with last week:

	Feb. 27	Mch. 6
American Railways	50⅞	49¾
Boston Elevated	148¼	148½
Brooklyn Rapid Transit	69½	58¾
Chicago City	160	150
Chicago Union Traction (common)	4¾	4⅝
Chicago Union Traction (preferred)	15	14¾
Cleveland Electric	—	—
Consolidated Traction of New Jersey	—	74½
Detroit United	75	75¾
Interborough-Metropolitan	33½	27⅝
Interborough-Metropolitan (preferred)	69⅞	64¾
International Traction (common)	—	54
International Traction (preferred), 4s	—	79
Manhattan Railway	142	139¼
Massachusetts Elec. Cos. (common)	18	18
Massachusetts Electric Cos. (preferred)	67	66
Metropolitan Elevated, Chicago (common)	25	24¼
Metropolitan Elevated, Chicago (preferred)	67	65
Metropolitan Street	104	—
North American	80	79
North Jersey Street Railway	40	40
Philadelphia Company (common)	45½	44½
Philadelphia Rapid Transit	20½	20
Philadelphia Traction	93¾	92¾
Public Service Corporation certificates	68	66
Public Service Corporation 5 per cent notes	96½	95
South Side Elevated (Chicago)	80	a80
Third Avenue	115	109
Twin City, Minneapolis (common)	101¼	97
Union Traction (Philadelphia)	56¼	56½

a Asked.

Metals

The "Iron Age" says there is continued activity in nearly all the branches of finished iron and steel, and some reports are almost buoyant. The orders for iron and steel bars during February were very heavy, and in the wire industry the spring trade is just opening up with much promise. Not very much has been done lately in steel rails. There has been some cancellation of railroad rolling stock, the Gould system countermanding a total of 4000 cars and 100 locomotives. The Steel Corporation has purchased between 5000 and 6000 tons Bessemer pig iron, for delivery next month. The reputed price is $22 valley furnace. It is well known that in spite of having all the furnaces, except two small stacks, in operation, the Steel Corporation is short of iron, but there have been no purchases for many months, and it is not clear that the latest transaction forehadows any systematic buying campaign.

Copper metal rules strong, but spot prices show no change. Lake is quoted at 25¼ and 25½, electrolytic at 24⅞ and 25⅛, and castings at 24½ and 24¾ cents a pound.

CONTRACT LET FOR PENNSYLVANIA ROAD

Contract for grading, concrete work and steel bridges for the connecting link of the Boyertown & Pottstown Railway Company between the power house at Pottstown and Swamp, Pa., was let to Fine & Harris, of Philadelphia, on March 2. There are to be two 70-ft. plate girder bridges and one 460-ft. plate girder steel tower viaduct, besides other small bridges on the line. The McClintic-Marshall Construction Company received the contract for the steel work through Fine & Harris. This line forms the connecting link between the Reading and Schuylkill Valley lines of the Interstate Railways Company, and will give a through line from Reading to Philadelphia when completed. The construction of the road is to be of the most improved type. The rails are to be of 75-lb. A. S. C. E., and the track will be stone ballasted throughout. The contracts for all materials for this road have been let, and in fact the Boyertown end of the line is laid nearly to Swamp at this time. The Pottstown end of the line is completed up to the borough line. It is expected that the line will be completed and ready for operation about July 1. The construction work is under the supervision of T. K. Bell as chief engineer, and directly in charge of Claude Bryan as division engineer.

B. R. T. OPERATING CHANGES

For convenience in operating its various properties the Brooklyn Rapid Transit Company has changed the scheme of its organization somewhat. The significance of the new order is best conveyed by the official announcement of the change, which says:

In order that the supply of electrical power and the maintenance of track, overhead work and structures of the railroads embraced in the Brooklyn Rapid Transit system may be under a concentrated management, and therefore more economically administered for each of the railroad companies, those companies have contracted with the Transit Development Company (which already owns some of the principal power houses of the system) to furnish power and to take charge of the maintenance and repair of the railway properties, including their equipment.

The Transit Development Company is incorporated under the Business Corporation law, and is authorized to manufacture and sell power and to do general contracting work. All the stock of this company is owned by the Brooklyn Rapid Transit Company.

Inasmuch as the Court of Appeals, in its recent opinion sustaining the right of the Brooklyn Heights Railroad Company to charge a fare of 10 cents to Coney Island, has decided that Article IV. of the Railroad law relates only to street surface railroad corporations, and that different provisions of the railroad law govern elevated railroad corporations and steam surface railroad corporations, it has been decided hereafter to limit the functions of each railroad corporation embraced in the system to the operation of its own character of railroad.

Under this plan, hereafter the Brooklyn Union Elevated Railroad Company (an elevated railroad corporation) will operate the elevated railroads, the steam surface railroad corporations will operate railroads of that character, and the street surface railroad corporations will operate street surface railroads only. In order to accomplish this re-classification the leases of the Brooklyn Union Elevated Railroad Company, the Sea Beach Railway Company and the South Brooklyn Railway Company to the Brooklyn Heights Railroad Company have been terminated, and the lease of the Prospect Park & Coney Island Railway Company has been assigned to the South Brooklyn Railway Company. This arrangement will in no way interfere with the through operation of trains and cars as heretofore wherever thereby the convenience of the public will be subserved.

Under the new conditions President Winter, of the Brooklyn Rapid Transit system, continues as head of the Brooklyn Heights Company; John F. Calderwood, vice-president and general manager of the Brooklyn Rapid Transit system, is president of the Transit Development Company; Henry Seibert, a director of the Brooklyn Rapid Transit Company, is president of the Brooklyn Union Elevated Railroad Company; David E. Valentine, another director of the Brooklyn Rapid Transit Company, is president of the South Brooklyn Railway Company; Horace C. Du Val, vice-president of the Brooklyn Rapid Transit Company, is president of the Coney Island & Gravesend Railroad Company and also of the Brooklyn, Queens County & Suburban Railroad Company; John E. Borne is president of the Nassau Electric Railroad Company, and J. C. Jenkins is president of the Sea Beach Railroad Company.

NEW YORK CENTRAL ACCIDENT

The hearings on the causes of the New York Central accident have been continued during the past week. That before the Coroner's Jury was concluded March 4; that before the Railroad Commission is still under way. The conclusions rendered by the Coroner's Jury were as follows:

That said train, made up as it was shown to have been, was running at a speed in excess of what has proved to be safe for such a train on a track laid at the existing curvature at this point, the rails of which were fastened on in the way they have proved to have been fastened, and the super-elevation, such as it was proved to have been, of 4½ ins.

That the running of said train at an unsafe speed over said track exerted sufficient lateral pressure on the outer or easterly rail to cut off or shear the heads of the spikes holding said rails to the ties, thus permitting the displacement and the resultant accident.

Our conclusion is that the New York Central & Hudson River Railroad Company did not take safe and proper precautions to guard its passengers at this point, and consequently were culpably negligent, and that the responsibility for the existing conditions seems to be divided between the construction and the operating departments.

In its recommendations the jury said:

We recommend that the New York Central & Hudson River Railroad Company and others operating railroad lines in this State be compelled to reinforce the fastenings of the outer rails on all curves on their lines constructed as the one in question has been proved to have been, by additional spikes, rail braces and increased superelevation, as from the testimony given we feel that unless such precaution is taken similar accidents may be expected.

We further recommend that until the above strengthening has been completed over curves not so reinforced, the New York Central & Hudson River Railroad and other operating railroad lines be required to lower the speed of trains over such curves to so-called equilibrium speed, or one that is absolutely safe, to protect the lives of passengers and employees, and that instructions to this effect be given those in charge of trains.

Owing to the lack of information of employees and representatives of the New York Central & Hudson River Railroad as to the determination or exactness of the speed of the electric trains, we recommend that they be compelled to install such recording instruments or make such tests to determine the speed as will enable their motormen to know with reasonable exactness the speed at which their trains are traveling. This information should cover speeds at the three different positions of the controlling lever handle, and be properly tabulated and placed in a prominent position in the cab of each electric locomotive.

Frank J. Sprague and B. J. Arnold, of the Electric Railway Commission of the New York Central Railroad, sent the following joint letter on March 4 to Assistant District Attorney Nathan A. Sprague, who has charge of the investigation for the District Attorney:

For some days you have been conducting an inquiry before Coroner Schwannecke to ascertain the causes of the disaster of Feb. 16 on the New York Central Road, and to place, if possible, the responsibility therefor. From remarks made at the hearing of last Saturday we infer that it is now nearing a close.

In the course of this investigation it has been suggested that there was some remissness on the part of the Electric Traction Commission, which had general charge of preparing the plans for the change from steam to electrical operation. The undersigned were members of that commission, which was in existence for the four years ending last December, and are therefore familiar with the details of its work.

The duties and responsibilities of that commission, while numerous, were not universal. Its outside members were neither officers of the road, nor in charge of any of its departments; in fact, during the latter part of its existence its duties were almost nominal, as but few meetings were called during a period of several months. At this time the immediate active work of installation in the electric zone was carried out under the supervision of another body known as the construction committee, of which we were not members, but which was composed exclusively of heads of departments and others in the continuous employ of the railroad, who were presumably in daily touch with the work.

Furthermore, no matter who designed or installed the electrical equipment, its upkeep and operation, as well as the maintenance of the tracks, the determination of schedules and the discipline of the operating forces were matters belonging solely to other hands than ours, with whom we were not in touch, and over whom, in our capacity as advisory engineers, we had no control whatever.

During the investigations, both by the State Board of Railway Commissioners and the Coroner's Jury, we have been in New York, subject to call at any time; in fact, one of us came voluntarily from Chicago to be available if wanted. We are conscious of no neglect of our duties, defect in plans or equipment, or lack of precautionary tests on our part. We stand ready to assume to its full measure any responsibility properly belonging to us as members of the Electric Traction Commission, but, in the absence of any request for our evidence, we protest against the possibility of being charged with responsibilities which we believe belong specifically to others, or which are the result of an accident, the causes of which are not yet fully determined.

We have no desire to force ourselves upon your attention, but if it is your wish to arrive at facts in regard to the responsibility of this commission, we suggest that that desire can best be obtained by calling all who are familiar with those facts.

If, however, it is now your judgment that any measure of responsibility rests upon this commission, then we demand the right to be heard.

Further particulars of the hearing will be published next week.

MR. SHONTS DISCUSSES THE TRACTION SITUATION IN NEW YORK

Theodore P. Shonts, the newly-elected president of the Interborough-Metropolitan Company, operating the surface, elevated and subway lines in the boroughs of Manhattan and the Bronx, New York City, formally entered upon his duties on Monday March 4. On Friday, March 1, however, Mr. Shonts consented to be interviewed regarding the transportation situation in New York in general. He said that for some days he had been devoting himself conscientiously to studying traffic conditions, and that as a result of his observations had decided on a number of important changes. Perhaps the most important of the new work outlined by him is the third-tracking of the East Side elevated lines and the operation of more cars in the subway. Mr. Shonts says he is firmly convinced that the morning and evening rush transportation problem on the lines north and south can be solved by third-tracking the Second and Third Avenue L lines, which work can be completed in a year, if the consent of the city is obtained. Plans have already been drawn up by the company for this work, and are in abeyance pending the consent of the city. These plans have been outlined before in the STREET RAILWAY JOURNAL, having been somewhat extensively dealt with in the issues of Dec. 29, 1906, and Jan. 5, 1907.

As far as the surface roads are concerned, Mr. Shonts thinks little can be done to better transportation facilities without the intelligent co-operation of the city authorities. In his opinion the operating companies do not get a reasonable use of the facilities that they have furnished for trolley transportation, and to correct this he would have the companies given something like exclusive use all day of certain streets. He believes heavy traffic could in many instances be diverted to streets on which there are no car lines, thus giving the companies greater opportunity to operate their cars.

PHILADELPHIA RAPID TRANSIT COMPANY'S PLAN FOR INCREASING ITS EFFICIENCY

After having carefully considered the plans for improving the street railway facilities submitted by the Retail Merchants' Association and the Trades League, the directors of the Philadelphia Rapid Transit Company have decided not to accept either proposition as a whole, but to present to the stockholders a plan of their own, embodying part of each of the two considered.

With but few exceptions the suggestions made by the Retail Merchants met with approval; but as several directors had ideas of their own to embody in the finished plan counsel was instructed to prepare a new one. On the other hand, the propositions submited by the Trades League nearly all proved objectionable to the directors, they practically agreeing to but one section of the plan, the section to which they did not take exception being the one demanding the surrender of the franchises for the Broad Street Subway and of the Frankford line.

Declaring the merchants' plan to be honest and business-like, President Parsons said that the repeal of the ordinance of 1857 would remove a menace which has caused the company much inconvenience in that it has frightened away capital; that the plan was a good one because of the mutual concessions made by the city and by the traction company, but that the company only agreed to the great sacrifices asked because of an anxiety on the part of the traction officials to secure the good will of the people. He said, further, that the agreement to surrender the franchises to the city at the end of fifty years for their actual cost was a great concession on the part of his company, and that the plan to be submitted by the directors themselves would forever put an end to the evils of the over-capitalization of franchises granted by the city.

LEGISLATION IN PENNSYLVANIA

Steam and electric railway legislation continues to engage especial attention at Harrisburg, with every prospect that bills affecting these interests will be the chief topics the balance of the session. The electric railway interests fortunately, this time, have every reason to expect better treatment than they have received hitherto. Former Attorney-Generals Hampton L. Carson and William Uhler Hensel, representing the organized electric railway interests, appeared before the House corporations committee Tuesday evening, March 5, in support of the Homsher bill granting trolley lines the right to carry freight. Mr. Hensel, with William Pepper, of Philadelphia, drafted this bill. Many of the electric railway operators are more concerned about the passage of the eminent domain measure than the trolley freight bill. The building of not a few lines is now in abeyance owing to the obstinacy of certain property owners along the proposed routes in coming to satisfactory terms with the companies, and at least one of these lines will not be built at the present time if the bill giving trolley companies the right of eminent domain is not passed at this session. That the steam railroad interests will vigorously oppose these two bills is pretty certain.

The House committee on electrical railways had a public hearing Tuesday evening, March 5, on the McNichol-Fahey bills. These bills, which are identical, provide:

"That it shall and may be lawful for any city, borough or township and any street passenger railway company or motor power company, to enter into contracts with each other affecting, fixing and regulating the franchises, powers, duties and liabilities of such companies and the relations and respective rights of the contracting parties.

"Such contracts may, inter alia, provide for payments by the companies to the local authorities in lieu of the performance of certain duties or the payment of license fees or charges imposed in favor of such municipality by the charters of the respective companies or by any general law or ordinance; for the appointment by the local authorities of a certain number of persons to act as directors of such company in conjunction with the directors elected by the stockholders, and further to provide for the ultimate acquisition by the local authorities upon terms mutually satisfactory of the leaseholds, property and franchises of the contracting companies."

Senator McNichol also introduced a second bill affecting trolley lines. It provides that articles of association of proposed trolley concerns shall not be recorded by the secretary of the Commonwealth nor letters patent issued thereon until the incorporators produce a certified copy of ordinances of all cities, boroughs and townships through which the route of the company extends, authorizing the construction of the lines.

To obtain State permission for extensions, similar copies of enabling ordinances must be filed.

The first of these measures is of vital importance to the city of Philadelphia, and embodies the plan proposed by the Retail Merchants' Association for settling the transportation difficulties with the Philadelphia Rapid Transit Company. Under its provision the city of Philadelphia may become a power in the conduct of existing companies, have a voice in the directory of the same and arrange for the taking over of the properties after a term of years.

Regarding the eminent domain bill, the trolley interests favor a restrictive clause providing that the right of eminent domain can only be secured when 51 per cent or more of the property owners along the right of way assent. Electric railway interests want a clause inserted in the freight-carrying bill regulating the class of freight electric railways may carry. On account of grades and equipment they would consider it unfair to be required to transport all classes of freight.

Senator Langfitt, of Allegheny, has introduced a bill of prime interest to electric railway corporations. It is as follows:

"That whenever the municipalities of this Commonwealth shall deem it proper to organize corporations under the laws of this Commonwealth for municipal purposes, they shall be and are hereby authorized to contract with the purchasers of such securities as may be issued by said corporations for the payment semi-annually of the interest thereon and sinking funds to redeem the same at maturity, and to levy and collect such tax as may be necessary therefor; provided, however, that the holders of the stock of such corporations shall hold the same as trustees for the said municipalities, and all revenues earned by said corporations shall be deposited in the proper treasuries to the credit of said municipalities as against the payments made on account of said interest and sinking funds as aforesaid."

Other measures introduced include the following:

SENATE

Providing that the stockholders of corporations, except those which are not chartered and conducted for profit, who shall be entitled to vote at a corporate meeting or election shall have all the right and power to vote by proxy and that one person may be constituted and act as proxy for any number of stockholders and providing the proxies dated more than two months prior to any meeting or election shall not confer the right to veto.

Requiring street railway companies to report to the Secretary of Internal Affairs the number of miles they operate.

To revoke exclusive rights of corporations which have been doing business twenty-five years.

HOUSE

Requiring electric railway companies operating suburban lines to equip their cars with toilets.

Giving traction companies the right to condemn lands on which to build their lines.

At a meeting of the House electric railways committee, March 5, the two bills endorsed by the Temporary Street Railway Association of Pennsylvania, comprising within its membership sixty-seven of the electric railway companies of the State, were favorably acted upon after a hearing had been given to former Attorney-General Hampton L. Carson, counsel for the association, and H. E. Reynolds, of Scranton, an advocate of the measures. Among the electric railway representatives at the hearing were W. E. Harrington, chairman of the association, who is also president of the Pottsville Union Traction Company and manager of the Eastern Pennsylvania Railways Company, of Schuylkill County; A. Merritt Taylor, president of the Philadelphia & West Chester Electric Railway Company; H. C. Reynolds, a director of the Northern Street Railway Company, of Scranton; Thomas A. H. Hay, president of the Northampton Traction Company, of Easton, and Frank H. Musser, president of the Central Pennsylvania Traction Company, of Harrisburg.

The bills favorably recommended for passage to the House of Representatives are the light freight act and the act conferring the right of eminent domain upon street railway companies, both of which have been previously referred to.

The eminent domain act provides, briefly, that street railway companies shall have the right of eminent domain, and in virtue of such right may take so much land or material as may be necessary for the construction of their railway, either as an extension of an existing line or as a new line not exceeding 45 ft. in width except where a greater amount shall be required for the slopes of cuts and embankments and such easements in lands lying within or without the limits of any street, road, lane, alley or other highway as may be necessary for the accomplishment of the objects of said company. In cases where agreement cannot be reached as to the value of the property taken it is provided that the Court of Common Pleas in the county in which the land is situated shall appoint five freeholders, finally to settle the question of compensation. It is also provided that either party shall have the right of appeal from the report of said viewers to the said Court of Common Pleas within thirty days after confirmation of the report, and the appeal shall be tried by a jury as in similar cases, but the costs of the appeal shall be paid by the losing party.

REPORT OF BUILDING OF PENNSYLVANIA RAILROAD TROLLEY LINES IN NEW JERSEY

The reported intention of the Pennsylvania Railroad is to connect all of the shore resorts on the New Jersey coast by a system of trolley lines extending from Sandy Hook to Cape May. Although the Pennsylvania has a network of lines throughout the whole of New Jersey, it has no good direct line north and south along or near the coast, and the new trolley system for which plans are being prepared is intended to correct this deficiency. The system will be built entirely for operation as trolley lines, because the traffic they will serve will be largely limited to the summer season.

GOVERNOR HUGHES ON TRANSIT EVILS

Governor Hughes has made two important statements in regard to the transit problem in New York City, one that relief from present intolerable conditions can be had only through the creation of a State public utilities commission, as recommended in his annual message, and the other that the responsibility for this relief is with the Legislature. The Governor will send to both Houses a special message on the subject of transit reform as soon as the public utilities bills are introduced.

GENERATING EQUIPMENT WANTED FOR AUSTRALIA

The commissioners of the New South Wales Government Railways at Sydney are calling locally for tenders for a 3000-kw turbo-generator for the Ultimo power house, which furnishes current for the Sydney tramways. The specification provides for turbo-alternator, condenser and air pump. The present equipment at the power house consists of 48 Babcock & Wilcox boilers of 250-hp nominal rating, 4 850-kw Allis-General Electric direct-current units, 3 1500-kw Allis-General Electric engine-driven alternate current units, and 1 1875-kw Parsons turbo-alternator. It may be mentioned that the system now comprises nearly 800 motor cars, and the output of the power house for the financial year ending June 30, 1906, was more than 35,000,000 kw-hours.

ELECTRICITY AND THE CASCADE TUNNEL

The rumor has been revived in New York of the substitution of electricity for steam in the operation of trains through the Cascade tunnel. According to the latest report officials of the company have completed all the plans for the work. The power for the electric plant will be obtained about 35 miles from the tunnel, where large water-power can be developed. By the construction of about 2½ miles of waterway it will be possible to obtain a head of 140 ft., which will supply all the power that can possibly be needed.

The Great Northern tunnel through the Cascade Mountains is built through solid granite, in which scarcely a crevice can be found in the whole length of the tunnel. From portal to portal the tunnel is 14,400 ft. long, or between 2½ and 3 miles. The grade is about 1.7 per cent, one end being 240 ft. higher than the other. It is possible for trains running down grade through the tunnel to drift most of the way.

THE MAYORALTY CAMPAIGN IN CHICAGO

Fred. A. Busse, present postmaster of Chicago, has been nominated by the Republican party for Mayor on a platform that gives unqualified indorsement to the traction settlement ordinances. As announced in the STREET RAILWAY JOURNAL last week, Mayor Dunne, the Democratic nominee, stands on a platform condemning the ordinances and upholding municipal ownership. The traction clause in the platform adopted by the Republicans reads in part as follows:

For ten years street car patrons have risked health and life in overcrowded, unsanitary cars, and suffered injury to their business and property through lack of sufficient and continuous service, awaiting the time when a settlement could be made with the companies that would properly safeguard the interests of the city. Such a settlement is at last possible through the adoption of ordinances in support of which all disinterested and intelligent citizens who have the interests of Chicago at heart can unite without regard to differences of honest opinion as to the public or private ownership or operation of municipal utilities. On Feb. 4, 1907, the City Council passed two ordinances, subject to referendum, which have for their purpose the immediate reconstruction and practical unification of the street railway systems. We believe these ordinances represent a great advance in municipal legislation, and, if ratified by the people, will settle in an equitable and satisfactory manner the question which has done so much to retard the city's growth and prosperity. We commend these ordinances to the support of the voters of Chicago, and pledge the Republican party, if they are adopted by the people, to enforce all their terms and conditions, to the end that the street railways of Chicago shall be operated for the benefit of the people.

The Citizens Non-Partisan Traction Settlement Association, which was organized recently in the interests of the traction ordinances, is now affiliated with a dozen or more other clubs favoring the ordinances. The club now has an aggregate membership of about 30,000 registered voters. The only requirement for membership is that the applicant favor the adoption of the traction ordinances.

STRIKE AT PORTSMOUTH, OHIO

Employees of the Portsmouth Street Railway Company, of Portsmouth, Ohio, struck last week for a straight 10-hour day and since then more or less violence has been displayed. To prevent men being brought from Huntington and Cincinnati to operate the cars, an obstruction was placed upon the tracks near Millbrook Park lake, where there is a high embankment, but it was discovered in time to prevent a wreck. Traffic was resumed on Thursday, but threatened riots on the part of the strikers and their friends have continually interrupted the work since. Friday night a car was burned and another derailed, while one of the strike breakers was badly beaten. It is claimed that the strikers have not taken part in any of the acts of violence. President York and other company officials claim that the city authorities did not give the company proper protection, and there is talk of asking for troops. The company operates the local lines and a suburban line to Sciotoville and other points up the river. No cars have run on this line for some days.

THE INDIANA, COLUMBUS & EASTERN COMPANY'S PROPOSED IMPROVEMENTS

Practically all of the improvement plans of the Indiana, Columbus & Eastern Traction Company and other lines of the Morgan-Dolan-Schoepf syndicate are being held up until after the new holding company has been organized and all the lines of the syndicate have been merged into one system. None of the plans of the company for through service between Columbus and Indianapolis, Columbus and Cincinnati and other points can be put into effect until all the lines are under one management. One of the drawbacks to the through service now is the lack of equipment, but none will be purchased until the consolidation of the lines is effected, for the reason that it is intended to adopt a general standard.

ANSWER TO LOW-FARE SUIT IN MEMPHIS

The Memphis Street Railway Company has filed a lengthy demurrer to the declaration filed in the suit of William G. Byrne, brought against that company some months ago to test the validity of the ordinance passed for the purpose of regulating the sale of street car tickets. The ordinance provides, among other things, for the sale of six tickets for 25 cents. The plaintiff, William G. Byrne, boarded a car and offered a quarter, requesting that he be given six tickets. The conductor informed him that he had no tickets for sale and the suit for damages was commenced.

The demurrer to the declaration recites that the ordinance purports to amend an ordinance passed Nov. 20, 1895, by eliminating the portion of the former ordinance requiring the sale of eleven tickets for 50 cents and substituting therefor a provision requiring the sale of six tickets for 25 cents. Continuing, the demurrer alleges that section 2 of the last ordinance contains a provision that the Memphis Street Railway Company shall accept the provisions of the ordinance so passed within ten days. The attack on this provision is made in the recital, "and the declaration on its face does not show that the street railway company did accept the provisions of the ordinance within ten days after its passage but, on the contrary, it did not and has not accepted the provisions of this ordinance up to the time of the filing of said declaration and the bringing of said suit." For the reason above set out, it is stated the ordinance is of no binding effect on the company.

The second ground of demurrer is that the city of Memphis has not sought to enforce the ordinance and that the suit of a private individual cannot be maintained before the city seeks to in some wise enforce the said ordinance. Thirdly, it is set out in the demurrer that the ordinance of Nov. 20, 1895, requiring the sale of eleven tickets for 50 cents, was a contract with the city, and that the passage of the ordinance requiring the sale of six tickets for 25 cents abrogates, invalidates, alters and impairs a subsisting contract. Further, it is asserted that the ordinance is a violation of section 10 article I. of the Constitution of the United States respecting the obligation of contracts, and that it is invalid and void in that it violates by its provisions article II., section 2, of the Constitution of the State of Tennessee.

OFFICIAL TERMS OF CONNECTICUT DEAL

According to an official statement, the Connecticut Railway & Lighting Company's property has been leased to the Consolidated Railway Company for 999 years from Aug. 1, 1906. The payment of the rental has been guaranteed by the New York, New Haven & Hartford Railroad Company. The lessee pays taxes and a cash rental amounting to $975,000 for the year 1906-07, increasing gradually to $1,400,000 for the year 1914-15 and for every year thereafter. Out of this amount must be paid fixed charges, consisting of bond interest and sinking fund amounting to $673,882 annually. Under the lease no further bonds are to be issued by the Connecticut Railway & Lighting Company. The holders of the stock of the company have ratified the execution of this lease. The common shareholders have agreed to pay to the Colonial Trust Company, trustee, $10 per share on their stock; while the preferred shareholders have agreed hereafter, and during the term of the lease, to accept 4 per cent dividends per annum in place of 5 per cent. The above payment of $10 per share on common stock, added to the surplus rentals received under the lease, will provide a fund sufficient to pay dividends at the rate of 4 per cent on the preferred stock from Aug. 1, 1906, and dividends at the rate of 4 per cent on the common stock from Aug. 1, 1907, which the agreement provides shall be so applied. The present certificates are to be exchanged for new certificates on which will be endorsed the above stipulations.

THE SITUATION IN CLEVELAND

A conclusion on the values of the Cleveland Electric Railway Company for holding company purposes was expected in a few days, but it seems that Presidents Andrews and Du Pont are having some difficulty in fixing the franchise values. They are proceeding upon a rule agreed upon before they began their work, but their attorneys have found that their ideas of the expiration of some of the franchises do not coincide. Although it was supposed this matter was settled by the late decision of the United States Supreme Court, the attorneys for the Cleveland Electric claim that some of the franchises were granted under different conditions and that the decision does not apply to them. Then there is some difficulty in arriving at the value of the franchises in the villages about the city. They were given on condition that the company carry people to the business portion of the city, but in case franchises on the city streets used for this purpose expire before the village franchises do and are not renewed, it would be a physical impossibility to do this. It is understood that there is a mutual understanding regarding the physical valuation of the properties and that there will be no trouble regarding this. If the franchise question were out of the way it is possible the report would be ready in a few days.

Last week the Low Fare Railway Company received a shipment of rails and hauled them to its proposed line on East Seventy-First Street, between Woodland and Quincy Avenues. Secretary Colver was asked what he intended to do, but declined to talk further than to say that his company was not bound by the truce between the Cleveland Electric and the Municipal Traction Company. He said that as soon as the weather would permit the company expected to proceed with track laying. The Cleveland Electric officials inquired into the matter, but whether any action will be taken remains to be seen. The rails were strung along the proposed route of the Low Fare Company on a permit issued by the street department.

REPORTED DEAL INVOLVING TERRE HAUTE PROPERTIES

By the filing of articles of incorporation with the Secretary of State for the Terre Haute, Indianapolis & Eastern Traction Company March 1, plans are said to have been completed for merging another group of interurban properties by the syndicate represented in Indiana by Hugh J. McGowan. It was reported some days ago that the Stone-Webster syndicate's holdings in and about Terre Haute were about to be taken over, and Mr. McGowan admitted that the attempt was being made to gain entrance to Terre Haute in order that connection might be made with the traction lines recently secured in Southern Indiana. Mr. McGowan is even quoted as saying that the interests he represents had considered the question of taking over the Terre Haute lines. The filing of articles for the new company, which declares its purpose to be the building of lines to fill up gaps, the leasing, purchasing, taking over, etc., of interurban lines, is therefore regarded as indicating the consummation of the Terre Haute deal. The properties to be absorbed by the new company and operated in connection with the Indianapolis & Western, now running from Indianapolis to Danville, embrace the Terre Haute & Brazil interurban line, the Terre Haute & Sullivan interurban line and the Terre Haute City lines. The gaps to be built are between Green Castle and Brazil, Sullivan and Vincennes and Vincennes and Princeton. When these are completed, through service between Indianapolis and Evansville will be possible. The new company is capitalized at $100,000, and its officers are: R. I. Todd, president; T. B. McMath, vice-president; W. S. Milholland, secretary and treasurer.

STREET RAILWAY PATENTS

[This department is conducted by Rosenbaum & Stockbridge, patent attorneys, 140 Nassau Street, New York.]

UNITED STATES PATENTS ISSUED FEB. 19, 1907

844,352. Controller for Electric Motors; Harry U. Hart, LeHavre, France. App. filed June 12, 1905. Provides a controller in which one or more of the braking notches will be serviceable when the reverse switch occupies either the forward or reverse position, regardless of the direction of motion of the vehicle.

844,465. Brake Staff for Railway Cars; Edward Posson, Chicago, Ill. App. filed Sept. 27, 1906. A tilting brake staff which may be operated in the usual vertical position or turned down to be operated in an approximately horizontal position.

844,500. Railway Chair; John Crozier, Ste. Agathe, Quebec, Canada. App. filed Sept. 11, 1905. The base and one fish-plate are integral and the other fish-plate has an interlocking connection with the base. The fish-plates are bolted as usual through the web of the rail.

844,622. Rail Chair and Tie; Abraham P. Sells, Searcy, Ark. App. filed Dec. 11, 1906. The rail rests upon a base plate which has flanges embracing the base of the rail and depending flanges embracing a hollow metallic tie. The ends of the tie are filled with blocks of wood into which spikes are driven through holes in the metal, said spikes further securing the base plate.

844,641. Lineman's Chair; George P. Yeakel and Whorton C. L. Ireland, Norristown, Pa. App. filed Sept. 14, 1906. Details of construction of a telpher chair.

844,660. Guard Rail Fastener; Frank Cleary and John Garrity, Rugby, N. D. App. filed Dec. 5, 1906. A body having upwardly and inwardly turned lugs adapted to receive the flanges of the track and guard rails, and also having an intermediate lug for the reception of the opposite flange of the guard rail.

844,692. Fare Registering Actuating Mechanism; Adolph O. Schmolinski, St. Louis, Mo. App. filed July 16, 1906. Details of construction.

844,720. Amusement Apparatus; August L. N. Fleming, Allegheny, Pa. App. filed Jan. 9, 1907. A revoluble sphere supported upon an inclined axial support and having a spiral track supported outside thereof. The wheels of the cars have double tread divided by a central peripheral flange.

844,762. Switch-Throwing Device; William H. Vaughn and James E. Tiffany, Johnstown, Pa. App. filed Dec. 31, 1906. By moving a segmental plate in the roadbed to the right or left, the switch is correspondingly thrown through suitable bell-crank and rod connections.

844,777. Control System for Connecting Motors as Braking Generators; Frank E. Case, Schenectady, N. Y. App. filed June 6, 1906. A control system for train motor having contactors and a reversing switch and circuits by which the motor is connected to excite magnetic braking effect when desired.

844,790. Support for Railway Motor Cables; Frank W. Garrett, Norwood, Ohio. App. filed March 6, 1905. The cable leads from the car body to the motors as nearly as possible in vertical alinement with the king-bolt or center of the truck to lessen the play thereof.

844,792. Mechanical Ear for Trolley Wires; Edward E. Gilmore, Philadelphia, Pa. App. filed Jan. 13, 1906. The conductor is longitudinally grooved on both sides and these grooves are engaged by depending plates with projecting ribs thereon which are clamped into the grooves by a conical wedge.

844,794. Step-Up Rail Joint; George L. Hall, New York, N. Y. App. filed Dec. 21, 1906. A joint for a new and an old, badly worn rail.

844,797. Block Signal System; Laurence A. Hawkins, Schenectady, N. Y. App. filed July 31, 1905. Sections of the track are charged with direct current. A single semaphore arm movable into danger and caution positions and track rails having circuits so engaged as to secure an overlap feature.

844,896. Semi-Convertible Car; Edward T. Robinson, St. Louis, Mo. App. filed Oct. 11, 1906. Relates to means for storing away the windows of a winter car between the ceiling and roof of the car.

844,918. Car Magnet Support; William M. Brown, Johnstown, Pa. App. filed Jan. 25, 1906. Relates to that class of railways in which the track sections are temporarily electrified during the passage of the train by depending electromagnets thereon. The present invention relates to a method of supporting these electromagnets between the trucks of different cars so that their action will be continuous during the passage of the whole train.

845,001. Railway Wheel; Alexander S. Henry, New York, N. Y. App. filed Sept. 14, 1906. Has independent hub and rim portions and an intervening non-conducting body portion in combination with an inwardly projecting annular flange on the rim portion provided with holes, insulating bushings to line said holes, said plates facing the body portion of the wheel provided with holes registering with the holes in the flange on the rim and securing-bolts passing through said registering holes.

PERSONAL MENTION

MR. THOMAS ROBINSON, president and general manager of the Florence Electric Street Railway Company, of Florence, Col., is dead.

MR. F. L. MORSE has resigned as assistant to President W. H. Bancroft, of the Utah Light & Railway Company, of Salt Lake City, and will return to New York, where he has other business interests.

MR. THERON A. ATWOOD, former railroad commissioner of Michican, has accepted the position of general manager of the Michigan United Railway system, with headquarters at Lansing, Mich.

MR. CLARK PRATHER has resigned as foreman of the Paterson car house of the Public Service Corporation of New Jersey, to become master mechanic of the Roanoke Railway & Electric Company, of Roanoke, Va.

MR. M. O. CHADBOURNE has resumed the management of the lines of the Albuquerque Traction Company, of Albuquerque, N. M., after acting for some time as superintendent of construction of the American Lumber Company.

MR. W. GILLETTE, of Buffalo, has been appointed general manager of the Fort Smith Light & Traction Company, of Fort Smith, Ark., to succeed Mr. R. S. Rand, who returns to the service of H. M. Byllesly & Company, of Chicago.

MR. P. P. CRAFTS has resigned as general manager of the Iowa & Illinois Railway Company, of Clinton, Ia., to become general manager of the Ft. Dodge, Des Moines & Southern Railroad, now under construction. Mr. Crafts will assume his new duties April 1.

MR. FRANK COOLEY has been appointed superintendent of inspection and employment of the Brooklyn Rapid Transit Company, to succeed the late Mr. F. D. Valentine. Mr. Cooley formerly was chief of police of the Brooklyn Rapid Transit system and has been connected with the company for ten years.

MR. J. C. MADIGAN has been appointed general superintendent of the Grand Rapids Railway Company. His former position was superintendent of transportation, but this change puts him also in charge of the shops. Mr. R. B. Savage, the assistant superintendent, has assumed many of the duties of the superintendent.

MR. FERRIS A. OVERFIELD, who recently resigned as general foreman of the eastern division elevated shops of the Brooklyn Rapid Transit system, to undertake a machine shop business, has been presented with a solid gold watch-chain, with diamond-mounted Masonic charm, from his employees and associates as a token of their esteem.

MR. W. H. ZIMMERMAN has resigned as general manager of the DeKalb-Sycamore Electric Company to accept a similar position with the Michigan Power Company, at Lansing, Mich., which expects to enlarge the present property by constructing a new auxiliary steam plant and further developing the water power on the Grand River.

MR. C. E. THOMAS has resigned as master mechanic of the Berkshire & Hoosac Valley Railway, of Pittsfield, Mass., to re-enter the service of the New York City Railway, by which he was employed for several years as foreman. Mr. Thomas is now located at 146th Street and Lenox Avenue as foreman of the New York City Company's general repair and new equipment shop.

MR. F. E. FITZPATRICK has resigned as general manager of the Sacramento Electric, Gas & Railway Company, of Sacramento, Cal., to become general manager of the Bay Counties Power Company, with headquarters in San Francisco, and Mr. C. W. McKillip, who has acted as supervisor of the Sacramento Company, has been appointed by the company to succeed to the position of general manager.

MR. D. H. ROBINSON, formerly superintendent of the Indianapolis & Eastern Railway, is now engaged in general contracting. Mr. Robinson was with the Indianapolis & Eastern Company more than three years, and resigned June 1, 1905, to become general superintendent of construction of the Indianapolis & Western Railway, from which company he resigned a year later. Mr. Robinson now has the contract for installing the overhead materials on the Indianapolis & Western Railway between Indianapolis and Danville, Ind., and between Plainfield and Greencastle, also the installing of a transmission line between Avon and Plainfield. The line will be in operation about June 1, 1907. The Indianapolis & Danville, Ind., division is in operation.

MR. R. ROSCOE ANDERSON has been appointed superintendent of transportation of the Rhode Island Company, of Providence, R. I., to succeed Mr. Samuel Riddell, whose appointment as general manager of the Chicago, South Bend & Indiana Traction Company is announced elsewhere in this issue. Mr. Anderson, who is thirty-four years old, was born in Utica, N. Y., but has lived in Providence since he was a boy. He entered the service of the Rhode Island Company March 1, 1894, as a clerk to Mr. A. T. Potter, who, at that time, was general manager, and who now is vice-president of the company. Mr. Anderson, in fact, remained as assistant to Mr. Potter until the latter's appointment to the vice-presidency, when he became chief clerk in the office of the superintendent of transportation, in which capacity he has served ever since.

MR. SAMUEL RIDDELL assumed on March 1 the duties of general manager of the Chicago, South Bend & Northern Indiana Traction Company, of South Bend, Ind., a new company recently organized to take over the Northern Indiana Railway. Mr. Riddell formerly was superintendent of transportation of the Rhode Island Company, succeeding in that position Mr. A. E. Potter, who, upon the resignation of Mr. R. I. Todd as general manager of the company to become connected with the Indianapolis Traction & Terminal Company, assumed the management of the Rhode Island properties. Mr. Riddell was born in Glen Ridge, Pa., 1878, and graduated from Swarthmore College in 1897. From that time until 1904 he was connected with various engineering companies. The period between 1904 and 1906 he spent familiarizing himself with the various departments of the Rhode Island Company, spending part of his time in the transportation department, the duties of which devolved upon him, when in January, 1906, he was appointed superintendent of transportation.

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Of this issue of the Street Railway Journal 8000 *copies are printed. Total circulation for* 1907 *to date* 89,650 *copies, an average of* 8150 *copies per week.*

The New York Central Accident

The testimony presented in connection with the accident to an electric train on the New York Central Railroad on Feb. 16, as developed in the inquiries during the past three weeks, indicates that the derailment was caused by a speed in excess of that for which the curve was constructed, aggravated by a local defect in the track at that point. It is gratifying to learn that the electrical equipment itself was not at fault; indeed some computations which are published elsewhere in this issue show that the electric locomotive is less severe on curves than the steam locomotive, in spite of its lower center of gravity. We doubt whether any engineering installation of anywhere near the same magnitude has ever been made in which greater care was taken to provide against the unexpected. Outside engineering advice was freely sought early in the plan of electrification by those in charge of the work, and this policy was continued by the establishment of an electric commission during the construction and testing of the locomotives. The first completed locomotive was run on a 6-mile experimental track for over two years, covering 50,000 miles of actual service under the constant supervision of the commission and the engineering department of the company. Other tests were conducted with regular trains on the tracks near New York. With such a novel installation, it might not have been surprising if serious troubles should have developed, and that they did not is remarkable evidence of the skill with which all of the details had been worked out. While the accident has taught certain lessons they have not reflected in any way upon the electrical equipment.

Master Mechanics Visiting and Getting Ideas from Other Shops

Master mechanics frequently get so much absorbed in work at their own shops that they do not take advantage of the many opportunities open to them to visit those of neighboring systems and get ideas. In the Eastern and Middle Western States particularly there is every opportunity to make such visits. Shops are not very far distant from each other, and the fraternal feeling existing between master mechanics makes all of them anxious to show the other fellow what they have in their shops.

That time given to the inspection of shops would be well repaid is hardly questioned. No matter how bright a man may be or what originality he may have in meeting problems, he can still absorb something from the other shop. In fact, it is often the case that a master mechanic who does not think he can be taught anything is usually so narrow minded that he does not realize how far behind general progress he really is. The inspection of a few shops would soon show that it is not in the larger shops alone that ideas can be obtained. Of course the large shops are the ones most apt to have unique devices and methods of doing things because the master mechanics of these have the men and can get the money to carry out new ideas. But wherever an ingenious man or one with original ideas is found, whether in charge of the shops or simply a

workman, interesting devices and methods will usually be in use.

There is, however, a knack in discovering the out-of-the-ordinary devices in a shop. Some men can go through a shop filled with them and see nothing unusual. Even an alert man will often miss many interesting things unless he has the assistance of some one familiar with the shop or enlists the help of those who are responsible for the devices and the practice used. Even these men, either through modesty or because they do not realize the value of their own devices, sometimes fail to point them out.

In regions where many shops are interconnected by interurban railways as in the Middle West, shop inspection might be carried on in a systematic manner. Several master mechanics might meet at certain intervals for the sole purpose of making trips of this kind. They could then go in a special car to several shops where preparations for them had previously been made. The master mechanic of each shop visited might, and probably would, have his shop pretty well cleaned up, but his greatest preparation ought to be in doing a little thinking about what the interesting features of his shop are and how to show them to the visitors.

It would be both a selfish and a narrow policy to leave at home on such visits the shop foreman and the more energetic heads of departments. These men frequently have no opportunity of observing the practice in other shops, and as a consequence they are often much hampered in developing ideas for the improvement of work at home. A few visits of this kind combined with an opportunity to talk with men interested in the same line of work elsewhere would not only broaden them but would result in their becoming more efficient in their own shops.

Reserve Equipment in Sub-Stations

Continuous service is so important a factor in the commercial success of any power transmission system that the designers of generating plants and sub-stations are justified in spending money liberally to insure it. At the same time, a wise policy will always endeavor to limit the complications of controlling mechanisms and to reduce investment in duplicate equipment to the lowest point consistent with reliable operation. It is particularly difficult in sub-stations of railway, lighting and power companies to feel always sure of the extent to which reserve capacity should be installed. The railway power station is supposed to be prepared for any emergency and the same principle applies to a large extent in the plant designed for supplying power for commercial purposes. In some cases the railway and central station services are consolidated so that it might be worth while to consider this subject.

The amount of business handled by a power plant is an important influence in determining how much money should be put into spare apparatus. If an hour's shut-down in a station selling electric power means the loss of thousands of dollars to a large number of industrial plants depending on the sub-station for energy, it is unquestionably wise to install enough reserve capacity in separate units to enable such concerns to operate at least in part, even if it is necessary to notify them by telephone to cut down their power consumption, say by 50 per cent, for a few hours. Interrupted service is bad enough in any case, but there are many industrial plants which can keep a large percentage of their men at work on preparatory processes requiring but little power, although the main production equipment may have to be shut down temporarily. The average manufacturer resents a sudden failure of his entire power supply, if it lasts more than two or three minutes, much more than a partial failure which enables him to avoid the heavy losses of stand-by labor charges throughout the entire establishment. It is fortunate that the machines consuming the largest amount of power do not always require the maximum attendance. In providing reserve capacity for power supplying sub-stations it must not be forgotten that interrupted service frequently occurring is a strong encouragement to consumers to cast about for other sources of current, and possibly to put in isolated plants.

The minimum reserve capacity for a power sub-station equipped with three-phase transformers in single units would seem to be an extra unit of standard size which can be immediately switched into service in case of trouble. If a three-phase transformer becomes damaged, its place must be taken by an equivalent unit, for there is no chance of partial operation as in the case of three single-phase units. A small sub-station equipped with three single-phase transformers can often get along very well temporarily if one burns out, by reconnecting the other two, provided that the interests depending on it are not too closely bunched. Operation on partial capacity is better effected when the consumers' motors are numerous and scattered than when the demand for power is concentrated. When only three transformers are to be installed for power service in a territory where a steady increase of business is anticipated, one cannot go far astray in providing, say, from 10 to 25 per cent reserve capacity in each unit over and above the immediate estimated needs. A large sub-station can better afford additional reserve capacity than a small one, either in the shape of an extra full-sized single-phase unit or in an increase of from 25 to 50 per cent in the rating of the original transformers. Careful engineering judgment is essential if reserve power and prospective business increase are to be given due weight.

In purely electric railway sub-stations the provision of a duplicate rotary converter or motor-generator set for purely reserve purposes is generally such an expense in proportion to the total sub-station cost that it is seldom a feasible scheme to include it in the layout. Few designers would care to recommend less than two rotaries in any railway sub-station of a permanent character unless a portable equipment is available for rapid transportation to the spot in time of trouble or serious overload. The better plan seems to be to include sufficient overload capacity in each machine to tide over any temporary shut-down and to employ first-class attendance in the sub-stations themselves. Reserve capacity is obviously more important in an urban sub-station than in one which operates cars in thinly-settled territory; in the former case, however, there is usually some chance of securing help by tie lines from some other sub-station, or directly through the trolley and feeders, and in the latter case a temporary stoppage of machinery seldom

affects as many people seriously at one time as does the industrial sub-station which goes to the wall. An extra transformer, however, is a pretty good investment for the majority of railway sub-stations.

Lighting sub-stations usually need reserve capacity in regular equipment rather than extra machines kept idle against time of need. The comparatively short duration of the peak load in the lighting sub-station favors the provision of little extra equipment, for the reason that if anything goes wrong the balance of the machinery can be overloaded enough to finish out the run, leaving the entire daylight hours for repairs. It usually happens that the lighting load in a new sub-station is for a considerable period much below the rated capacity of the equipment, for it takes months and some times several years to develop fresh territory.

Whatever may be the decision followed in regard to reserve capacity, it is hazardous practice in any sub-station to be without a liberal supply of spare parts. The cost of attendance ought to be in some degree proportional to the value of the sub-station equipment. Interchangeability is a feature of cardinal importance, especially in combined power, railway and lighting sub-stations. In the last analysis the reserve equipment provided may be modified by local circumstances, but it should never be entirely left out and should always be supplemented by skilful maintenance.

The Coal Supply

A very interesting paper upon this important subject was recently read by Mr. Campbell, of the Geological Survey, before the National Geographical Society. In some respects his conclusions were encouraging, especially as to the gross aggregate of fuel, but upon the whole the paper conveys a grave and sinister warning that should be seriously taken to heart. To begin with, the three chief coal areas of the United States have been pretty well explored and have been very heavily raided already. One can cherish few illusions regarding them. The Appalachian coal belt of anthracite and good bituminous coal is the oldest of our fields. The anthracite has already been drawn upon so heavily that the end is almost in sight. Outside of this single area anthracite exists only in very limited spots, and in relatively inconsiderable amounts. By far the larger part of the high-grade bituminous coal, including nearly all the good coking coal reasonably free from sulphur, comes from this same belt, upon which the commercial attack has been centered on account of its favorable location. The Western bituminous coals are with rare exceptions of rather inferior quality and either coke very badly or carry too much sulphur to be useful in the iron industry. A generation or two will practically make an end of the Appalachian field or at least reduce it to deep mining in undesirable veins. The two great areas of the Middle West, one mainly in Indiana and Illinois, the other in Iowa, Missouri and Kansas, are both of bituminous coal of only fair grade. Both are being worked very energetically, so that the easily worked deposits are on the way to rapid depletion.

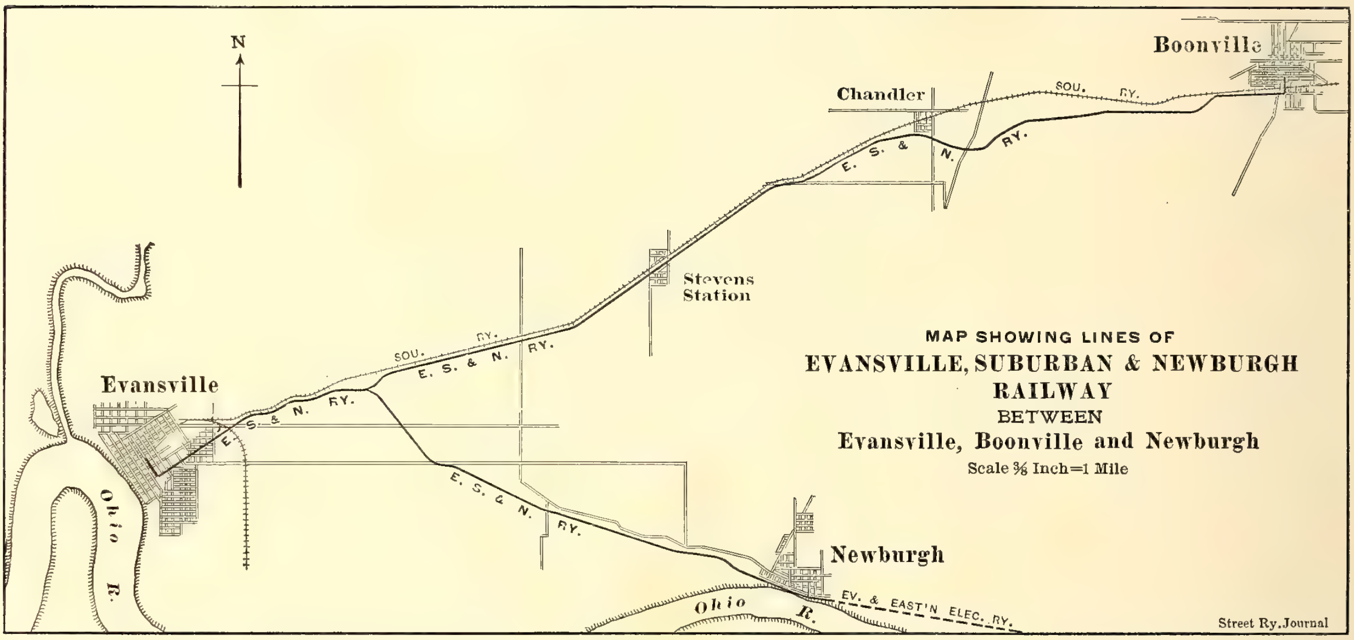
Outside of these three areas the coal supply, while abundant, is generally of poor quality. In Montana, Colorado and New Mexico there are extensive fields, in spots producing a good grade of coal, even small amounts of anthracite. As a rule, however, the coal in these Rocky Mountain beds is not promising, grading as it does mostly from a medium quality of bituminous down to the meanest lignite. Most of the coal lands still in the hands of the Government produce only lignite, which, like the poorer bituminous coals, slacks so readily on exposure to the air that it has small value for transportation. There are huge beds of this in North Dakota and in Texas. These Western fields are, however, 2000 miles from the Atlantic seaboard, where the need of fuel will be soonest felt. On the Coast there are a few fields, mostly of rather poor coal, and far beyond in Alaska are still other beds, somewhat better but very distant from the center of manufacture. The estimate of the total coal in the United States runs to 2,200,000,000,000 short tons, a quantity apparently prodigious and capable of supplying the amount mined last year for several thousand years. But so far as exploration has gone by far the larger part of this coal is poor, including as it does vast amounts of low-grade bituminous coal and lignite, and much even of this is at a very great distance from our present centers of activity. There are no indications anywhere of deposits at all comparable in quality with those of the Appalachian field now rapidly being exhausted. And in twenty-five years the rate of consumption of coal has quadrupled and is now increasing with great rapidity.

Mr. Campbell sees no reason to expect a lessened rate of increase for many years to come, and in spite of the immense stores which he describes he estimates that the real life of our coal fields may be about 200 years. Against this we may set, on the one hand the possibilities of checking the increased consumption by more efficient utilization, and on the other we must face the still nearer exhaustion of the relatively good and cheap supply. The testing plant of the United States Geological Survey has shown that, taking the coals as they come, they are nearly three times more efficient as power producers in the form of producer gas than merely as coal to be burned under a boiler. This is particularly true of the poorer coals and lignite. A possibility is therefore opened of large saving which may stave off the day of complete exhaustion. From another standpoint this is meager comfort, since the cost of transportation bears heavily on poor coal, and while it can be converted into gas or into electrical energy at the mines it is still very far away from present manufacturing centers. There seems to be no escaping the conclusion that long, very long before the coal supply actually nears exhaustion the conditions of cost and of supply will be such as will shift the centers of industry very far from their present locations. This process is beginning even now in the moving of the cotton and pig iron industries southward toward regions of cheaper power and more genial climate. Another generation will see vast industrial changes impending from this very cause. It will be an evil day for the Atlantic seaboard when the Appalachian coal field is done for, and this will take nothing like the 200 years which Mr. Campbell considers. It is high time that every effort should be made to lessen the waste of utilization and to render available even the poorest fuels, lignite and peat, to put off the evil day when Nature's storehouse shall have been emptied.

THE EVANSVILLE, SUBURBAN & NEWBURGH RAILWAY

The Evansville, Suburban & Newburgh Railway, which operates separate electrically-equipped lines east out of Evansville, Ind., to Newburgh and to Boonville, has several features in its organization, operation and construction not often encountered in electric railway work. The road does not depend on passenger traffic alone. Steam freight service is now given on the Newburgh division, and within a short time similar service will be established on the Boonville branch.

The railway company was organized in 1888 when the Newburgh division of the road was built. This line was operated as a freight and passenger road with dummy steam engines until May, 1905, when electrical operation of passenger trains was begun. The change in the motive power of the road was made under an act of the Indiana State Legislature passed March 9, 1903, which permitted steam roads to be changed for electrical operation, and it has taken advantage of an act approved Feb. 25, 1905, which permitted roads changed under the previous act to continue to use steam as a motive power in addition to electricity. The system is the only one that could take advantage of the later law, and it is therefore the only line in the State that has the right to operate both with steam and electricity.



ROUTE OF THE EVANSVILLE, SUBURBAN & NEWBURGH RAILWAY, BETWEEN EVANSVILLE, BOONVILLE AND NEWBURGH

After the electrification of the Newburgh line, construction work on the Boonville division was begun, and this was opened for traffic July 3, 1906. The tracks of the system form a Y. The main line continues out of Evansville to a junction about 4 miles west of the city, where one branch takes off south of east to Newburg, 10 miles from Evansville, and another continues north of east to Boonville, 18 miles from Evansville and 10 miles northeast of Newburgh. There is a total of 28 miles of main-line tracks. The region traversed by both lines is good farming country with an average density of population. Newburgh is an old river town which, after a lethargic period of a decade or more, due to the falling off of river traffic, has begun to build up again. At present it has a population of about 1500. About midway between Newburgh and Evansville is located the Southern Indiana Insane Hospital, a State institution having about 700 patients, and the travel of the attendants and of visitors between Evansville and the hospital is such as would be occasioned by a town of about 700 people.

From Newburgh east to Rockport, 24 miles, the Evansville & Eastern Electric Railway is being constructed. The Evansville, Suburban & Newburgh system has a thirty-five-year contract with this company whereby the cars of the new company will be brought into Evansville over its tracks. The cars, both freight and passenger, will be turned over to the old company at Newburgh and will be handled by the old company's trainmen.

Boonville, at the terminus of the north division, is the county seat of Warwick County, and has a population of about 4500 people. It is surrounded by coal fields, and the development of these alone assures of a substantial future growth. Mining on an extensive scale, however, was only begun within the last six years, and previous to this time the town was supported largely by the farming community around it. The only other town on this division is Chandler, with about 700 people, and which lies 7 miles west of Boonville. Several large coal mines are located near the line in the vicinity of Chandler. These are worked both by miners living in Chandler and by others making their homes in Boonville, who use the electric line in going to and from their work.

TRACK AND ROADWAY

At the time the Newburgh line was electrified, the track and roadway was entirely rebuilt. The track was originally constructed with a 40-lb. T-rail. New ties and rails were laid and all the trestles and crossings were replaced with new work. All of this work was carried on without interfering with the regular schedule of trains, which consisted of five trains in each direction daily. In fact, during the whole work, with the exception of occasional trains being delayed a few minutes by ballast trains, no inconvenience whatever was caused.

As rebuilt, the Newburgh line now conforms with the best practice in interurban work, as does also the newly constructed Boonville line. The reconstruction of the Newburgh line, as well as the construction of the line to Boonville, was done by the railway company under the super-

vision of the Tennis Company, of Cincinnati, C. H. Battin, vice-president of the construction company, being in immediate charge of the work. Both lines are built on private right of way varying in width from 50 ft. to 100 ft. The Boonville line has a maximum grade of 0.1 of per cent, and the Newburgh line 0.7 of one per cent. The character of the country between Chandler and Boonville necessitated considerable grading. The heaviest cut is 14 ft. in depth, and fills 20 ft. high were made. Practically all the curves outside city limits can be taken at full speed. No large streams are crossed by either line, and only one steel bridge span was employed. The waterways are crossed over 14-ft. timber bridge spans having double lines of chords measuring 8 ins. x 16 ins. At the bottom of cuts the roadbed is 19 ft. wide and at top of fills 14 ft. Notwithstanding the fact that gravel could have been obtained at much less expense, broken limestone was used for ballast because of its superior qualities. About 2200 cu. yds. per mile were used. The rails are 70 lbs. and the ties are of white oak, laid 17 to a 33-ft. rail. Through style sidings 500 ft. long in the clear are located at intervals of about 4 miles, and are provided with switch stands of the low target type and automatic spring switches and frogs.

TROLLEY AND POLE LINE

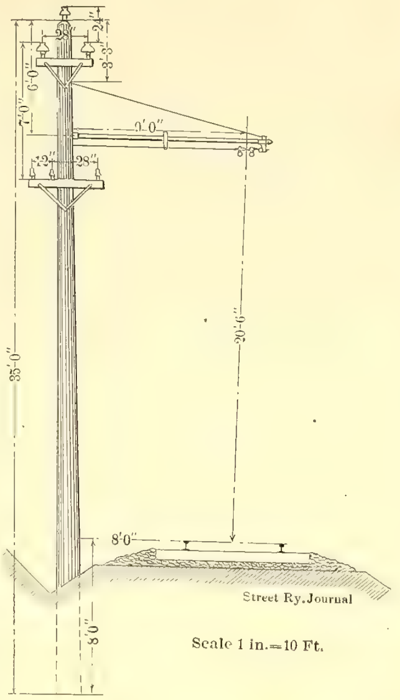
Bracket overhead construction is employed except in the terminal cities. The poles are placed 100 ft. apart. They are of chestnut, are 35 ft. long and have 8-in. tops and 14-in. butts. Both the butts and tops were treated with a preservative compound consisting of a mixture of coal tar and crude oil. A cross-arm below the bracket carries telephone and feeder wires, while those poles between Evansville and the one sub-station on the line carry on a ridge pin and a single cross-arm a three-phase, high-tension line. The brackets are of Ohio Brass Company manufacture and support two 000 grooved trolley wires. Lightning arresters are placed over the entire system at intervals of 1700 ft.

A HEAVY CUT NEAR BOONVILLE. NOTE ALSO THE SHORT POLES USED AS ANCHORS FOR THE GUY WIRES ON THIS CURVE

STATIONS

The present station in Evansville is inadequate, but plans have already been prepared for a thoroughly modern two-story structure, measuring 70 ft. x 150 ft., to replace it. On the ground floor of the new station waiting rooms and ticket and freight offices will be located, while the second story will contain the offices of the company. The station will be built on Fifth Street, near Main Street, on the site of the present one.

At Boonville a large two-story building formerly used as a hotel and located one block south of the public square, which is the center of the business district, has been purchased and converted into a passenger station. The remodeled building contains separate ladies and gentlemen's waiting rooms and ticket and express offices. It is lighted with current from the city mains and is heated from the city central station heating system. An express station with a covered track between it and the main building has been built to the west of the passenger station.



DETAILS OF OVERHEAD CONSTRUCTION AND SECTION OF TRACK

The station at Chandler is a neat structure with the enclosed portion surrounded by a veranda. An unloading platform for freight is provided.

A TANGENT ON THE BOONVILLE BRANCH, SHOWING THE HEAVY BALLAST AND THE OVERHEAD CONSTRUCTION

In Newburgh there are two stations, one in the lower and one in the upper part of town. Both are built with waiting rooms and offices for agents. All of the stations mentioned are provided with local and private telephones. Small shelters will be placed at all road crossings and at other points where stops are made.

POWER SUPPLY

The possibility of future extensions and the fact that power can be rented at a reasonable rate makes it inadvisable at the present time to erect a power house. However, should it be deemed advisable to build a station at any time the company has on hand a surplus of $200,000 which can be used for this purpose. Power is rented on a meter basis from the Evansville Gas & Electric Light Company.

VIEW ON THE NEWBURGH BRANCH APPROACHING THE HOSPITAL FOR THE INSANE

Largely because of the demands made upon it by this railway and also by the Evansville & Mt. Vernon Electric Railway, the lighting company is now rebuilding its generating plant in Evansville. Two Curtis steam turbines of 1000-kw and 500-kw capacity respectively, together with more boilers, have been installed, and further generating capacity is contemplated. Three 100-kw oil-cooled Westinghouse transformers in the generating station raise the current generated at 2300 volts and 60 cycles to 13,200 volts.

A pole line through the city streets carries the high-tension line to a point about one mile from the station to the tracks of the railway company, where the wires are received on the trolley poles. The high-tension wires are of No. 6 copper and are arranged triangularly with 28 ins. as the minimum distance between wires. At the time of the electrification of the Newburgh line a sub-station was built at a point midway between Newburgh and Evansville. After the completion of the line to Booneville the apparatus in this station was removed to the present one, located about 8 miles out of Evansville on the Boonville division. The sub-station building is of brick. It contains two rooms. In one is installed all the high-tension apparatus, including three 13,200-volt to 265-volt oil-cooled transformers, lightning arresters and stick high-tension switches. The two 300-kw Westinghouse rotary converters in the operating room are started by induction motors. They are each located near a side wall of the room, while a six-panel switchboard of Vermont marble occupies a position near the rear wall and midway between the converters. The switchboard is arranged in duplicate for each of the converters, there being two a. c. panels, two d. c. panels and two feeder panels. Bus-bars tie the d. c. panels together so that the machines may be operated in multiple and the two feeders leaving the station are so connected that they may be thrown on either of the feeder panels.

EXTERIOR OF THE BOONVILLE SUB-STATION

ROLLING STOCK

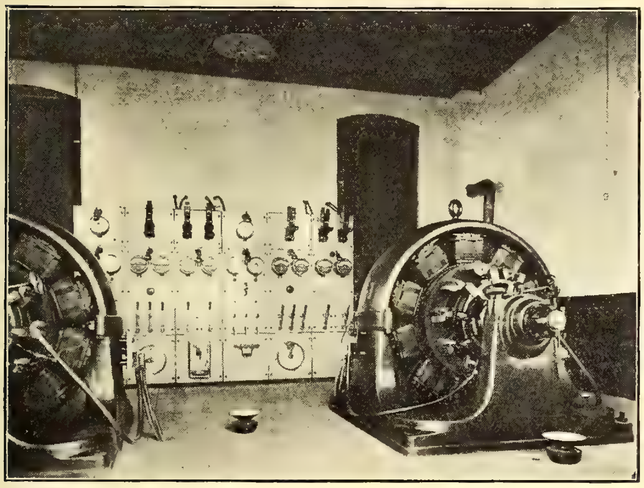
The five electric passenger cars operated on the line were built by the St. Louis Car Company. They are 45 ft. 11 ins. long over bumpers and 9 ft. wide over all. The bottom framing was made in accordance with plans furnished by the railway company and is of extra heavy construction. The center sills of 4½-in. x 6-in. yellow pine are reinforced by 6-in. I-beams running the full length of the car body. A 6-in. channel bar is bolted to the inside of the side sill, and at each end this bar is bent to extend alongside the end sill to which it is securely bolted. On the bottom side of the side sill is bolted a steel plate the edge of which projects ½ in. beyond the outside surface of the sheathing to prevent the bottom edges of the sheathing being damaged by collisions with vehicles. Each of the four platform timbers is reinforced by 1-in. x 6-in. steel plates which extend back beyond the bolsters. A feature somewhat out of the ordinary is the "barn door" type of construction of the vestibule doors. These consist of two parts, an upper and a lower, the division being made at the height of the belt rail. The two parts may be opened and closed inde-

OLD STEAM PASSENGER EQUIPMENT NOW USED TO HAUL EXTRAORDINARY CROWDS

pendently of each other, permitting the upper half to be opened in warm weather and the lower half closed for the protection of passengers. The floor of the car is double, being filled in between with felt paper. The interior is finished in mahogany ornamented with marquetry work. The ceiling is of the full empire design and the half oval deck sash are glazed with leaded art glass, Holophane globes enclosing clusters of five lights and located in the domes of the ceiling. Peter Smith hot-water heaters are installed.

While this door gives the motorman access to his cab, which is partitioned off from the central portion of the car by a pipe rack, the chief reason for placing it in the end of the car was to permit the hauling of timbers, rails or other freight which, because of its length, could not have been loaded through one of the side doors.

In addition to the electrical equipment, the company still has the cars and engines used before the electrification of the road. This equipment, which is now used for passenger service in emergencies only, consists of four closed and eight open passenger cars and three enclosed locomotives with 10-in. x 14-in. cylinders. The freight equipment consists of thirty-two standard gondolas and box cars, but it is the intention to increase this equipment by the purchase of additional gondolas to be used in coal shipments and by a locomotive of standard type.



INTERIOR VIEW OF BOONVILLE SUB-STATION

CAR HOUSE OF THE EVANSVILLE-BOONVILLE LINE

Three of the cars are of the combination baggage and passenger type, while the others are for passengers alone. The car body, which is painted a Pullman green, is mounted on St. Louis Car Company trucks having wheel bases of 6 ft. 3 ins. and fitted with steel-tired wheels. The trucks carry four GE-56 motors. Three of the cars are provided with type-M control and two with K-14 controllers. The cars weigh complete 63,000 lbs. each.

ONE OF THE COMBINATION PASSENGER AND BAGGAGE CARS

The one express car operated on the Boonville division is shown in an accompanying illustration. The car is 45 ft. long and measures 8 ft. 9 ins. over the sills. To avoid overhang of the ends the trucks are placed as far apart as the clearance of the pilot permits. The arrangement of the end doors is somewhat out of the ordinary. In each end a door opening out onto the bumper occupies the space between the right end corner post and the adjacent front post.

REPAIR SHOPS

The electrical equipment is housed and repaired in a brick building in Evansville near the city limits. This building, which is 120 ft. long, is divided into two compartments by a fire wall extending lengthwise of the building. In one compartment are two storage tracks while the other, which contains one track with a pit underneath, is used as a repair shop. This room is provided with a concrete floor. An overhead runway facilitates the handling of armatures and heavy parts. A full equipment of machine tools has not yet been installed, but it is the intention to fit the shop up with these within a short time.

OPERATING FEATURES

The road is operated on a very economical basis, and in fact the operating expenses exclusive of taxes and insurance, are only 44.6 per cent of the gross earnings. General Manager Gus Muhlhausen operates the road on the "everybody busy" principle. Another fact tending to reduce the cost of operation is that practically no trouble whatever is

experienced with the electrical apparatus of the cars. During almost two years of operation of the system by electricity but one armature has been lost, and this is thought to have been grounded by lightning. The small amount of trouble is the result of the careful inspection and attention the cars receive in the shop, and partly of the treatment to which they are subjected on the road. Nearly all of the

THE CHANDLER STATION ON THE EVANSVILLE-BOONVILLE LINE

motormen are experienced engineers and, possessing a thorough understanding of machinery in general, they have proper respect for the electrical equipment and know how to observe care in handling it. They are instructed to watch the armature bearings and other parts of the car as closely as was their custom of watching for trouble in the equipment when driving the steam locomotives.

Regular fares are about 2 cents per mile, with a minimum fare, outside of Evansville, of 10 cents. For regular patrons of the road a book with $12 worth of coupons is sold for $9, which gives a 1½-cent per mile rate. With the exception of at 7 a. m. and 12 o'clock noon on the Boonville line, a one-hour schedule is maintained between 6 in the morning and 8 at night. The first car leaves Boonville at 6 o'clock and carries about 100 miners to the mines near Chandler, and the last one leaves Boonville at 11:15. The running time between Boonville and Evansville is about 45 minutes. On the Newburgh line cars are operated on a schedule of 1 hour and 20 minutes. Three cars are required to maintain the regular schedule of both divisions. When large excursions are to be handled the old steam locomotives and all of the twelve passenger cars may be pressed into service. By means of a train consisting of a locomotive and seven cars similar to those shown in an accompanying reproduction, together with the electrical equipment, on the occasion of the county fair at Boonville last fall, 3200 people were carried from Boonville to Evansville between 4 and 10 o'clock p. m.

FREIGHT TRAFFIC

The system will depend as much on freight receipts as on passenger earnings, and is one of the very few electric railways in existence belonging to steam railway associations. As a member of the American Association of Railways and of the Louisville Car Service Association, it is permitted to receive car-load lots from other roads and to bill cars through from its own system to foreign points. The road has track connections in Evansville with the Southern and the Illinois Central Railways, and ground has been purchased in Evansville upon which freight yards of ample capacity will be built.

In winter when the Ohio River freezes over, and in the low-water seasons, Newburgh is entirely dependent on the railway for its commodities. But the greater portion of the freight business on this branch consists in the handling of

CONVERTED HOTEL IN BOONVILLE USED FOR A PASSENGER STATION

coal from several mines located on the line. Two steam freight trains handled by the dummy engines are run in each direction daily. Heavy freight traffic has not yet been established on the Boonville division. Package freight is cared for by the express car to which reference has already been made, which makes two round trips between Evansville and Boonville daily.

Several of the mines near Chandler will have track connections with the road, and as the capacity of some of these mines is as high as fifty cars per day, the steam locomotive of standard type to be purchased will handle the coal trains.

EFFECT OF ELECTRIFICATION

A forcible example of the effect of changing over to electrical operation on passenger traffic was shown by comparison of the passenger receipts on the Newburgh division for the last eight months of 1905, when passenger cars were

THE ONE EXPRESS CAR ON THE SYSTEM. AN UNUSUAL FEATURE IS THE NEARNESS OF THE TRUCKS TO THE ENDS OF THE CAR

operated by electricity, and for the eight months of the previous year. Without any cause other than the change in motive power and the increased number of trains the travel shows a 40 per cent increase. The receipts from passenger service during eight months of 1904 were $9,440, against $15,936 for the same period of the year following. The months of July and August of the latter year show an increase of 75 per cent in the passenger traffic. When operated by steam, 45 minutes were required to make the trip, as against 28 minutes under electrical operation, and

there were but five trains in each direction on week days, as against eleven when the motive power was changed.

FRANCHISES

All of the company's franchises are perpetual. Neither in Evansville nor in any of the towns is the company required to pay a revenue or franchise tax of any kind. The franchise in Evansville provides for a double track to Fifth and Main Streets and permits the hauling of freight in car-load lots by steam to Canal and Eighth Streets, which is but a few blocks from the wholesale and retail district of the city. The franchise in Boonville permits car-load lot freight to be handled by steam to a point three blocks from the public square, and in Newburg freight may be hauled through the town. The company also owns real estate in the terminal cities and at other points along the railway, exclusive of the right of way, valued at $35,000 to $40,000.

The officers and all of the stockholders of the company are Evansville and Newburgh business men who keep in touch with the management of the property and take considerable pride in it. F. W. Cook, as president of the company, is active in the management of the system. The thorough manner in which the construction work has been carried out and the absence of any appearance of cheap work in it is largely due to the efforts and ideas of General Manager Muhlhausen, whose experience as general manager of the former steam road has convinced him that the best of track and car construction will in the end result in most satisfaction to the company and its patrons.

IMPROVEMENTS IN SCRANTON

Plans are under way for a $250,000 viaduct to be built jointly by the steam railroad companies and the Scranton Railway Company, in Scranton, Pa., to eliminate the grade crossings in that city. The viaduct, including approaches, will be 1300 ft. long, and will provide for a double-track electric road and for a 30-ft. highway. The plans are being prepared at the Philadelphia office of the American Railway Company for this structure. The Scranton Railway Company has also a new power station in contemplation.

NEW SOUTH WALES TRAMWAY REPORT

The report of the railway commissioners of New South Wales for the quarter ended Dec. 31 shows for the tramway lines as follows:

Tramways	Quarter Ended Dec. 31, 1906	Quarter Ended Dec. 31, 1905
Miles open	127	125¾
Revenue	£232,517	£212,456
Expenditure	£196,099	£182,355
Tram miles run	4,159,133	4,079,208
Earnings per tram mile	1s. 1½d.	1s. 0½d.
Expenditure per tram mile	11¼d.	10¾d.
Percentage—Expenditure to earnings	84.34	85.83
Number of passengers carried	39,745,065	36,320,934

The Chicago Union Traction Company is probably the only electric railway system having in its organization the office of "superintendent of sanitation." This office is held by Thomas J. Manning, who confines his work principally to the sanitation and cleaning of cars.

UNDERWRITERS' NATIONAL ELECTRIC ASSOCIATION

The annual meeting of the Electrical Committee of the Underwriters' National Electric Association to consider changes in the National Electrical Code will be held March 27-28 at the rooms of the New York Board of Fire Underwriters, No. 32 Nassau Street, New York. As is well known, it has already been the endeavor of the Electrical Committee to make only such changes in the Code as become necessary by progress in the art or such as have been shown by some field experience to safeguard hazard, as changes in the Code, even when desirable, cause more or less confusion and trouble. A number of suggestions have been received during the past year in regard to changes in the Code, and the committee feels that it may fairly expect that the parties who have sent in these suggestions will be present at the general meeting and ready to support their recommendations with such arguments as they may have in their favor.

The sub-committee on wiring and equipment of street railway property, including rolling stock, has made the following report in regard to the two matters which were referred to them at the last meeting of the association:

1. Rewording of section submitted permitting of a less distance than 4 ins. between woodwork and the current carrying parts of resistances in panel heaters, as required under Rule 32. Under direction of the Laboratories a series of tests on both panel and cross-seat type of heaters were conducted early last year; the conclusions drawn from these tests were that it was not advisable to change the requirements, and your committee so recommends.

2. In regard to wiring of street railway property the following changes are recommended:

Rule 21: Section *d*.—Add fine print note to read as follows: The above requirement does not apply to the grounded circuits of street railway systems.

Rule 28: Section *b*.—Amend to read as follows:

Must not be used when the difference of potential between the two wires under normal conditions is over 300 volts.

Rule 33: Section *c*.—Amend to read as follows:

Must have a cut-out switch located at a proper place outside of the building so that the trolley wire in the building can be cut out at one point, and section insulators must be installed so that when this cut-out switch is open the trolley wire will be dead at all points within 100 ft. of the building. The current must be cut out of the building whenever the latter is not in use or the road is not in operation.

Rule 33: Section *d*.—Amend to read as follows:

All lamps and stationary motors must be installed in such a way that one main switch can control the whole of each installation, lighting and power, independently of the main cut-out switch called for in section *c*.

Rule 33: Section *e*.—Amend to read as followss

Where current for lighting and stationary motors is from a grounded trolley circuit the following special rules to apply:

1. Cut-outs must be placed between non-grounded side and lights or motors they are to protect.

2. Cut-outs must be so placed that no group of incandescent lamps requiring more than 2000 watts will be dependent upon one cut-out.

3. Switches must be placed between non-grounded side and lights and motors they are to protect.

4. Must have all rails bonded at each joint with a conductor having a carrying capacity at least equivalent to No. 00 B. & S. gage annealed copper wire. All rails and all lighting and stationary motor circuits must be connected to the outside ground return circuit by a No. 00 B. & S. gage copper wire, or by equivalent bonding through the track.

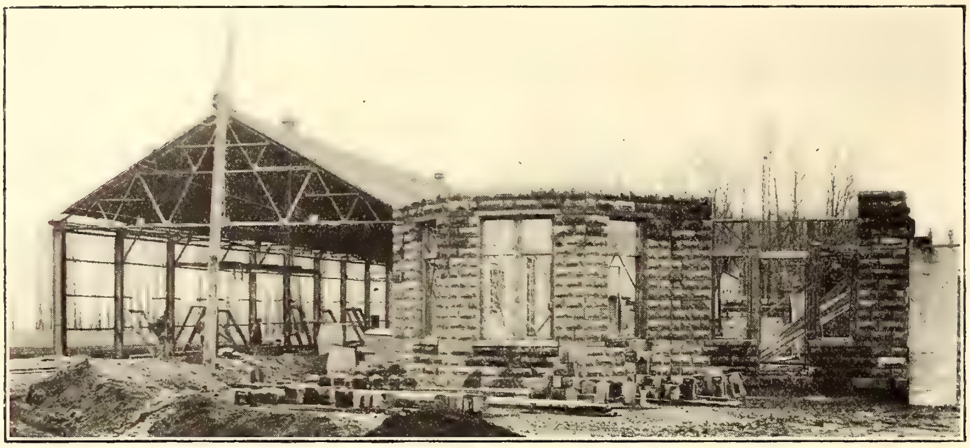
Rule 33.—Add new sections to read as follows:

All pendant cords and portable conductors will be considered as subject to hard usage (see 45 *f*).

Must, except as provided in section *e*, have all wiring and apparatus installed in accordance with rules for constant potential systems.

THE DUNELLEN TERMINAL OF THE PUBLIC SERVICE CORPORATION AT LINCOLN, N. J.

The Public Service Corporation of New Jersey has recently erected a terminal at Lincoln, N. J., to take care of about fifty cars on the main, Arlington, Netherwood and Bound Brook lines operated from this site. The general design is that of open operating depots so largely adopted by this company because they represent a smaller investment than the closed terminal, can be erected quickly, and are particularly advantageous for this company, as the operating conditions over a large part of its suburban territory are liable to change. Besides it may be turned into a closed terminal when desired. The car house originally was located at Westfield, and was moved to its present site. This proved both easy and economical, as the structure is of steel framing with corrugated iron roof and sides. There has also been erected at this point a shop that will be operated as an overhauling depot in connection with the Plank Road shops. Offices and trainmen's quarters are provided in a separate building.



CONSTRUCTION VIEW OF THE CAR HOUSE AND SERVICE BUILDING

CAR HOUSE AND SHOP

The car house proper is 205 ft. long and 45 ft. wide, accommodating three tracks spaced 13 ft. centers. The rear of the car house is separated from the main building by a partition and doors so that it can be kept heated for the benefit of the shopmen. Adjacent to the car house is an addition for washing cars, large enough to accommodate two 25-ft. cars or one large car. This building is separately heated with Peter Smith hot-water heaters and is arranged with a tank for obtaining warm water. The floor is of concrete and is graded to drains which connect with sewers, so that dripping water is quickly carried away.

In the shop proper there are three pits each 50 ft. long, while in the open car house the three pits are 100 ft. long. The cars that need overhauling will be placed over the shop pits, while those requiring inspection only will be placed over the open pits.

An interesting feature of the open car house is the wheel grinder installed for taking out flat spots without going to the shop. This wheel grinder was first described in the Street Railway Journal for Sept. 2, 1905, on page 343, and is now the standard for this work in the Public Service Corporation's shops. Seven of them are now installed on different parts of the system.

The machine consists of two electrically-driven emery wheels mounted on a single casting securely bolted to the pit floor. The emery wheels are arranged to move either in a transverse or vertical direction. To regulate the speed of the wheels the operating current is first sent through a water rheostat. All cars with flat wheels are brought over the wheel grinder pit and jacked up. The car wheels then are made to revolve in a direction opposite to those of the emery grinder. When the grinding is once started an ordinary flat spot can be taken out in the comparatively short time of ten minutes. The average cost for grinding a pair of wheels on one axle is about 30 cents.

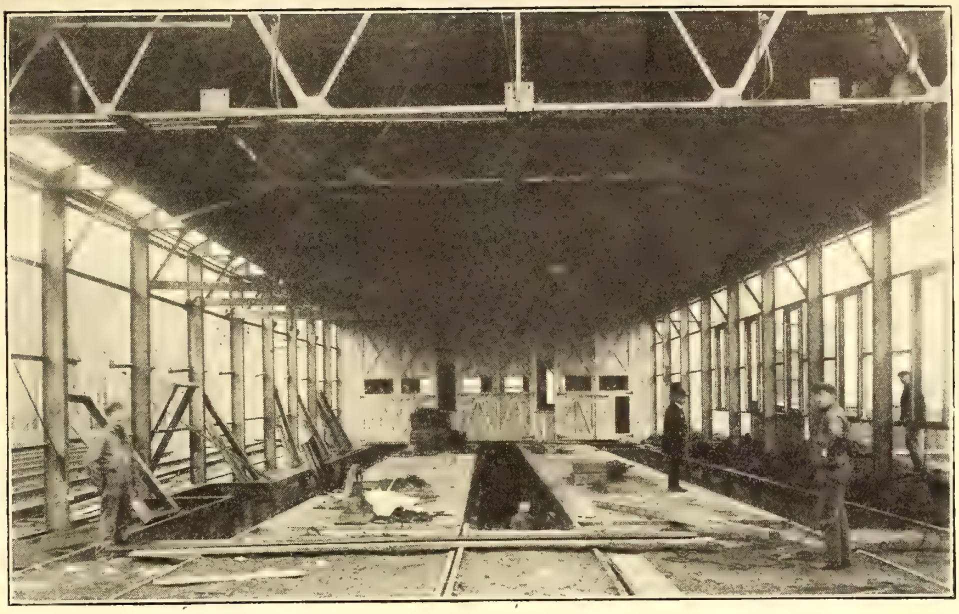
CAR HOUSE FRAMING AND ROOF NEARLY COMPLETED, ALSO SHOWING THE ADJOINING CAR-WASHING HOUSE

The pits in the shop are equipped with narrow-gage tracks running along the bottom. These are to be used for the operation of a traveling pit air hoist. At each pit a revolving jib crane with chain 8-in. x 5-ft. air hoist to handle

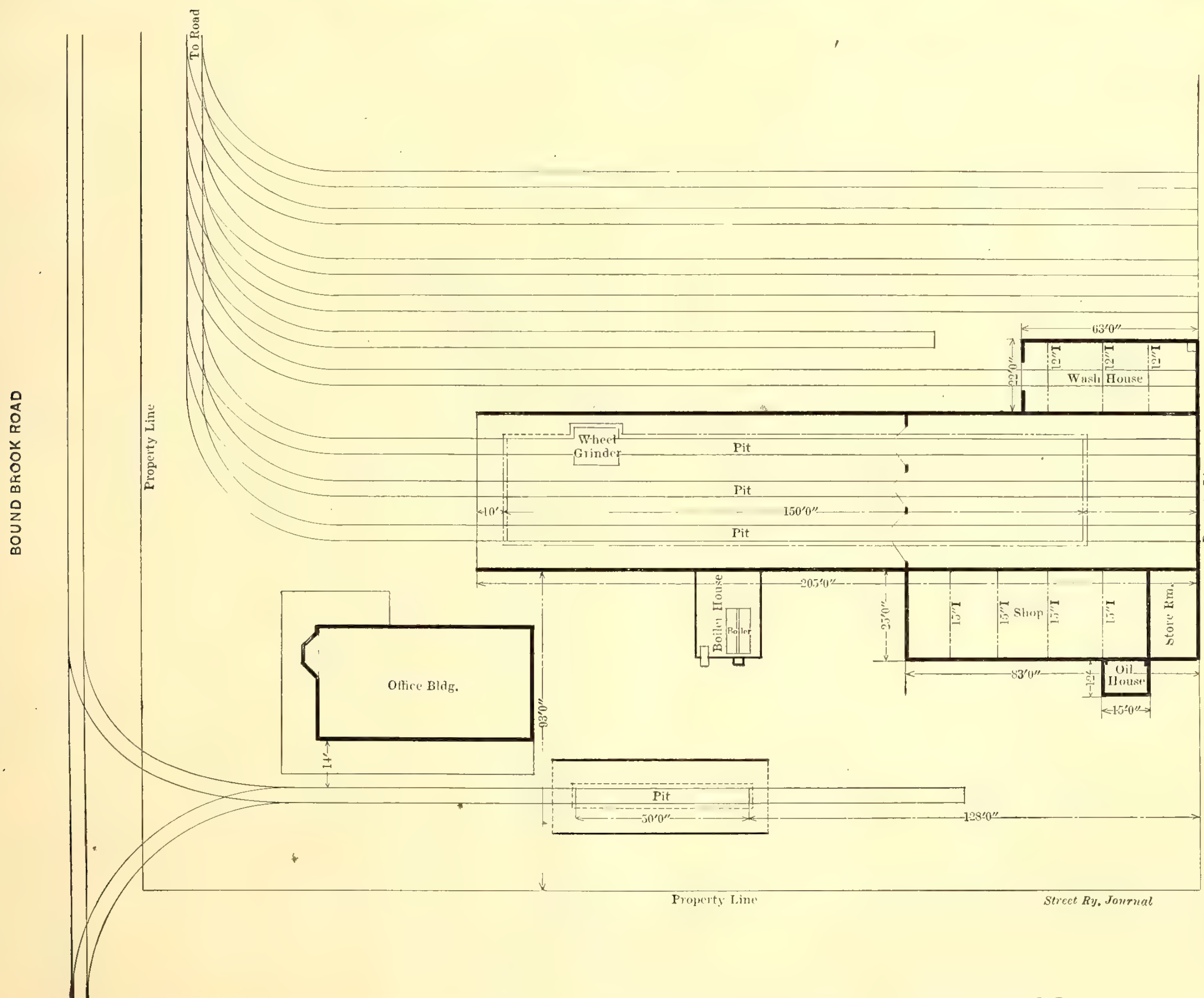
heavy parts to and from the pits to the shop floor is to be installed. Moreover, there will be a traveling chain hoist whose carriage will operate on the bottom of an I-beam supported from the trusses. This traveling hoist will facilitate the lifting of car bodies when trucks are to be run from under them. The shop also contains an electrically-driven forge, lathe, drill press, an air compressor and other machine tools.

OIL HOUSE

Adjacent to the shop is a fireproof oil house for storing all the inflammable material necessary about the depot. This oil house follows the standard type adopted by the company for small terminals. From one of the accompanying drawings it will be noted that it covers an area of 7 ft. x 12 ft. The walls are of brick, 12 ins. thick and 7 ft. high. The



INSIDE THE CAR HOUSE DURING THE CONSTRUCTION PERIOD



GENERAL PLAN OF CAR HOUSE, STEAM PLANT, OFFICES AND STORAGE AT LINCOLN, N. J.

entrance is a standard self-closing fire door. The roof is made of concrete, the reinforcement generally consisting of old T-rails placed on 4-ft. centers. The floor is of concrete. In addition to the oil stored in barrels, the oil house is equipped with an oil filter and waste tank of the type illustrated in the STREET RAILWAY JOURNAL for Sept. 2, 1905.

OPEN STORAGE TRACKS

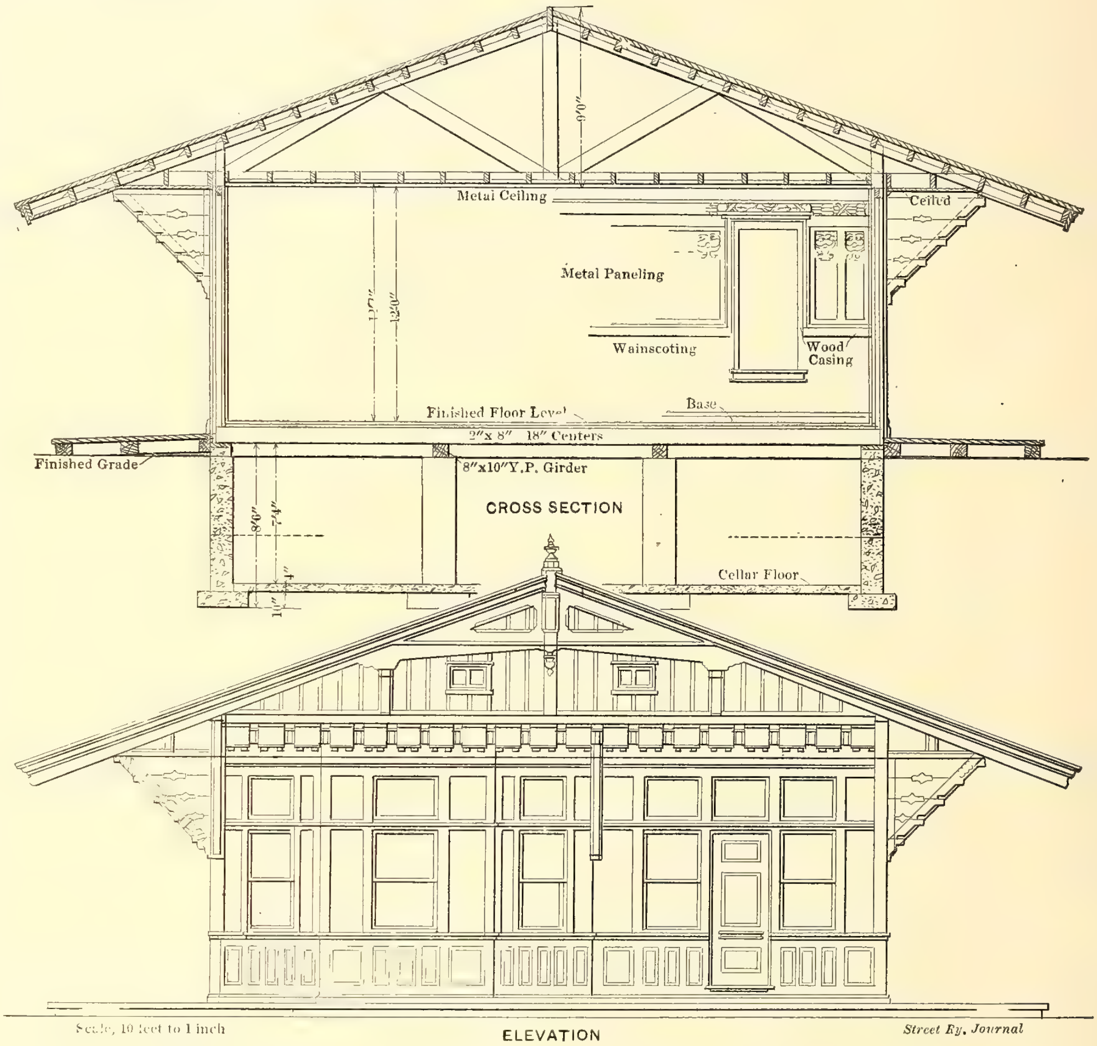
It will be noticed from an inspection of the general plan that in addition to the tracks in the car house there are five open storage tracks 300 ft. long, besides the wash house track. The track layout also shows a Y-connection near the office building. This is for single-ending cars that run in either direction from the terminal. The office building is so situated with reference to this track that passengers will be able to step directly off under a shed and go to the waiting room. A shed-protected pit is located in the rear of the Y-track connection to permit the proper inspection of single-ending cars.

GENERAL SERVICE BUILDING

The building which serves for an office, waiting room and trainmen's quarters is of very neat appearance and is erected on the plan of a small steam railroad station. The building has a bay window front and a low overhanging roof, and, as shown in the accompanying views taken during erection, it is constructed of concrete blocks. The superintendent's office is in the front of the building, where it occupies a space of 19 ft. x 15 ft. The starter will also be located here, as the position of the room makes it easy to get a good view of the track in either direction.

As this installation is a terminal and layover point for cars, the waiting room shown was provided There is also a carmen's room, 22 ft. x 45 ft., which is to be fitted up with pool tables, current literature library and table games. Adjacent to this room is a room for 100 employees' lockers. In may be interesting to note that these lockers will follow the standard type adopted by the Public Service Corporation for all of its terminals. Each locker is 6 ft. high, 12 ins. wide and 18 ins. deep, with the sides and back of sheet metal, while the front door, bottom and shelf are of expanded metal ¾-in. mesh. Besides the shelf which is 18 ins. from the top of the locker there are five closet hooks. The bottom is 6 ins. from the floor and is supported by small angle-irons with cast-iron feet. The door has three hinges and is equipped with substantial Yale locks, and is also fitted with a hasp and staple to permit the use of separate padlocks. All locks are arranged for a master key kept by the superintendent in his office. These expanded metal lockers present a very neat appearance, are reliable, and from the points of cleanliness, safety and compactness answer the purpose a great deal better than the old wooden lockers formerly used. They were furnished by Merritt & Company, of Philadelphia, to the specifications of the Public Service Corporation.

Adjoining the locker room is a neat and substantial toilet laid out with slate stalls and baseboard. All of the exposed piping is nickel plated and the other fittings are of heavy porcelain. The floor is of concrete, pitched toward a center drain which allows it to be thoroughly washed out with a hose at frequent intervals. The floor of the rest of the building is comb-grained yellow pine, kept well rubbed and oiled.



CROSS-SECTION AND ELEVATION OF DUNELLEN OFFICE BUILDING

HEATING SYSTEM

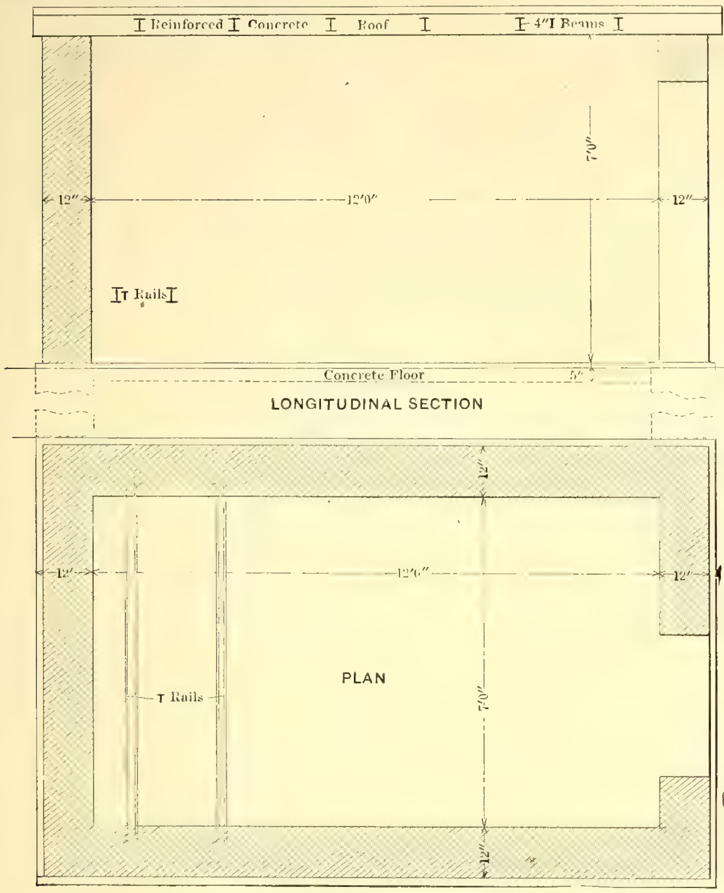
Heat is furnished for the shop and office building from the boiler house indicated on the general plan. This is a depressed room whose roof and glass side extend 4 ft. above the ground. This arrangement brings the boilers low enough to permit the water of condensation from the radiators in the office and shop to return by gravity.

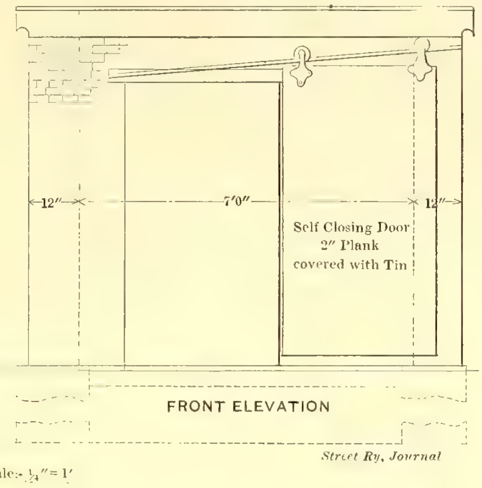
The boiler equipment consists of two Bundy cast-iron boilers removed from Westfield. They are of such capacity that taken together, they furnish ample heat in the coldest weather; in milder weather only one boiler is put on the line. Hence this arrangement easily secures the desirable flexibility in service. The radiators in the office building are new, and while steam pipes were originally intended for the

car house, the company happened to have so many old radiators on hand that it was found desirable and economical to use them in this car house.

FIRE PROTECTION

The building and office are equipped with chemical fire extinguishers and inside hose connections to standpipes; there are also outside connections to fire hydrants. Fortunately the water pressure in the vicinity is upward of 85 lbs., a condition which is very favorable for fire fighting and made unnecessary the installation of pumps or of elevated storage tanks.



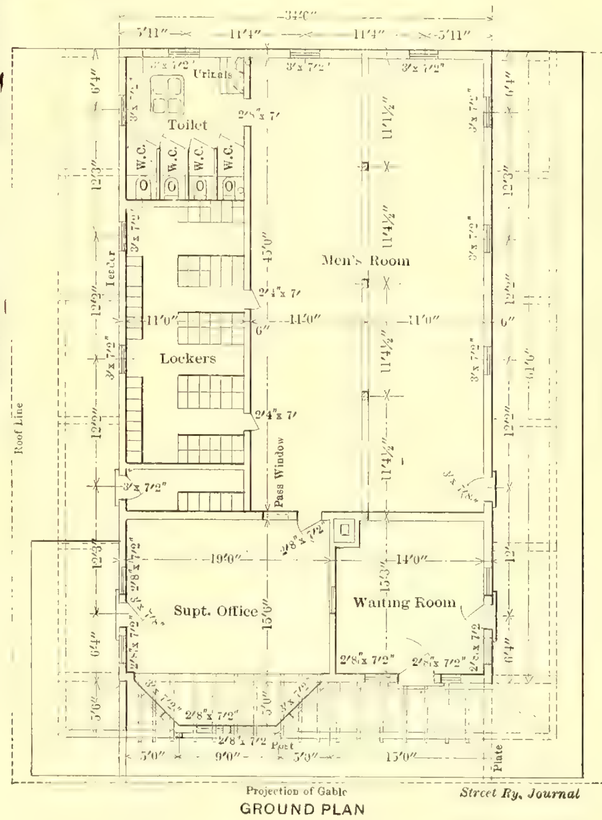


PLAN, ELEVATION AND SECTION OF OIL HOUSE

UNITED RAILROADS REBUILDING ITS CABLE PLANT—NEW MOTOR AND TRUCK SHOP

The United Railroads of San Francisco is rebuilding its cable power house at Washington and Mason Streets to almost twice its original size. The company has bought two lots adjoining on Washington Street, and has begun tearing down some new flats that were started there. It has also bought two lots back of these and extending completely through to Jackson Street, so that the whole land area is now 180 ft. 6 ins. on Washington Street and 187.6 on Mason, with a wing 170 ft. long and 50 ft. wide extending to Jackson Street above the corner. The new building is to be of brick and three stories high. The old chimney has been cut down and rebuilt and is now but 60 ft. tall, as that height is ample for fuel oil. The building will be completed in four months.

The Scofield De Palos Company has completed a motor and truck shop, 96 ft. x 306 ft., and a machine shop, 96 ft. x 102 ft., both one story in height, for the United Railroads at the corner of San Jose and Ocean Avenues. These buildings are of bridge construction and corrugated iron and cost $60,000. The street car company is now using them for making repairs to its rolling stock. The buildings just finished are but part of the large plant which the street railway corporation has in contemplation on its Ocean Avenue property. Eventually it will spend several hundred thousand dollars on improvements at this point, but in the immediate future the building will probably be limited to a



GROUND PLAN OF OFFICE BUILDING AT DUNELLEN TERMINAL

reinforced concrete warehouse, to cost $90,000, and in addition to the machine shop just finished, which will cost about $30,000. These two buildings will be of bridge construction. Plans are being prepared in the office of Chief Engineer Hartwell, of the United Railways, for a car house on H Street, between Thirteenth and Fourteenth Avenues, that will occupy an area of 250 ft. x 400 ft. and will cost about $100,000. The contract has not yet been awarded for this building, which will contain eighteen tracks, capable of accommodating 150 cars of the new type adopted by the company. The building will be fireproof.

PROPOSED REINFORCED CONCRETE TRACK CONSTRUCTION

Martin Schreiber, engineer maintenance of way of the Public Service Corporation of New Jersey, has proposed a concrete track construction for paved streets which presents the novelty of reinforcing rods for the footings to give a continuous beam construction and expanded metal or reinforcing rods in the concrete bed under the paving. The reinforcement for the footings consists of three 7/8-in. twisted rods on each side. This reinforcement considerably reduces the amount of concrete required and at the same time strengthens the sub-structure so much that even heavy street cars should have no difficulty in getting over soft foundations without depressing the track. This assumption is confirmed by a case in Cleveland where cars were operated for days over a cavity caused by a burst water pipe without any effect on the concrete roadbed. With proper reinforcement, of course, the construction would be even better.

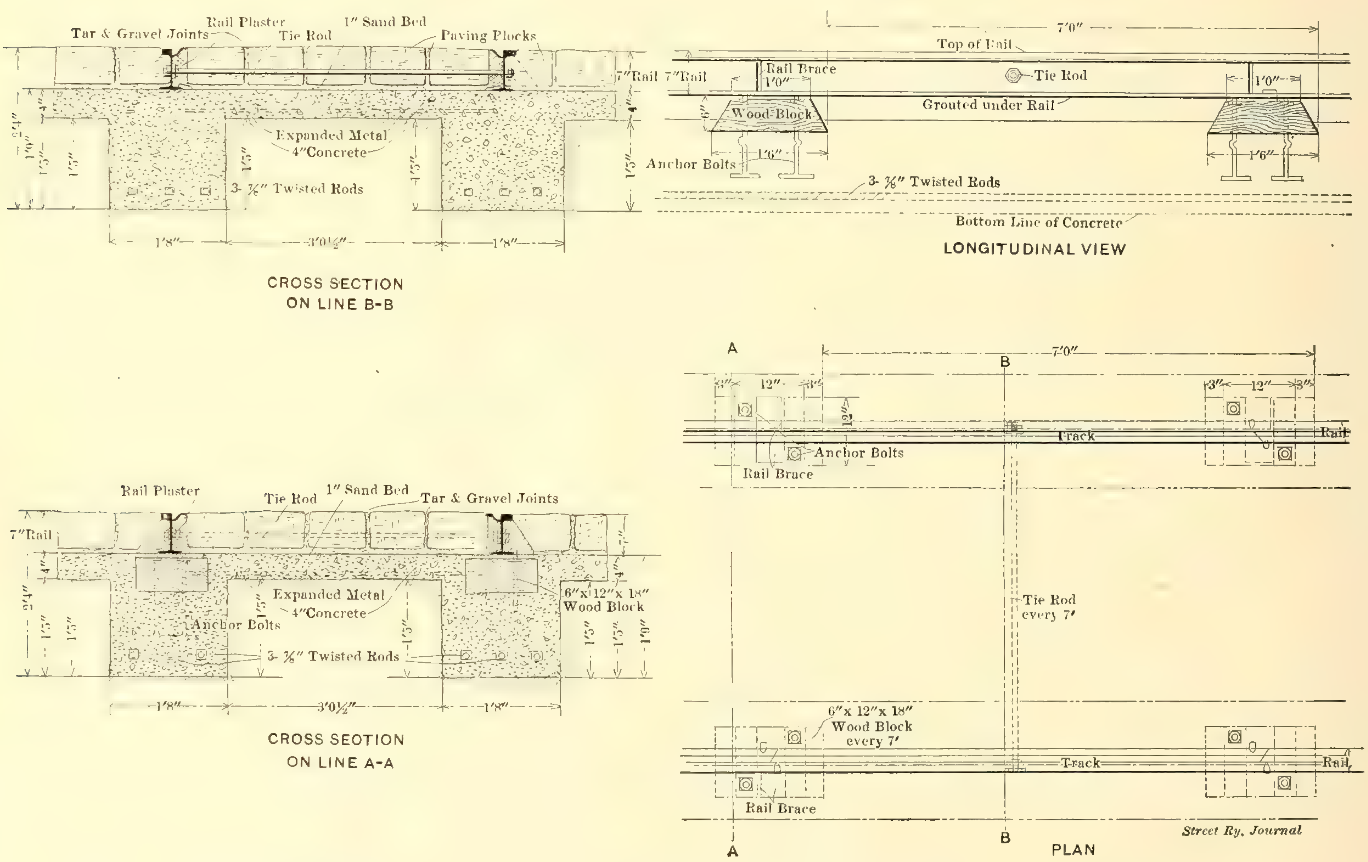
It will further be noted from the illustrations that the footings are 1 ft. 8 ins. wide at the base and extend to a height of 1 ft. 5 ins. before reaching the concrete under the pavement. The footings are of rectangular section for convenience in pouring the concrete. The pavement, whether block or asphalt, rests on a 1-in. sand cushion and 4 ins. of concrete reinforced either with continuous expanded metal or 1/2-in. twisted rods placed every 8 ins.

The rails are not fastened directly to the concrete but to brace tie-plates laid on 6-in. x 12-in. x 18-in. wood blocks placed at intervals of 7 ft. These blocks give greater elasticity to the track than is possible with the usual all-concrete construction. The rails do not rest directly on the blocks but are spiked to tie-plates which are bolted to the blocks by two anchor bolts.

This construction requires no wood or metal ties, but the track is held to gage by the brace tie-plate construction every 7 ft. and the tie rods installed midway between the blocks, so the rails are held to gage actually every 3 ft. 6 ins.

As the concrete is not allowed to extend higher than the base of the rails, all that is necessary to replace worn-out rails is to take up the pavement and loosen the fastening between the rail base and the rail brace plate. As these plates cover the block completely, the latter is saved from wear and will last practically as long as the rest of the substructure.

Mr. Schreiber estimates the total cost of this construction as outlined on the drawings, would be about $6 per running foot of single track. It is to be understood that this construction is advocated only where there is no likelihood that the tracks will have to be disturbed for water and gas pipes, conduits, etc.



SECTIONS AND PLAN OF PROPOSED REINFORCED TRACK CONSTRUCTION IN CITY STREETS

CINCINNATI CAR MEN TO VISIT EASTERN CITIES ON AN INSPECTION TOUR

The annual outing of the Street Railway Employees' Mutual Benefit Association will be held at Chester Park on June 20, 21 and 22, three days having been decided upon in order that the time may be so divided that all employees may attend, and also because of the large crowds that are always present. It has been decided to send twenty-four of the most popular employees on a circuit of the East, stopping three days in New York, two at Atlantic City, two at Washington and three at the Jamestown Exposition.

CORRESPONDENCE

ON THE SUBSTITUTION OF THE ELECTRIC MOTOR FOR THE STEAM LOCOMOTIVE

New York, March 11, 1907.

Editors Street Railway Journal:

In your issue of Feb. 9 you printed a letter from G. B. Henderson discussing certain features of the paper which we had the honor to present at the meeting of the American Institute of Electrical Engineers on Jan. 25. Mr. Henderson attempts to show that we have made mistakes in our conclusions in respect to certain important factors, and we have thought it might be worth while to point out some of the fallacies of assumption which have led him to conclusions materially differing in some respects from those at which we arrived. We also avail ourselves of the opportunity to explain certain details of assumption and calculation which we had not thought it necessary to include in our paper.

Perhaps the most important factor of operating costs in respect to which Mr. Henderson's views are not in agreement with the results of our calculation is the item "Fuel." In discussing this important subject in our paper we endeavored to adopt and follow a conclusive line of reasoning. We were careful to state in detail the facts and assumptions upon which we based our calculations of aggregate freight and passenger ton-miles. In estimating the average works cost of the kilowatt-hour we took the figure 0.6c.; this figure being somewhat in excess of the actual results attained at the Seventy-Fourth Street plant of the Interborough Rapid Transit Company. We showed that this is the cost in a plant using coal at $3 per ton and employing high-priced labor. We pointed out that where "fuel is less expensive, as in the Middle West, large modern plants, using steam turbines, are producing the average kilowatt-hour at a price not exceeding 0.5c. exclusive of capital charges, and in at least one case at a works-cost approximating 0.4c." We were very careful to state the essential points in our reasoning in detail, and the conclusion reached was stated as follows:

"The cost of a kilowatt-hour effective for traction, therefore, is 0.8c., and the cost of a horse-power-hour effective for traction about 0.6c., of which 0.35c. is for fuel when coal of 14,000 B. T. U. per pound costs $3 per ton of 2240 lbs., and 0.25c. is for other power-house supplies, power-house labor and maintenance of power-house equipment."

As our estimates of average length of run and average speed of train were necessarily approximations and not established facts, we included in our paper charts showing the effect upon power consumption of changes in assumptions covering length of run and average speed. These charts showed that no probable error in the assumption, sufficient to cause a material error in our estimates of the energy required, can exist.

Incidentally, and in the way of corroboration, we obtained from the records of the Manhattan Railway Company the actual aggregate coal consumption and the aggregate ton mileage during the year ending June 30, 1901, when steam locomotives were employed, and during the year ending June 30, 1904, when electricity was exclusively used. From these quantities we calculated directly the ton mileage per pound of coal in the case of each of the two contrasted motive powers. Our conclusions were stated in the paper as follows: "The average speed under electric operation is approximately 2 miles an hour greater than that attained by steam, and if correction be made for this difference the ratio of ton-mileage per pound of coal, excluding weight of locomotives, is approximately 3 to 1, and including locomotives 2 to 1 in favor of electric traction."

Mr. Henderson attempts to controvert conclusions thus carefully worked out by the following statement: "The continuous service given on the elevated lines is certainly very conducive to a small fuel account, but we could not expect such satisfactory results from overland freight traffic.

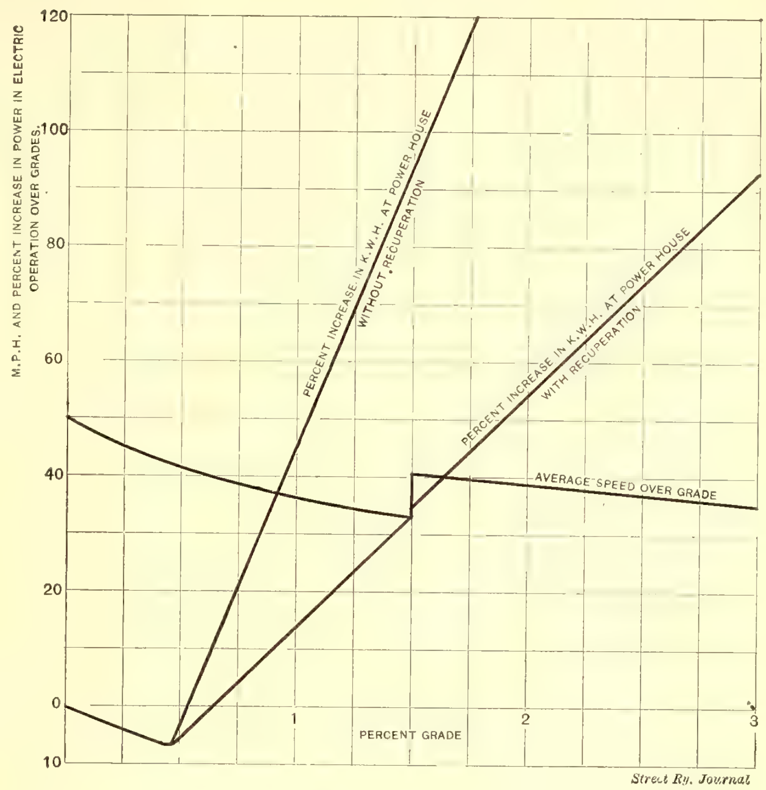


FIG. 1.—POWER CONSUMPTION DUE TO GRADES IN PASSENGER SERVICE

Passenger Service, 300-Ton Train, including 1 Locomotive; 50 M. P. H. Down Grade; No Stops Included; Single-Phase Motors; Motor, 85 Per Cent Efficiency; Transmission, 90 Per Cent Efficiency.

The tests made at the St. Louis Exposition indicate that under favorable conditions a locomotive may operate with a consumption of about 2 lbs. of coal per horse-power-hour, but there are many cases, as where heavily-loaded freight engines are ascending steep grades, in which the consumption may be two or three times that amount. Therefore we believe that some advantage will accrue in the cost of train operation, but by the time we allow for the transmission losses and develop at our locomotives only 70 per cent of the power produced at the central station, it is apparent that we cannot expect such a ratio of improvement as 3 to 1, which has been suggested, or even possibly 2 to 1." Of course there is no argument embodied in Mr. Henderson's statement. It is simply an expression of opinion, and the confusion of ideas is such that it would be entirely pertinent to content ourselves by referring him to the text of

our paper, but his letter apparently is written in good faith, and as it is typical of much so-called reasoning published from time to time in our technical journals, it may be worth while to point out some of its errors.

In the first place, his statement that the "continuous service given on the elevated railways is conducive to small fuel account," and that "similar satisfactory results could not be expected from overland freight traffic," is an unusually flagrant case of what logicians call "begging the question." As a matter of fact the energy per ton-mile in Manhattan service is about 100 watt-hours, while in the average passenger service of the United States it will approximate 33 watt-hours and in freight service 18 watt-hours. If by "continuous service" he refers to load factor he is answered by the fact that on the Manhattan this

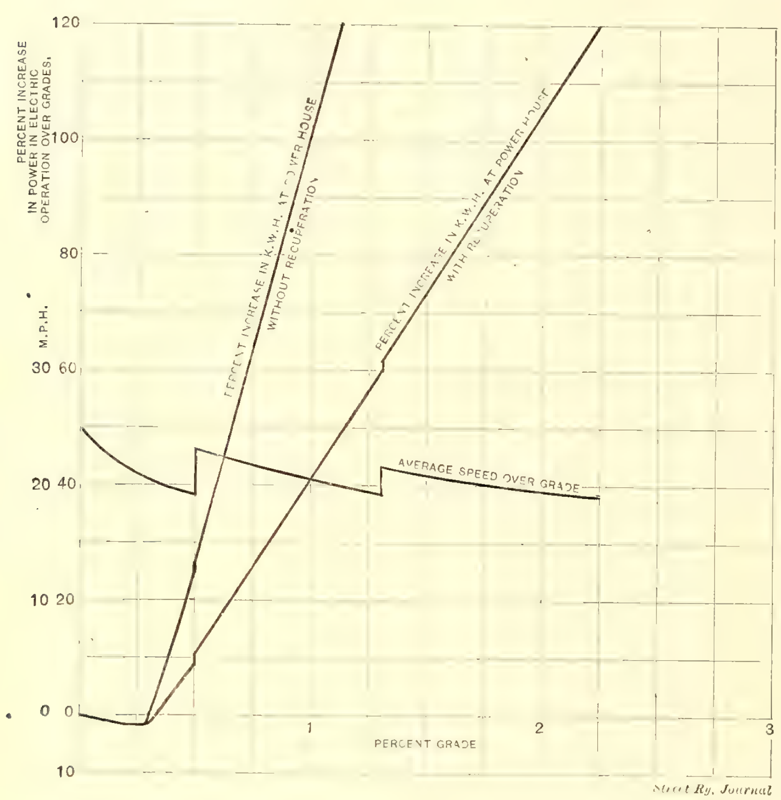


FIG. 2.—POWER CONSUMPTION DUE TO GRADES IN FREIGHT SERVICE

Freight Service, 1300-Ton Trains, Including 1 Locomotive; 25 M. P. H. Down Grade; No Stops Included; Single-Phase Motors; Motor, 85 Per Cent Efficiency; Transmission, 90 Per Cent Efficiency.

factor does not exceed 0.5, while in overland freight traffic, if stretches of line 300 miles in length be supplied from each power house, the average load factor will be very materially higher.

If, on the other hand, he means to assert that when steam locomotives were used on the Manhattan conditions of service were such as to favor high fuel economy, as compared with average conditions in overland freight traffic, he is undoubtedly correct. The point, however, does not favor his contention that our estimates are in error. On the contrary, it emphasizes the superiority of electric service. In other words, we have compared electric service on the Manhattan elevated with the exceptionally economical steam service which preceded it, and we have shown that, notwithstanding the very excellent economy in fuel consumption attained in that steam service, the electric equipment used to-day requires not more than one-half the amount of coal per ton-mile which was consumed in the days of steam operation. Moreover, electric service on the Manhattan, which shows this superiority over the exceptional steam service which preceded it, is using 100 watt-hours per ton-mile, as against one-third of that amount which would be required in the average passenger service of the United States and one-fifth of that amount which would be required in average freight service. The high energy consumption in Manhattan service is, of course, due to the fact that trains stop about three times in each mile and attain comparatively high speed between stations.

All this possibly may be confusing to the class of railway men who have been accustomed to deal with energy problems along the lines indicated in Mr. Henderson's communication, but it may be useful to the many clear-headed steam railway engineers who are capable of appreciating the value of careful analysis of utilization of waste energy which in 1905 cost the railroads of the United States something over $156,000,000.

The attempt to reach accurate conclusions relative to aggregate fuel consumption by starting with test conditions of a model locomotive and applying loose guesses and assumptions to the results obtained under these test conditions is practically useless. In the early days of electric lighting the companies supplying dynamos and engines talked of 4 lbs. of coal, or even 3 lbs. of coal, per kilowatt-hour. Some years later the National Electric Light Association collected statistics of coal consumption based upon actual bills paid by central station companies, and found for many hundreds of central station plants that the grand average fuel consumption was more than double the figures based upon tests. A similar mistake is made by Mr. Henderson in this instance, and has been made by others who have attempted to deal with this question.

Mr. Henderson says further: "But by the time we allow for the transmission losses and develop at our locomotives only 70 per cent of the power produced at the central station, etc., etc." It is difficult to realize how any one who has taken the trouble to read our paper and our calculations could fail to understand that our figures from Manhattan records covering fuel consumption comprise all losses as well as power actually utilized in the propulsion of trains and for train auxiliaries.

Referring to our diagrams showing the relations of speed and energy consumed, Mr. Henderson remarks that "It seems as if they were based upon trains on a level only and that no allowance has been made for the adverse effect of rising grades."

He remarks further: "It must not be assumed that an undulating profile will require no more power than a level division, because the work of ascending a grade is a very severe and heavy draft on the power whatever it may be, and which is not compensated by the following run down hill, even if this should be of as great amount as the ascent." It is pertinent to remark here that "what goes up must come down," and, therefore, since trains operate in both directions, down grades, in the aggregate, must be equal to up grades. The point which Mr. Henderson has in mind is a very serious one in the operation of steam locomotives and

is one of many causes which contribute to the relatively very high fuel consumption of steam service, as contrasted with electric service. It is not of material importance, however, in electric service, when we consider the average grades and curves. In general we have found that the additional resistance, due to grades and curves, can be practically neglected in the electric operation of trains. Unlike the steam locomotive, the electric motor, under certain conditions, operates at higher efficiency on grades and curves than when running free on a straight and level track. This is due to the fact that the motor and gear ratio are properly selected to obtain the highest average efficiency in operation. The effect of this selection throws the load in continuous operation on level track below the point of maximum efficiency. In ascending a grade the speed is reduced, and within reasonable limits this reduction implies an increase in motor efficiency. Again, the reduction in speed due to grade results in a reduction of rolling friction and train resistance. These gains are not offset in descending grades unless in addition to gravity power be used to attain a speed exceeding the maximum limit which we have assumed, namely, 50 miles an hour in passenger service and 30 miles an hour in freight service.

Theoretically, as long as the grade does not introduce a resistance, in excess of that of the train friction independent of the grade, the energy expended in lifting the train will be recovered in overcoming train friction in going down grade. If the ascending and descending speeds are equal, the energy consumption will be the same per ton-mile as on a straight and level track of the same length. If the ascending speed is reduced, as it is in the case of the series motor, the total watt-hour consumption will also be reduced. In Fig. 1 and Fig. 2 we have plotted the effect of grades upon power consumption, in both passenger and freight service. In order to keep the discussion distinct from the question of motor and transmission efficiencies we have assumed a motor efficiency of 85 per cent in all cases and 90 per cent transmission efficiency. All power calculations are carried back to the power house, and that portion of the recuperated energy which cannot be utilized by the train auxiliaries has been returned to the power house at 90 per cent efficiency. Extra electric locomotives are added as needed. It will be noted from an inspection of these curves that the power consumption over grades is less than it is over straight and level track, in passenger service, for all grades less than .55 per cent, and in freight service less than .35 per cent. Comparatively few lines are absolutely level, but on the other hand the aggregate mileage on grades exceeding 0.5 per cent is comparatively small. It is believed, therefore, that the general result will be very close to that obtained over straight and level track. Nevertheless, we have added to our calculations of energy required 10 per cent in the case of passenger service and 15 per cent in the case of freight service to cover contingencies, including switching, "double-headers" and the additional resistance due to grades and curves. We have assumed maximum speeds sufficiently high to compensate for the reduction in average speed due to grades.

In some recent calculations in which we have investigated the subject in great detail the foregoing conclusions were corroborated. In one case in express service the detailed calculations of runs over the road showed a consumption of power of 53 watt-hours per ton-mile, while on a straight and level track the result obtained was 52.8 watt-hours per ton-mile. In the local service over the same line the figures were 84.2 watt-hours in the detailed calculations and 86 watt-hours on a straight and level track. These results were obtained from calculations relative to the electrification of the suburban portion of a steam railroad over 30 miles in length; a large percentage of its tracks being on grades and curves. There were maximum grades of 1.47 per cent, 1.55 per cent and 2.32 per cent, and curves of 6 deg. 22 sec. and 8 deg. 30 min. Numerous other calculations and elaborate tests have verified these results.

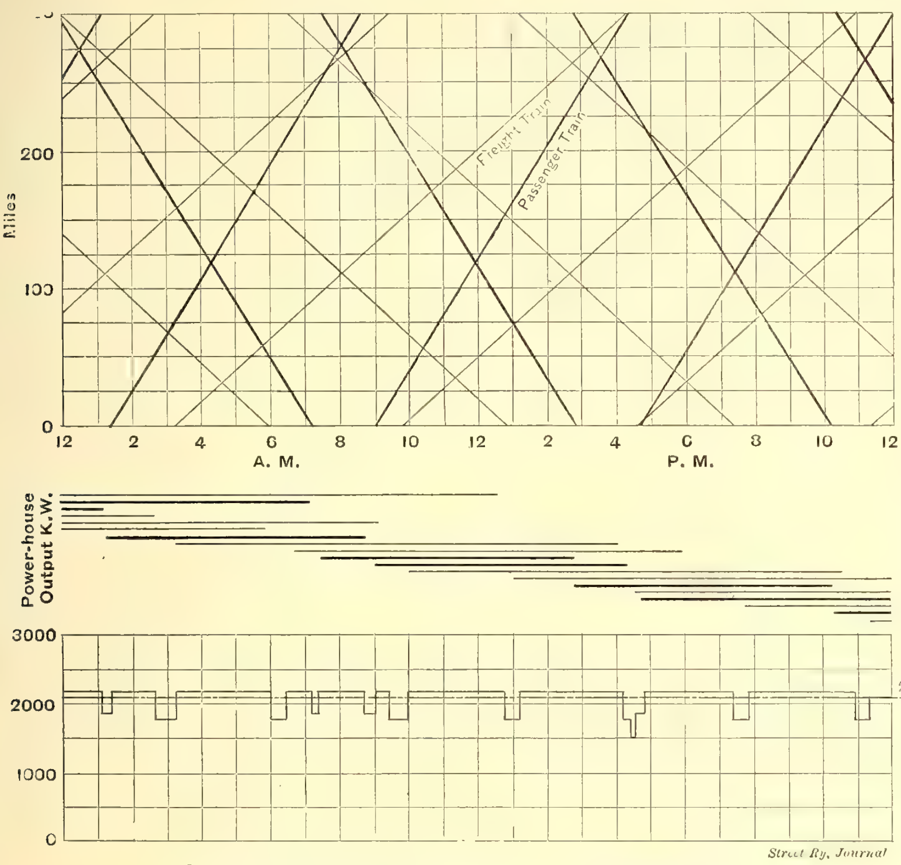


FIG. 3.—POWER-HOUSE LOADS, MAXIMUM SCHEDULE

DATA FOR FIG. 3

Section 300 miles. Tracks per mile of line 1.4.

Passenger trains, weight 226 tons.
" " ave. speed 40.5 m. p. h.
" " length of run 10 miles.

Freight trains, weight 937 tons.
" " ave. speed 23 m. p. h.
" " length of run 15 miles.

Average trains on section,

passenger	1.98
freight	3.84
Total	5.82

Average load, 24 hours:
(1.98 × 273 + 3.84 × 351) ÷ .90 eff. = 2100 kw at p. h.

Estimated momentary peak, 85 % eff.
1/3 trains accelerating, 1/3 running, 1/3 standing = 2970 kw.
Load factor, 1 hour reading = .968.

Presenting no calculations whatever, and touching lightly upon only a few of the facts pertinent to this subject, Mr. Henderson naively remarks: "Under these conditions we should say that the amount of power needed for general

operation in this country would be at least double that which has been estimated by the authors." This conclusion may be satisfactory to Mr. Henderson, but it certainly is not convincing.

Mr. Henderson, by reasoning(?) similar to that which he brings to bear upon the fuel consumption, apparently satisfies himself that about twice the power house capacity indicated by our estimate would really be requisite for the operation of the railway systems of the United States. It is unnecessary to attempt to follow him, but it may be well here to define the load factor assumptions upon which our estimates are based.

The report of the Interstate Commerce Commission gives the total revenue traffic for the entire United States for the year ending June 30, 1905, as 1,038,441,430 train-miles, of which 459,827,029 is passenger train mileage and 546,424,405 freight train mileage. The unclassified balance, 32,189,996, we have assumed to be mail and express train mileage. Including the mail and express trains with the passenger train service there is an average of 6.2 passenger and 6.9 freight trains per mile of line per day, or approximately 7 trains each way per day.

Using average weights of equipment, as stated in our paper, and the average haul of goods and passengers, the traffic amounts to 3,000,000 ton-miles per mile of line per annum, of which 600,000 ton-miles is in passenger service and 2,400,000 ton-miles in freight service. In electric operation these figures would be reduced by the weight of engine tenders and a part of the weights on pony trucks.

To supply electric power for the operation of the steam roads, we have assumed that the power houses would be located at average intervals of 300 miles. This requires a transmission of 150 miles, and for this purpose we assumed in our calculations 60,000 volts. As stated in our paper, both the distance of transmission and the voltage employed are within current practice in plants now in commercial operation in this country, under conditions and for purposes identical with those contemplated in our paper.

In our calculations we assumed that passenger trains are geared for a maximum speed of 50 m. p. h. and freight trains 25 m. p. h., on a tangent and level track. We assumed that the average run of passenger trains is 10 miles and freight trains 15 miles between stops. With the gear ratios used this gives an average speed of 40.5 and 23 m. p. h., respectively. At these speeds the average load on each power station supplying 300 miles of line is 1.98 passenger trains and 3.84 freight trains, an average of 5.82 trains of both kinds. With equal intervals between passenger and freight trains, respectively, the average load on the power house is 2100 kw, the load factor is 0.97, and the maximum momentary peak is estimated to be 3000 kw. This method of operation is shown in Fig. 3.

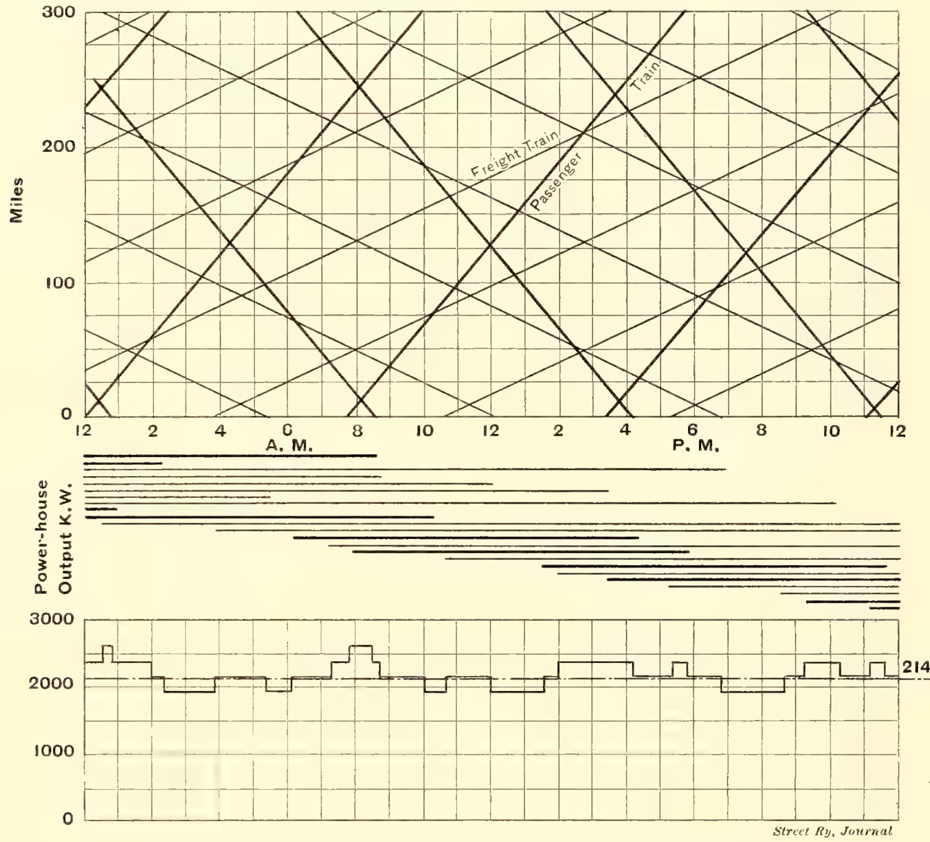


FIG. 4.—POWER-HOUSE LOADS. REDUCED SPEEDS

The schedule speeds above mentioned include momentary stops only. As trains are now operated the average passenger train, owing to stops and delays of various kinds, does not make more than 30 m. p. h., and through and local freight trains probably do not average more than 12 m. p. h. In Fig. 4 we have illustrated the results at the power house if trains were operated at these modified average speeds. The average load remains practically the same as before, while the load factor is reduced to 0.823 and the estimated maximum momentary peak is increased to 4700 kw. Our estimate of the total power house capacity of all the railroads of the United States is 2,100,000 kw, which is approximately 3000 kw for each 300-mile section. This is nearly 50 per cent in excess of the average load. The generators proposed for this power house equipment have a momentary overload capacity of 100 per cent and can carry an overload of 50 per cent for several hours. It is evident, therefore, that the average power plant provided, after deducting 20 per cent for reserve, is ample to take care of ordinary variations in traffic.

DATA FOR FIG. 4

Passenger trains, ave. speed 30 m. p. h.
Freight trains, ave. speed 12 m. p. h.

Average trains per section, passenger....	2.6
freight	7.4
Total	10.0

Average load, 24 hours:
$(2.6 \times 210 + 7.4 \times 187) \div .90$ eff. = 2140 kw at p. h.

Estimated momentary peak, 85 % eff.

⅓ trains accelerating, ⅓ running, ⅓ standing = 4720 kw at p. h.
Load factor, 1 hour reading = .823.

It is manifestly impossible for railroads to operate their passenger and freight trains on equal headway. Some roads as a matter of convenience dispatch freight trains in "fleets" and cattle and some produce trains must arrive at their destinations at fixed times of the day. This method of operation is desirable and practicable in steam operation, and obviously is objectionable in electric operation, as power house capacity must be provided for the maximum number of trains on the division. On the other hand, on those

roads where traffic is most congested, the track facilities can best be utilized by equal spacing of trains. When this question becomes important, therefore, the natural tendency is towards an approximately equal distribution. As the generators included in our estimates have a continuous overload capacity of 25 per cent, 50 per cent for several hours and 100 per cent momentarily, and as we have provided an excess of nearly 50 per cent in case of emergency, the power house capacity provided is ample for any reasonable variation in the method of operating trains. In this connection, we would call attention to the fact that, under average conditions, freight trains require twenty-five hours to traverse the length of line supplied from a single power house, hence if trains are dispatched in "fleets" a second "fleet" will begin to draw upon the power house as the first "fleet" passes off, the power house load remaining practically constant.

Mr. Henderson quotes Mr. Wilgus, of the New York Central, to the effect that in the electrification of the New York terminal of that system "The actual cost of electrification was only about one-fourth of the total cost of expenses made necessary by that electrification." He does not undertake to explain this remark, but apparently is much impressed by it, and infers that the cost of electrifying railways should be multiplied by four to cover total costs of the change. This, of course, is erroneous. It is probable that Mr. Wilgus included in the statement referred to the cost of the new terminal buildings, the double-deck track terminal and the very expensive yard construction involved in the plans which the New York Central has adopted and which provide for a great increase in the traffic which it is expected to handle at Forty-Second Street terminal. Obviously the cost of excavation incident to alteration in track arrangements and the cost of new and expensive terminal buildings, in no way a necessary concomitant of electrification, should not be charged against electric power. So far as our estimates are concerned they are based, as stated, upon duplication of existing motive power equipment, including, of course, power houses and systems of electric distribution. Naturally they include nothing for such work as increase of terminal facilities which may be necessary to provide for increased traffic.

Lewis B. Stillwell.
H. S. Putnam.

THE NEW YORK CENTRAL ACCIDENT

The shearing of the spikes on the outside rail of the 3-deg. curve near Woodlawn Bridge, where the New York Central train was wrecked on Feb. 16, has attracted a great deal of attention to the theory of superelevation on curves, the strength of spikes and the strains produced on curves by steam and electric locomotives operating at different speeds. The evidence before the coroner and Railroad Commission showed that the same type of electric locomotive as that used with the wrecked train had frequently been run at Schenectady and on the so-called "instruction tracks" in the New York zone near Highbridge under the same conditions as they would have in actual service except that the speed was higher than normal, yet the electric locomotives showed no tendency to widen the gage. Some studies made subsequent to the accident by the engineers of the General Electric Company, the American Locomotive Company and the railroad company indicated, in fact, that the electric locomotive imposes a maximum strain on the track in question that is well within the factor of safety, and at 60 m. p. h. is only slightly more than the standard Atlantic type of steam locomotive used by the New York Central Company. An abstract of this analysis is given below:

There are three fundamentals of "mechanics of curve resistance":

(1) Component of slipping in the direction of the radius, due to curvature.

(2) Component of slipping in the direction of the tangent of track, due to unequal rail lengths inside and outside.

(3) Net effect of centrifugal force (super-elevation of outer rail considered).

In determining the effect of these components, consideration should be given to the action of the rigid wheel base on the curve in question, taking into account the clearance in the gage and the clearance between the main drivers and the rigid frame.

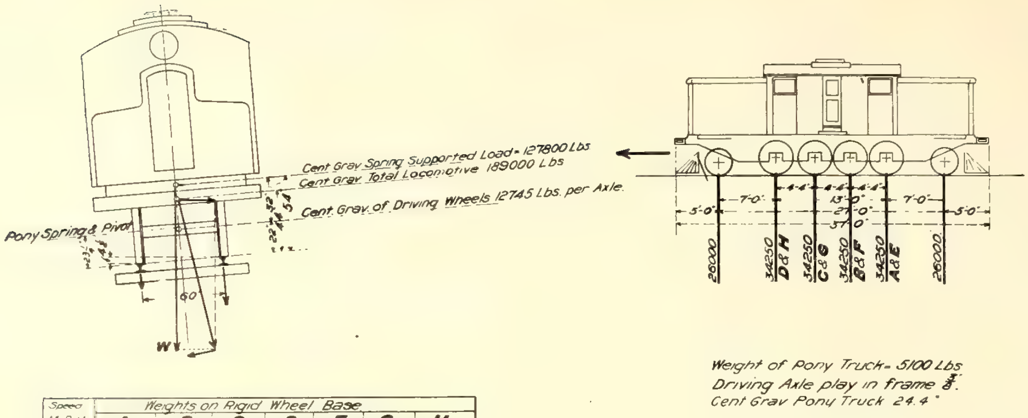
It will be appreciated that the radial slip on the front outside driver of either an electric or steam locomotive when rounding the curve is self-contained and of itself does not tend to displace the rail, and that the radial slip on the inside front driver does tend to displace the outer rail acting through the front axle to the outer front driver. If the clearance between the driving wheel hubs and the locomotive frame is more than the ordinate of the curve at the second axle, the second axle will run to the outer rail until the flange of outer second driver bears against the rail, thus the frame of the locomotive does not have to carry the radial slippage of the second set of wheels. The centrifugal effect (3) and the super-elevation of the outer rail are readily calculated and need no explanation.

To solve the problem to the last refinement becomes a complicated and tedious investigation, but if the fundamental and major elements only be considered the guiding effect may be determined with sufficient accuracy for all practical purposes.

Where the second driving axle bears against the locomotive frame and so transmits the radial thrust of the second axle to the outer front driver, a comparison of the New York Central electric locomotive with the Atlantic type steam locomotive on a 3-deg. courve with a 4½-in. superelevation shows that the pressure of the steam locomotive driver against the rail (force P) is greater at all corresponding speeds. The resultant shear on the spikes, however, allowing for the friction of the rail on the tie plates, is less with the steam locomotive than with the electric up to about 80 m. p. h., where the shear on the spikes due to the outer front driver is practically the same for both.

The difference between the pressure against the rail and the shear on the spikes is affected so far as the drivers are concerned by the height of the center of gravity, which, under the influence of centrifugal force, increases the vertical pressure on the outer rail. The greater effect of the higher center of gravity of the steam locomotive disappears, however, at the higher speeds by reason of the increasing preponderance of the horizontal force due to centrifugal action. At about 90 m. p. h. the shear on the spikes for the steam locomotive would not only be in excess of that of the electric locomotive, but at this speed the steam locomotive would be in danger of overturning.

The maximum shear on the spikes is not necessarily caused, however, by the driving wheels of the locomotives, but at certain speeds may exist at the leading wheel of the guiding truck. Although the pressure of the guiding truck wheel against the rail may be actually less than that of the driver, the weight upon the rail of the guiding wheel is so much less that the resultant shear on the spikes is consequently greater.



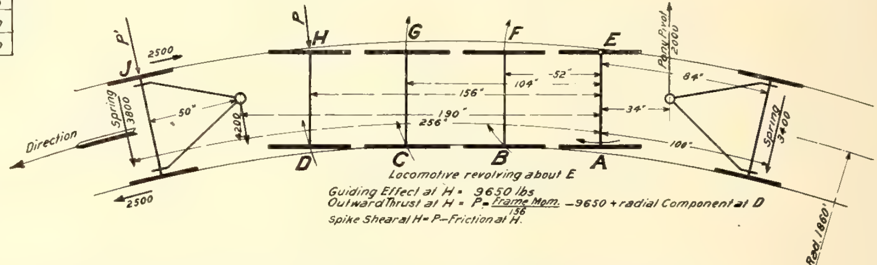
Speed M.P.H.	Weights on Rigid Wheel Base A	B	C	D	F	G	H
40	14325	20570	18500	17500	13725	15745	16750
50	13775	19975	17100	16800	14275	17140	17450
60	13125	19300	15945	15645	14945	18300	18605
70	12425	18500	14900	14300	15745	19355	19950
80	11425	17600	13770	12770	16650	20470	21480

FIG. 1.

On the electric locomotive the shear on the spikes at *J*, due to the guiding truck is in excess of that due to the drivers up to about 40 m. p. h. On the steam locomotive the shear on the spikes due to the guiding truck is in excess of that due to the drivers up to about 65 m. p. h., and this shear exceeds that of either the driving or truck wheel of the electric locomotive up to between 50 and 60 m. p. h.

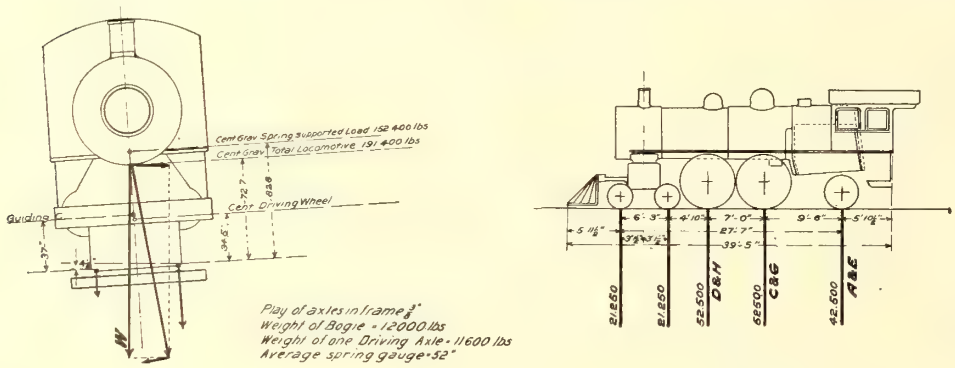
Considering, second, the conditions where the second driver axle clears the locomotive frame by reason of the end play and so bears directly against the outer rail without transmitting to the leading driver the thrust due to its radial slip; the pressure against the rail of the leading steam locomotive driver as in the first condition is greater at all corresponding speeds. The resultant shear on the spikes is less, however, with the steam locomotive, due to the effect of its higher center of gravity.

Under this second condition the shear on the spikes with the electric locomotive due to the guiding truck is in excess of that due to the drivers up to about 75 m. p. h. On the steam locomotive the shear on the spikes due to the guiding truck is in excess of that due to the drivers at all speeds, and this shear exceeds that of either the driving or truck wheels of the electric locomotive up to 75 m. p. h.



Speed M.P.H.	Centrif. Effect at H	Friction Resistance Rigid Wheel Base A	B	C	D	F	G	H	Rad. Component of D	Axle C 6 not thrusting against rail P	spike shear at H	Axle C 6 thrusting against rail P	spike shear at H	P'	Spike shear at J
40	-1590	3600	5150	4620	4380	3440	3920	4180	4080	4740	560	3860	—	6410	2410
50	1320	3450	4980	4300	4200	3560	4280	4360	3930	7400	3040	4120	—	6600	2570
60	4880	3300	4800	3980	3900	3740	4560	4650	3640	10470	5820	4480	—	6830	2780
70	9050	3130	4620	3720	3580	3940	4830	5000	3350	14130	9130	7460	2460	7100	3020
80	13790	2900	4400	3430	3200	4150	5100	5360	2970	18360	13000	11000	5640	7400	3300

FIG. 2.

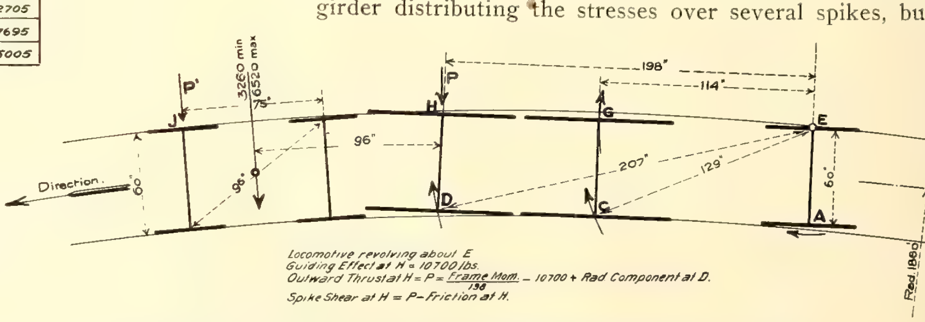


Speed in M.P.H.	Weights on Rigid Wheel Base. A	C	D	G	H
40	22120	27085	27085	25165	25165
50	20540	25365	25365	26885	26885
60	18590	23245	19545	29006	32705
70	16590	21055	14555	31196	37695
80	13640	17945	7245	34305	45005

FIG. 3.

Summarizing, then, it will be seen from the attached tables that for a speed of say 60 m. p. h. on a 3-deg. curve with a super-elevation of 4½ ins., the maximum shear on the outer spikes of the outside rail under the most unfavorable conditions is for the electric locomotive 5820 lbs., as compared with 4890 lbs. for the steam locomotive. The ultimate shearing resistance of the standard spikes used on the curve in question ranges from 14,440 lbs. to 17,060 lbs. Assuming a factor of safety of 4, the permissible shear per spike is 3810 lbs. up to 4265 lbs.

The 100-lb rail in use on the curve acts as a continuous girder distributing the stresses over several spikes, but to



Speed M.P.H.	Cent Effect at H	Friction Resistance Rigid Wheel Base A	C	D	G	H	Rad Comp of D	Axle G-C not thrusting against rail P	Spike Shear at H	Axle G-C thrusting against rail P	Spike Shear at H	P'	Spike Shear at J
40	-380	5530	6770	6770	6280	6280	6280	6120	—	6260	—	7830	4630
50	1970	5130	6340	6340	6720	6720	6080	7450	730	6220	—	7950	4740
60	7450	4650	5810	4890	7250	8170	4680	11230	3060	5460	—	8130	4890
70	13090	4150	5260	3640	7800	9420	3500	15390	5970	7570	—	8170	4840
80	21050	3410	4480	1810	8580	11250	1730	21160	9910	13020	1820	8200	4770

FIG. 4.

be conservative, two spikes may be taken as resisting the unbalanced outward thrust. Consequently at 60 m. p. h. we have actual maximum shears with either steam or electric locomotives ranging from 5820 lbs. to 4890 lbs., borne by two spikes, which with a factor of safety of 4 are proper for shears of 7620 lbs. to 8530 lbs. In other words, the actual factor of safety is approximately 6.

In conclusion, it appears that under the most unfavorable assumptions the electric locomotive imposes slightly greater unbalanced stresses than the steam locomotive on a 3-deg. curve properly maintained, with super-elevation of 4½ ins., and that the shearing force on spikes, one on the outside of the outer rail in each tie, with tie plates, is far within the limits of safety for speeds in excess of the so-called "equilibrium speed" of about 46½ m. p. h. to which the super-elevation of 4½ ins. corresponds. And it should be noted that with the second driver running against the outside rail up to 70 m. p. h. there is no resultant spike pressure at the first driver, and at 70 m. p. h. while the spike pressure at the first electric driver is 2460 lbs. the spike pressure at the first steam locomotive truck wheel is 4840 lbs.

DINING SERVICE ON THE FORT WAYNE & WABASH VALLEY TRACTION COMPANY

Buffet service has become quite a feature on many Western interurban railways, and in fact it is a necessity on

MENU ON THE LIMITED CARS OF THE FORT WAYNE & WABASH VALLEY TRACTION COMPANY

trips extending over several hours. The Fort Wayne & Wabash Valley Traction Company fully recognizes the value of keeping its patrons in good cheer by serving a high-class luncheon on the four daily limited trains each way which make the trip from Fort Wayne to Indianapolis in four and one-half hours. On March 1 the company began serving menus of the type shown in the accompanying reproduction. This one was designed by J. B. Crawford, superintendent of transportation, and undoubtedly is among the most artistic ever given out by an electric interurban railway. The one reproduced shows a graceful young woman in a rose garden looking toward the famous Spanish palace, the Escurial. The attractions of the menu however, are not confined to its ornamentation, for an inspection of the items shows the large variety of food, delicacies and drink offered at prices more reasonable than one is usually asked on steam trains. The new service should not only pay for itself, but attract additional traffic.

CENTRAL CALIFORNIA TRACTION COMPANY TO USE 1200 VOLT MOTORS

The Central California Traction Company, which has been operating local lines in the city of Stockton, Cal., is now building an interurban system to Lodi, a distance of 15 miles, and later will build to Sacramento, an additional distance of about 35 miles. In the construction of the new lines some features novel to Western construction will be introduced. For the interurban road power will be taken from a third rail, while the overhead catenary construction is to be used on the city lines. This latter type is used at present in connection with the span-wire construction on the lines now in operation in Stockton. The wires are supported by wooden poles from angle-iron brackets with gas-pipe braces every seventh pole and on curves. The 000 copper trolley wire is suspended from a ⅜-in. galvanized-iron messenger cable by adjustable spacers.

A 40-lb. A. S. C. E. standard rail with a conducting equivalent equal to 400,000 circ. mils is to be used for the third-rail construction. This rail will be supported on reconstructed granite supports set 12 ft. apart, and will be covered on top and sides. The difference in elevation between the top of the running rail and the bottom of the third rail is 3 ins. The cars will be operated by the Sprague-General Electric multiple-unit control system, with the innovation of 1200-volt motors. For city operation 550-volts will be used, the 1200-volt system being installed on the interurban stretches. The lights, heaters and air pump will be operated on 550 volts to be supplied by a dynamotor on each car during third-rail contact. In the city on changing to the trolley potential of 550 volts, the dynamotor will be cut out and the auxiliaries operated directly from the trolley wire.

The Central California Traction Company has the following operating officials: General manager, E. P. Hilborn; consulting engineer, R. S. Masson; electrical engineer, H W. Crozier; roadway engineer, D. S. Unruh.

ANNUAL REPORT OF THE RAILROAD DEPARTMENT OF Y. M. C. A.

The annual report, just issued, of the railroad department of the Y. M. C. A. shows an increase in number of associations between 1905 and 1906 from 207 to 230, of membership from 74,324 to 84,610, and of attendance from 33,951 to 41,984. Among the new street railway associations mentioned are those at Birmingham, Ala., and Sherman, Cal. Announcement is also made that a building costing $40,000 is assured during 1907 by the Atlanta street railway branch.

A SUCCESSFUL PUBLICITY CAMPAIGN

BY G. W. HARRIS

To reap the largest success possible to it a street railway company must have the good will of the community it seeks to serve. The old fashioned policy of secrecy—of ignoring the desires and demands, even the needs and rights, of the public—has been tried and found wanting. In too many places it has been persisted in too long. The general awakening of public service corporations of all kinds throughout the country to the need of some sort of check to the growing hostility on the part of the great mass of the people toward the corporations as such, regardless of their individual deserts, is shared by the street railway companies; and in many places the managements of these companies have found it incumbent upon them to change radically their attitude toward the public. Even the biggest traction corporation in the world, which always has more business than it can handle satisfactorily, has come to realize the necessity of fostering a more friendly public feeling, and the first announcement made by Theodore P. Shonts on assuming his new duties in New York City was an appeal through the newspapers for the good will and the "co-operation" of the people.

Mr. Shonts was prompt to recognize the fact that not only the best way but practically the only way to gain this friendliness of the public he seeks for the corporation he is to manage is through the newspapers. Other managers of traction companies in widely scattered parts of the land are learning that it pays to keep thoroughly in touch with the public and to welcome the intelligent criticism of the best element of the community and encourage suggestion for service betterments. This is the age of publicity, and nothing else can approach the legitimate use of the local press for setting the street railway company right in the eyes of the people, for telling the public what the company is trying to do, for combating the unjust and misguided attack of the "crank" who does not understand the situation or of the knave who twists the facts to serve his own ends.

That a properly conducted campaign of newspaper publicity will work wonders has been proved abundantly by a publicity campaign just concluded by the C. W. Lee Company, of Newark, N. J., for the Roanoke Railway & Electric Company, of Roanoke, Va., of which R. D. Apperson is president and J. W. Hancock general manager. Besides operating the street railway system of Roanoke this company does an electric lighting business in which it enjoyed a monopoly until six months ago, when a rival concern started in with cut rates and by insinuations of "robbery," "extortion" and open charges of "unfairness" soon succeeded in stirring up a deal of bitter feeling against the older company. Several other things added fuel to the fire of discontent—among them the fact that the main business streets of the city were torn up for repaving and remained in a chaotic condition for six months or longer. Despite the fact that the company paid one-third of the cost of the new pavement in all the streets traversed by its tracks and that it was required to double-track its system in the business center of the city, the contractor employed by the city was permitted to take his own time to finish the work and to handle it in such a way as to hamper seriously the running of the street cars on any kind of schedule. Of course the company got all the blame for this, and in fact began to be blamed for just about everything that went wrong whether having any earthly connection with it or not. There was an epidemic of "cussing the street railway."

In the hope of bringing about a better understanding of its real position, of what its service meant to the city, and a better feeling toward the company on the part of the public, the publicity campaign was undertaken. This took the form of a display advertisement, regularly paid for as an advertisement, three columns wide and 12 ins. or 13 ins. long, a new one every day, printed in each of the three daily newspapers of Roanoke; and a "reading notice" measuring anywhere from one inch to a column and a half, the space for this being determined solely by its value to the papers as news. The advertisements were called "Electric Talks" and were numbered consecutively. Contracts were made with all the papers for 2000 ins. of advertising space to be used in two months, and the daily space was apportioned as needed. In the free reading notices was printed only news of what the company was doing: these articles told of the progress of the double-tracking and street paving work; when a new boiler or other new equipment was installed, described it and told how it would help to improve the service; explained any changes in car schedules. Two new steel bridges were ordered for one of the lines, an article described them in detail and told to whom the contracts were let and how much they were to cost; if an accident happened (and several did happen), the company printed a true account of it and announced what steps would be taken to remedy the difficulty and prevent its recurrence.

"Electric Talks" began with some more or less general consideration of what the company had already done to pro-

ELECTRIC TALKS—NO. 4

Everybody admits the benefit of the rapid extension of street railways. They are revolutionizing life in our cities by enabling people to live away from their work in healthy and pleasant homes in home neighborhoods—away from the factory and the shop—where the air is purer and all surroundings are more wholesome.

The Roanoke Railway & Electric Company has been doing this sort of work for Roanoke.

Look anywhere you like in the region of American homes which encircle the business part of Roanoke and you can see plainly the effect of the service which we render.

Take one example:

In 1903 we extended our Franklin Road line into the section south of Tenth Avenue, five squares, to Woods Avenue.

Before that there was not one house on Woods Avenue west of Franklin Road. Now it is built up solidly for three blocks with good, substantial homes. The same is true of Fourteenth Avenue. Then there were four houses west of Franklin Road. Now it is also built up solidly. On Tenth, Eleventh and Twelfth Avenues, and on Franklin Road itself, there are now twice as many houses as there were before our line was extended. To the east of Franklin Road twenty-five or thirty new houses have been built and occupied on Roanoke Street south from Tenth Avenue, since we began to take people there. Many new homes also have been established on Maple Avenue—and on other streets of the section.

The extensive development in the Crystal Spring section and in the West End section, along and adjacent to Patterson Avenue and Thirteenth Street, also have followed the building of the street car lines.

What do these things mean?

Simply this: That the development of this city follows the extension of our street railway system.

Have you thought of that? Have you considered what it means to the welfare of this city?

It is worth your careful attention.

What we told you yesterday, in regard to our improvement in street car equipment, we repeat:

This is only the beginning.

We are here to stay. We are planted firmly to grow and flourish—and to help the city of Roanoke to grow and flourish.

In all our business dealings with the people of Roanoke we guarantee a "square deal." Don't forget that.

Have we not the right to ask the same at the hands of the city and its people?

ELECTRICITY TALKS.

Note.—Each day you will find here something new on the street railway and electric lighting situation and its relations to the people of Roanoke. This will interest you. Watch for it—read it—ponder it. Our constant endeavor is to serve the best interests of the public.

ROANOKE RAILWAY & ELECTRIC COMPANY,
By J. W. Hancock, General Manager.

TALK NO. 4.—ON BUILDING UP THE CITY THROUGH EXTENSIONS

vide a street railway service for the city; how, by extending its lines to new sections and in various other ways, it had helped to build up the city, to extend its growth and to bring more people and more business to it. Then the cost of the improvements made since the present management took hold of the property was taken up in detail and what it meant as a permanent investment for the benefit of the city was explained. Something of the complex and complicated nature of the street railway business was elucidated in an elementary way. It was explained how the double-track work would improve the service, and outlines were given of the company's plans for extensions and other improvements. The company's aims and purposes and its guarantee of a "square deal" to the people were reiterated day after day. It was a campaign of education and a campaign of truth-telling. There was never any attempt to color the statements made or to distort the facts.

An attempt was made to give the advertisements as neat and distinctive an appearance as the equipment of the local composing rooms made possible, and above all else to make the "Talks" interesting. In a foot note the people were urged to read and ponder the statements made. The company soon had abundant testimony that they were doing so. By the end of the first week the "Electric Talks" were the talk of the town. Everybody was reading them and talking about the company. People began to write letters to the newspapers about them. Some berated the company, but others took its part against the fault-finders. Each of the papers in turn took up the controversy in some aspect and printed editorial articles commending the company for its adoption of a policy of publicity and for its open and fair way of dealing with the public. The direct benefits to the company were so unmistakable that before the second month had expired it decided to continue the campaign for a third month.

The improvement in public sentiment began to be shown in various ways. At the outset the proprietor of one of the newspapers had hesitated about entering into a contract to advertise the street railway. He said he was afraid the company sought to dictate the editorial policy of his paper,

ELECTRIC TALKS—NO. 16

The business of running an electric street railway system is a complicated business.

It is also a costly business.

Just how costly, right here in this city, the Roanoke Railway & Electric Company is trying to give you some idea in these "Talks."

Yesterday we told you that this company had spent $64,324.23 for new street car equipment in the last four years.

That is only one item. Let us look at some others.

Since 1900 this company has rebuilt the roadbed of half of its system, has put in approximately 50,000 new ties, has "bonded" anew all its tracks with copper, and has put down several miles of new 60-lb. steel rails, at a cost of $71,944.43.

Besides that we have put in new overhead work—trolley wires, feeder wires, and so on, at an additional cost of $8,565.68.

Now, let us see what these items foot up:

New cars, motors and trucks	$64,324.23
New roadbed and tracks	71,944.43
New trolley wires, etc.	8,565.68
	$144,834.34

Remember this: That $144,834.34 was invested in the Roanoke Railway & Electric Company by its stockholders in order to provide simply a street railway trackage and a street car equipment for the people of this city. It does not include improvements to the power station or the car house.

You say the stockholders will get their money back, out of the earnings of the street railway system?

When?

A simple computation will show that $144,834.34 means 2,896,687 nickels paid in street car fares.

But when the people of Roanoke have ridden in the street cars 2,896,687 times (and paid cash for each ride) they will not have paid anywhere near one-half of the cost of this $144,824.34 worth of improvements.

Why?

Because this simple method of computing returns leaves nothing for operating expenses.

You cannot run a street car without a motorman and a conductor. You cannot run a trolley car without electric current. You cannot generate electric current without boilers, engines and dynamos. You cannot keep a fire under your boilers without coal. And you must have men to fire the boilers, men to run the engines and dynamos, men to take care of the cars, the car house and other property, and other men to manage the company's office—to sell tickets, to keep the books, to do a thousand and one other things—and you must have competent superintendence over all these things.

Now the salaries of these men, and the cost of maintenance, the wear and tear on your cars, tracks, wires and electrical machinery, eat up by far the larger part of every five-cent piece paid in street car fares.

Do you begin to realize something of the complicated costliness of this street railway business? Something of what it means in dollars and cents to give the people of Roanoke an adequate street railway service?

Note.—Each day you will find here something new on the street railway and electric lighting situation and its relations to the people of Roanoke. This will interest you. Watch for it—read it—ponder it. Our constant endeavor is to serve the best interests of the public.

ROANOKE RAILWAY & ELECTRIC COMPANY,
By J. W. Hancock, General Manager.

TALK NO. 16.—ON THE COST OF OPERATING AN ELECTRIC RAILWAY

ELECTRIC TALKS—NO. 20

All comparisons are not odious.

Let us give you one that we think is creditable—and then see what you think of it.

In the last six years the city of Roanoke has grown some. In that time the municipality has had to make improvements to keep pace with that growth. It has made many minor betterments from year to year which have been met by its regular revenues (from taxation) and by local assessments on the property directly benefited. These may be summed up as the regular increase in the cost of maintenance.

But besides this the city government has appropriated:

For street improvements	$275,000.00
For sewer improvements	100,000.00
For the Fire Department	25,000.00
Total	$400,000.00

These expenditures have been met, or are to be met, by the proceeds of the bond issue of Jan. 1, 1906. They may be termed expenditures for extraordinary improvements, outside of the regular cost of maintenance.

You know how much fuss and pother there was over that bond issue. You know that many people feared it would burden the city unjustifiably—would cripple its finances. You know whether you favored it.

But you can have no doubt now that the improvements it is securing will be of lasting benefit to Roanoke.

Those are the only extraordinary improvements authorized by the city since 1900—yes, since the bond issue of 1891. But they made a creditable showing.

Now, since 1900 the Roanoke Railway & Electric Company has spent for extraordinary improvements, outside of the regular cost of maintenance, the sum of $360,775.80. Furthermore, its directors have authorized the expenditure of $108,000 more, just as soon as the additional new equipment can be procured from the manufacturers.

Now let us figure up the total amount:

Improvements made since 1900	$360,775.80
New improvements authorized	108,000.00
Total	$468,775.80

Here, then, is our comparison. For extraordinary improvements:

Authorized by Roanoke Railway & Electric Company	$468,775.80
Authorized by the City of Roanoke	400,000.00
Difference	$68,775.80

In other words, this company in the last six years has authorized the expenditure of $68,775.80 more than the city of Roanoke for extraordinary improvements. These are the exact figures.

There has been no fuss and public outcry about the appropriation of its $468,775.80 by the Roanoke Railway & Electric Company. The directors simply voted the amounts called for, and the money is spent to give the people of this city the best possible service.

What do you think of this showing?

Does it disclose a niggardly policy on the part of this company? Or does it bespeak a policy of public spirit and a genuine interest in the welfare of this magic city of Virginia?

Note.—Each day you will find here something new on the street railway and electric lighting situation and its relations to the people of Roanoke. This will interest you. Watch for it—read it—ponder it. Our constant endeavor is to serve the best interests of the public.

ROANOKE RAILWAY & ELECTRIC COMPANY,
By J. W. Hancock, General Manager.

TALK NO. 20.—COMPARISON OF IMPROVEMENT EXPENDITURES BY THE CITY AND THE RAILWAY

and that the company would prejudice the people against him and his paper. He was reassured on that point, but for several days—until he came to understand just what the company was doing—he watched the "copy" for the "Talks" with eagle eye. It was not long, however, before he became enthusiastic over the campaign. One day he said:

You certainly are giving us a right fine line of talks. And the people are reading 'em; yes, sir, everybody is reading 'em. Everybody who comes in here is talking about them. They can't help but do your company a whole lot of good.

A few days later he said:

I want to tell you that these "Electric Talks" are not only doing your company a whole lot of good, but they are doing this town good. You're telling the people a lot of things they never knew before, things they ought to know. I did not have any idea of what the street railway had done for this town. It certainly has spent a big pile of money. And telling the people about it is going to help you a lot. Why, before these talks started there wasn't a day that I didn't have anywhere from one to a dozen people come in here and ask me why I didn't jump on the street railway. Everything that went wrong was blamed on the street railway, and people kept telling me I ought to jump on it, for this, that and the other thing. But they're letting up since you began these talks. Yes, sir, the kicks have been dropping off gradually; last week I only had three or four kicks, and for the first five days of this week I haven't had a single person ask me why I don't jump on the street railway.

Before the campaign ended this editor assured the company that its "Electric Talks" constituted the "best advertising that ever was done in the city of Roanoke."

The counsel for the company had not approved of the campaign. He said simply that it would be throwing a whole lot of money away. Before the first month was up he had changed his mind on that point and was glad to admit that he had been entirely wrong and that it was doing "a heap of good." He said:

Why, sir, I had no idea what you could do with newspaper publicity. I am convinced that this is the finest thing for the company that it ever undertook. There is nothing so telling as the constant hammering day after day, and the people of this city simply have got to hear and understand our side. You're making friends for us every day. But besides all that, I want to tell you something that probably has not occurred to you: I can go before a jury with the facts you are printing in these "Electric Talks," and the fact that they have been printed in the newspapers of Roanoke, and I honestly believe that before a year is ended I can save this company in decreased verdicts for damages more money than this whole campaign is costing.

People generally, before the campaign had run its full course, came to admit to themselves and to one another that the street railway company was not so bad, after all, that it had done some things for the benefit of the city and that at least, when charges were made against it, it deserved a hearing for its side before final judgment was passed.

The most progressive business men of the city saw some of the advantages accruing to the company from this kind of advertising, and several were prompt to copy the idea, on a smaller scale, for their own advertising. L. E. Johnson,

ELECTRIC TALKS—NO. 30

Ask yourself how many times you used the street cars last week.

And where you went.

If there had been no street cars to ride in, how would you have gone to those places?

If you had walked how much time would you have lost?

If you had ridden how much money would you have paid in cab hire?

In other words, how much time and money did the street railway save you last week?

How much of a convenience is it to you?

Have you ever grumbled when the service was not just what you wanted it to be at the moment?

Have you ever stopped to consider the hundreds of other times when it was just what you wanted—when it took you to your desired destination, swiftly, comfortably, without delay, without loss of time, without hitch or hindrance—all for the trifling cost of five cents?

In our modern life this great convenience of street car transportation is so much a matter of course that the average man seldom thinks of the subject at all—unless something goes wrong and he is delayed five minutes; then he "kicks."

It is no easy job to provide satisfactory street railway transportation for the 40,000 people of Roanoke and its neighboring towns.

But the Roanoke Railway & Electric Company has undertaken that job, and it is going to stick at it as long as there is any city of Roanoke.

We are spending time and thought and money and energy all the time to give you the best street railway service that it is possible to give. We are making improvements in that service constantly. As the city grows and comes to need them, we stand ready to extend the street car lines, and to build new ones, when and where the people want them.

We are telling you these things in detail in these "Electric Talks" because we want you to understand our position, and because we want your good-will and your co-operation in the work of helping to build up this magic city of Virginia—helping to bring more people and more business—to make the city flourish as never before.

Just one thing we ask you to remember.

In all the business we transact we guarantee a "square deal."

EDISON LIGHT—RIGHT LIGHT

Note.—Each day you will find here something new on the street railway and electric lighting situation and its relations to the people of Roanoke. This will interest you. Watch for it—read it—ponder it. Our constant endeavor is to serve the best interests of the public.

ROANOKE RAILWAY & ELECTRIC COMPANY,
By J. W. Hancock, General Manager.

TALK NO. 30.—ON HANDLING THE TRAFFIC

ELECTRIC TALKS—NO. 35

The largest factor in an adequate and satisfactory street car service is the provision of sufficient equipment and facilities to accommodate the people who want to ride in the street cars.

At a steadily increasing yearly outlay the Roanoke Railway & Electric Company is providing additional equipment and facilities, in the determination to give to the people of Roanoke and its environs an adequate and satisfactory service.

Let us tell you to-day about one item of expenditure in this direction.

With a single track your service schedule must be determined by the length of time it takes a car to traverse the whole line. And the longer such a line is the more infrequent will be the intervals at which a car can start from or pass a given point. A switch midway on such a line is a great help, permitting the running of two cars in place of one. But even then there is always the likelihood of one car's having to wait at the switch for the other, and it is a difficult problem to keep to schedule time.

With double tracks cars going in opposite directions can pass one another at any point, and you can maintain any schedule demanded by traffic needs.

As we told you yesterday we are ready to extend our double tracks in Jefferson Street from Church to Walnut Avenue, and in Salem Avenue from Commerce to Park Street; and also to replace our old track with new 72-lb. rail and new ties, laid in concrete, in Commerce Street from Campbell Avenue to Franklin Road and in Campbell Aenue from Roanoke Street to Park Street.

All the new rail for this work has already been ordered, and after Feb. 1 (before which date the City Government says the work must not be started) this improvement will be rushed as rapidly as the weather will permit and the necessary materials and men for the work can be procured.

The cost to us of this improvement—the new roadbed, ties and rail, new trolley wire, laborers' hire, and our share of the new paving—will total about $50,000.

At the same time, the city is going to pave those sections of the streets named whereon our track improvements are to be made. The accepted bids for this work provide for a total cost to the city of $33,304.30, or about $16,696 less than we shall spend for improvements on the same streets. The city has contracted also for additional small sections of new pavement on streets where there are no car tracks. Adding the cost of these to the other gives a total of $42,525.10 which the city will spend this year for new paving.

That means, as you can see, that this company has contracted to spend $7,475 more than the city of Roanoke for street improvements in the immediate future.

Does not that indicate to you that we are "holding up our end"? Does it not prove to you that we are in earnest when we tell you that we are determined to give an adequate and satisfactory service?

EDISON LIGHT—RIGHT LIGHT.

Note.—Each day you will find here something new on the street railway and electric lighting situation and its relations to the people of Roanoke. This will interest you. Watch for it—read it—ponder it. Our constant endeavor is to serve the best interests of the public.

ROANOKE RAILWAY & ELECTRIC COMPANY,
By J. W. Hancock, General Manager.

TALK NO. 35.—ON CONTEMPLATED IMPROVEMENTS AND THEIR COST

president of the Norfolk & Western Railway, whose headquarters are at Roanoke, in speeches before the Roanoke Chamber of Commerce and other civic bodies was emphatic in expressing his appreciation of the progressiveness of the Roanoke Railway & Electric Company in conducting a publicity campaign; repeatedly and untiringly urged publicity for every project and association in which he was interested, and when a big strike was threatened by the employees of his railroad justified the faith that was in him and actually succeeded in gaining the sympathy of the public and averting a strike by copious publication of the railroad's side of the controversy in the local newspapers. And he was frank enough to give the credit for this happy outcome to his adoption of newspaper publicity.

Not only was the majority of the public won over to a better feeling toward the company—a feeling of genuine friendliness, indeed—but incidentally the company's lighting business received the biggest impetus it had ever known and is now growing faster than ever before in the eighteen years of the concern's history. Its rival was fairly driven to the woods.

ELECTRIC TALKS—NO. 44

"Keeping everlastingly at it is the secret of success."

Who first uttered this aphorism we do not know, and we do not care. We recognize the truth of it, and we have made it the policy of the Roanoke Railway & Electric Company in this company's endeavor to provide for the city and the people of Roanoke

The best street car service,
The best electric lighting service,
The best electric power service,

that can possibly be given—and to keep the service in each of these lines satisfactory and adequate to the needs of this growing city at all times.

In the earlier numbers of these "Electric Talks" we told you in detail what we had done, since this company was reorganized, to increase its equipment and facilities and improve its service; and we showed you how much new capital we had invested to make these improvements possible.

And we said: This is only a beginning.

Later we told you that we are going to spend about $50,000 for the extension of our double tracks and other road improvements this coming spring, and that we had already ordered the new rails for this work. For, we pointed out that the largest factor in an adequate and satisfactory street car service is the provision of sufficient equipment and facilities to accommodate the people who want to ride in the street cars.

To-day we have something further to tell you in this connection:

We have just bought from the J. G. Brill Company, of Philadelphia, six new street cars.

Understand what we say; we are not promising to buy six new street cars sometime in the dim future—we have already bought them, and the manufacturers agree to deliver them, here in Roanoke, by the first day of next May.

All of these six new street cars are of the newest type and best make of trolley car in the market to-day. They are of a later design than any cars we now have on our lines, and they are equipped with air brakes and all the latest appliances.

Two of these cars are of the type known as the Brill semi-convertible, double-truck car, which means that while the windows, reaching two-thirds of the way to the floor, can be opened up in hot weather, the car cannot be entered from the side.

These cars we intend expressly for the Salem line. Each car will seat forty-four people.

The other four of the six new cars are equally large, and are of the full Brill convertible, double-truck type, of the latest design. These will be used on the various lines of this city wherever they are most needed.

Each of these six new cars, with all its necessary equipment, cost us an average of about $5,000. You can figure out what the total expenditure amounts to for this one item of additional street car equipment.

We are telling you these things because we want you to know that our guarantee of a "square deal" to the people of Roanoke on all the business we transact is genuine, and that we are "making good" on that guarantee.

EDISON LIGHT—RIGHT LIGHT.

Note.—Each day you will find here something new on the street railway and electric lighting situation and its relations to the people of Roanoke. This will interest you. Watch for it—read it—ponder it. Our constant endeavor is to serve the best interests of the public.

ROANOKE RAILWAY & ELECTRIC COMPANY,
By J. W. Hancock, General Manager.

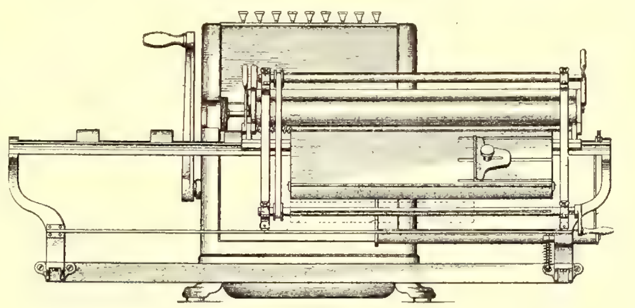
TALK NO. 44.—EXPLAINING THE VIRTUES OF THE NEW SEMI-CONVERTIBLE CARS

Everybody connected with the street railway management is abundantly satisfied with the results of the campaign, and indeed is surprised that its benefits are vastly larger, more direct and more pronounced than any of them even had hoped for. When the work was nearing its end each of the proprietors of the daily newspapers volunteered to give a letter of commendation. One of these, typical of them all, and addressed to the publicity managers, may be quoted here to show what the most intelligent and progressive people of the city thought of the campaign:

As your Mr. Harris is about to close his advertising campaign in behalf of the Roanoke Railway & Electric Company, I take this occasion to say a few words regarding his work. The campaign was inaugurated in November last, and with the exception of a brief holiday vacation each day's issue of our papers has contained something new and encouraging to our people and something directly beneficial to the company. The open manner in which Mr. Harris has dealt with the public has in large measure allayed prejudice, and has placed the Roanoke Railway & Electric Company in a strong position. The people now know, as they never knew before, what the company has done and its aims and purposes for the future. "Electric Talks" have been commented upon in a most favorable manner by the people of Roanoke, and demands for copies of our papers containing them have come from a number of cities.

MAKING UP PAY ROLLS ON THE SOUTH CHICAGO CITY RAILWAY

By the use of a special attachment to an adding machine and a special form of pay-roll blank, the tedious process of addition and other tiring mental work in connection with pay rolls is avoided in the accounting office of the South



ADDING MACHINE FOR MAKING UP PAY ROLLS

Chicago City Railway. Not only is there a saving in work, but the pay rolls for 200 trainmen are posted from day to day in less than an hour, and at the end of the half month the pay roll is closed up in approximately three hours' time. The results, moreover, are secured with every assurance of accuracy. The system of getting up the pay rolls and the attachment to the adding machine were devised by Wm. R. Gaither, auditor of the road.

The device, which has been applied to a special Burroughs adding machine, having keys for adding hours and minutes, displaces the usual carriage and roll at the back and consists of a carriage with rollers long enough to take paper 18 ins. wide. One roller carries a supply of paper, and this, after being led over the platen of the machine, upon which it receives the impression of the type, is wound upon a second roller. Provision is made in the device for rapidly reeling the paper from one roller to the other.

The paper upon which the pay rolls are made out is obtained in long rolls about 18 ins. wide, ruled off into square spaces. A length sufficient to make up the entire pay roll is cut off and wound upon the lower roller of the adding machine carriage. After the paper is in the machine the

first operation is to print upon it the badge numbers of the men. In doing so the paper is automatically unrolled from the lower roller, so that the numbers are put down in a vertical column at the left edge of the roll. The paper is then rolled back on the lower roller, and in the second column of spaces the men's time for the first day of the pay period is printed. In the next column each man's time for the second day is entered and his total time for the two days, as added by the machine, is entered below it by pressing the total key of the machine and pulling the lever. This action also clears the machine for the next entry, as is shown by an automatically printed star. The total time is, in a similar manner, carried out each day until the end of the half-month period. Then the rate per hour in cents of each man is placed in the column next beyond that for the last day and for the total time. A rate book is then used to figure the wages due and the amount is inserted in the proper column and the pay roll is totaled by the machine. The wages of each man are then distributed between the two systems operated under the one management, and finally the number of the pay check issued to each man is inserted. After the pay roll is completed it is removed from the machine and the roll of paper is then cut into sheets about 17 ins. long for convenience in handling in loose leaf binders. On each sheet is then pasted a heading as shown in the accompanying reproduction. The names corresponding to the badge number are inserted in the proper blank spaces either by hand or with a typewriter or an addressograph. As will be seen, the sheet remains in the machine during the entire period in which it is being printed. Experience on the South Chicago system has shown that since the adoption of this machine about four days' time of one man per month is saved.

Other records may be kept on the roll of paper on which the pay roll is kept, by using a roll longer than required for the pay roll. On the additional length may be kept the car mileage by car numbers, car earning and earnings by routes, and each day's storeroom requisitions may be charged to the proper accounts. At the end of the half month when the pay roll is completed that portion of the roll containing this may be cut from the portion containing the records and removed from the machine. The record portion will be left in the machine until the end of the month.

SOUTH CHICAGO STREET RAILWAY COMPANY.

Time Book and Pay Roll of Trainmen *Conductors* *first* Half Month of *January* 1907

Names	1st.	2nd.	3rd.	4th.	5th.	6th.	7th.	8th.	9th.	10th.	11th.	12th.	13th.	14th.	15th.	Rate	Amount	Dis. Check	H.W.& E.C. E.Ry.Co.	S.C.C. Ry.Co.	Check No.
6 *Sherman*	10.20 *Yoder*	10.20 20.40 *	10.35 31.15 *	10.20 41.35 *	10.20 51.55 *	10. 61.55 *	10.20 72.15 *	10.20 82.35 *	10.20 92.55 *	10.20 103.15 *	10.20 113.35 *	10.20 123.55 *	10.20 134.15 *	10.20 144.35 *	10.20 154.35 *	23	3,565			3,565	9,712
7																					

Street Ry. Journal

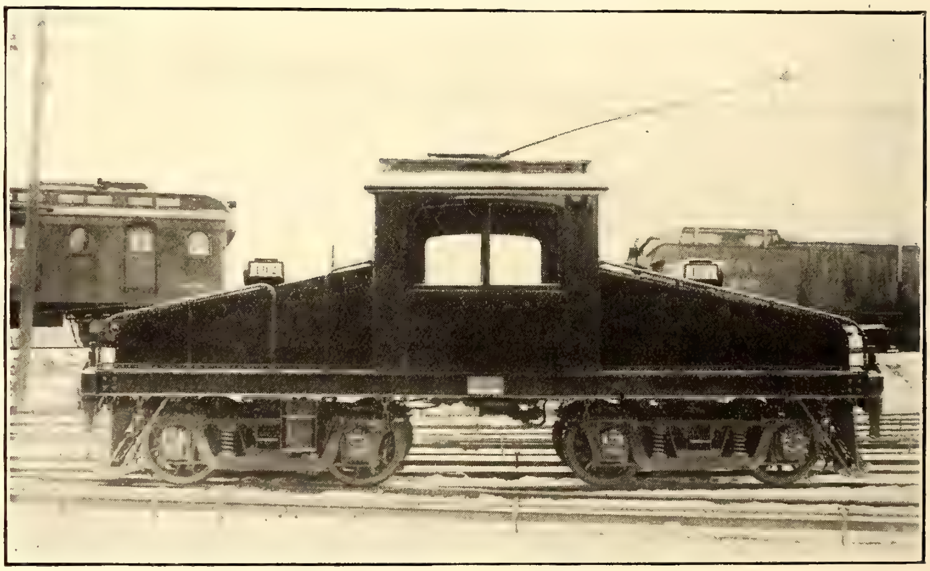
SOUTH CHICAGO STREET RAILWAY COMPANY PAY ROLL, MADE UP ON ACCOUNTING DEPARTMENT

The attachment to the machine has been patented by Mr. Gaither. Although used on a Burroughs machine, it may be adapted to other makes.

ELECTRIC LOCOMOTIVE FOR ILLINOIS TRACTION SYNDICATE

The accompanying illustrations show one of two locomotives recently built by the General Electric Company and American Locomotive Company for the Illinois Traction Syndicate. The locomotive is a swivel truck switching type weighing 40 tons on drivers, and equipped with four GE-55-H motors; in other words, is classified as a 404-E-80-4-GE-55-H type, in accordance with the standard system of classification recently adopted by these companies for the rating of electric locomotives.

The cab is the well-known type having a main operating cab and sloping end cabs; the operating cab, having a floor space of 8 ft. x 9 ft. 6 ins., stands in the center of the locomotive and contains an air compressor, together with engineer's seats at the operating windows, control mechanism, master controllers, brake valves and sander apparatus.



ILLINOIS TRACTION LOCOMOTIVE

The end cabs are of the most recent type and cover a floor space of 9 ft. 6 ins. x 5 ft. 6 ins. each, leaving a 24-in. side platform on either side running from the operating cab to the end of the locomotive. The doors from the operating cab open at diagonally opposite corners on this side platform, thereby giving easy access from the locomotive cab to the end of the locomotive for coupling purposes. At the same time it gives the engineer an unobstructed view of the

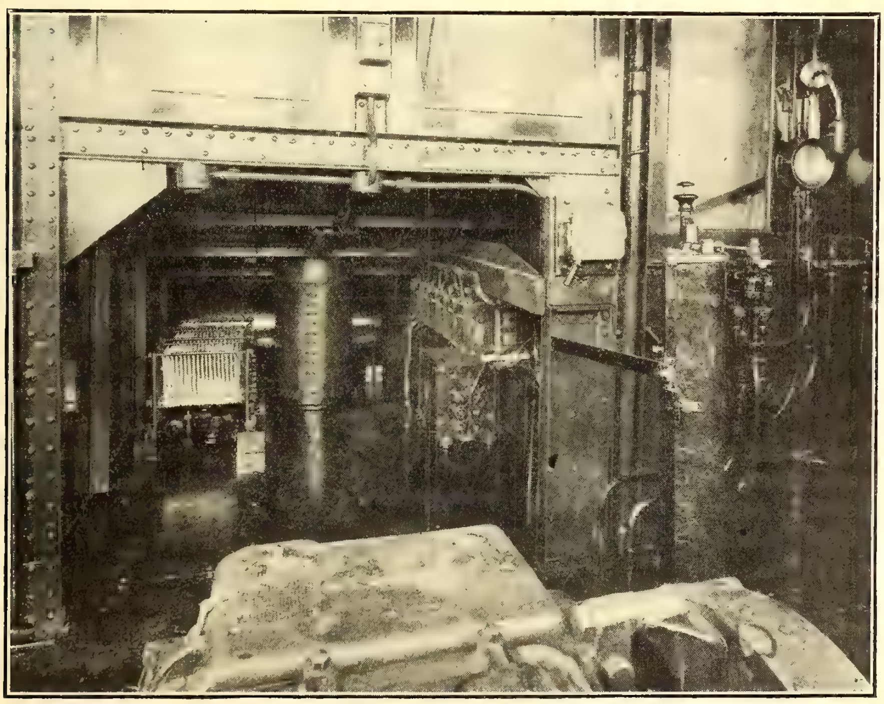
track in front of him, or of the train which he may be handling, to the rear, and of the brakeman or switchman at the couplers.

The cab framing is built of 2-in. x 2-in. and 3-in. x 3-in. angles, with sides and roof of No. 8, or ⅛-in., sheet steel. The end cabs are bolted to the floor and main cabs through gaskets, or shielding angles, to protect against rain wash.

The platform is built up of a framing consisting of four 10-in. channels running the length of the locomotive and riveted to the end frames and bolster. The end frames are iron castings with push-pole sockets cast near the outer ends, and with lugs for riveting to center and side sills and the draw-bar castings. Over the centerpins the sills are trussed together with heavy braces stiffened by castings and forming a built-up body bolster. The floor consists of solid sheets of ⅜-in. plate riveted to the longitudinal sills and serving as a stiffening member for the frames. The M. C. B. vertical plane coupler is carried in a draw-bar casting bolted to the end frame and center sills.

On each end of the platform is carried a heavy pilot built of 1-in. round bars riveted to a ½-in. bottom plate below and the 4 x 4 angle above. This angle in turn is bolted to the end frame of the locomotive with space blocks which permit adjustment in height of the pilot, and the whole is braced with two center braces and two side braces extending from the pilot bottom place to the center and side sills of the platform. The pilot steps on the pilot and stirrups on the end frames give easy access to the side platforms of the locomotive at each end.

The truck is of the M. C. B. equalized type with plate bolster. The wheel base is 6 ft. 6 ins., the wheels 36-in. diameter with fused steel tires, and the journals are 5½ ins. x 10 ins., the construction being particularly heavy in order to meet the demands of locomotive service. The weight of the truck is carried upon equalizers, each of which is made of two 5½-in. x 1½-in. bars held apart by suitable distance pieces and carrying the truck frame on spiral springs. The top frame is a 2-in. x 3½-in. rolled bar, and end frames of the same section are bolted to it. The truck transoms are built up of 13-in. channels riveted to ½-in. x 18-in. gusset plates and securely bolted to the truck frame. The plate bolster carrying the center pin and side bearings is built up of 9-in. channels and plates riveted together.



INTERIOR OF ILLINOIS TRACTION LOCOMOTIVE

The motors used, GE-55-H two-turn, are designed especially for the slow speeds and heavy tractive effort. At the rated load of the motors the locomotive will give a tractive effort at the rail head of 16,800 lbs., and at the slipping point of the wheels will develop 20,000 lbs. tractive effort with a load on the motors slightly in excess of their rated load.

The view of the interior of the locomotive cab shows the apparatus at one of the engineers' operating positions, and also the interior of the end cab. In front of the engineer's seat stands a master controller operating the contactors used for type-M single-unit control. Brake apparatus for both straight and automatic air, and pneumatic sanding valves are also within easy reach. In the end cab are the contactors and rheostats of the control system. The air reservoir and pneumatic sanders arrange for sifting sand through nozzles carried upon the trucks directly in front of the forward wheels of the locomotive. In the center of the main operating cab stands a CP-23 air compressor operated from the 500-volt circuit, having a piston displacement of 50 cu. ft. per minute.

Some of the dimensions of the locomotive are: Length over all, 31 ft. 1 in.; height over cab, 11 ft. 9 ins.; width over all, 9 ft. 6 ins.; rigid wheel base, 6 ft. 6 ins.; weight of electrical equipment, 27,500 lbs.; weight without electrical equipment, 52,500 lbs.

INSPECTION OF FORT WAYNE & WABASH PROPERTY

Through the courtesy of the Westinghouse Electric & Manufacturing Company, the Westinghouse Machine Company and the Babcock & Wilcox Company, about fifty engineers of Cincinnati and the vicinity made an inspection trip, March 10, to the new power station of the Fort Wayne & Wabash Valley Traction Company at Fort Wayne, Ind. This station, which was described at some length in the Street Railway Journal for Oct. 13, 1906, contains Babcock & Wilcox boilers and six Westinghouse-Parsons steam turbines with an aggregate capacity of 7000 kw.

The party left Cincinnati at 8:30 o'clock p. m. Saturday, March 9, in three special sleeping cars, arriving at Fort Wayne early Sunday morning. The greater portion of the morning was spent in an inspection of the plant. The plant of the Fort Wayne Electric Works was also visited. The party was in charge of Edwin K. Gillette, district manager Babcock & Wilcox Company; J. S. Brett, manager Cincinnati office Westinghouse Electric & Manufacturing Company, and Arthur Brown, district manager Westinghouse Machine Company. Included in the party were Thomas Elliott, consulting engineer of the Schoepf-McGowan syndicate, who designed the power plant visited; Herbert McNulta, chief engineer of the Cincinnati Traction Company; Charles Kilgour, second vice-president Toledo Urban & Interurban Railway; M. H. Folger, Cincinnati Traction Company, and James H. McCabe, district manager Murphy Iron Works.

STORAGE BATTERY FOR STATIONARY PURPOSES

The Westinghouse Machine Company has just put on the market a storage battery for stationary purposes known as "Type S." Elaborate tests of these batteries have been conducted at Pittsburg and have proved satisfactory. Both positive and negative plates are of pure lead with the active material formed by the Planté process. The surface of the plate is laminated and the entire plate, including plate and leaves, is pressed into one homogeneous piece. Allowance is made for expansion. The negative plate is similar to the positive plate with the exception that there is approximately 30 per cent more active material due to an increased number of laminations, and also because of a heavier formation permissible through the absence of subsequent corrosion in a negative plate. By providing relatively greater volume of active material in the negative plate it is believed that all the difficulties encountered in the ordinary form of Planté negative caused by shrinkage have been overcome.

The claims made for the plate are long life, maximum efficiency, and freedom from injurious sulphatation. The batteries are made in all sizes.

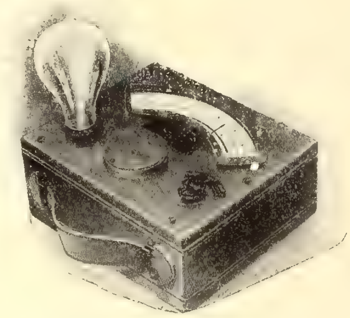
FREIGHT CARS FOR THE ILLINOIS TRACTION SYSTEM AND THE DETROIT UNITED RAILWAY

With the completion of the link between Decatur and Champaign, Ill., the Illinois Traction system, which operates and is building an interurban railway network between the principal cities in Central Illinois, will open up a through interurban route between Danville, Ill., and St. Louis, Mo. The operating company has already developed quite an extensive freight business, but when lines now under construction are completed freight traffic promises to be the source of considerable income. To care for growing traffic the company has had constructed three 50-ft. freight and express cars. The cars are built with monitor roofs and hexagonal ends. In addition to a large sliding door in each side at the center of the car body, small hinged doors are provided at the ends of the car for the convenience of trainmen. The motorman's cab is not separated from the body of the car, but a curtain is so arranged that it can be let down to prevent the lights in the car from blinding the motorman. The cars are provided with Westinghouse air brakes and General Electric type-M control. They were built by the St. Louis Car Company.

The same car company has also built several freight cars for the Detroit United Railway, which operates practically all of the interurban lines radiating from Detroit. A considerable revenue is derived by hauling milk from the outlying districts into Detroit, and quite an amount of freight is shipped by wholesale merchants in Detroit to retail dealers in the small towns along the interurban lines. Some new freight cars which have been recently added to the freight equipment to take care of increasing traffic differ considerably in construction and appearance from the type of freight or express car usually found on interurban systems. The car is provided with a closed cab at one end and an open platform at the other. A door in the rear of the car opens out on the platform and entrance may be gained to the cab or front vestibule either through a door from the outside of the car or through a door in the end of the car body proper. A large sliding door is located on each side of the car at the center of the body. The interior is well supplied with light by six small windows on each side. The car is provided with M. C. B. couplers which are placed at the standard height for steam roads. The body is painted a lemon yellow.

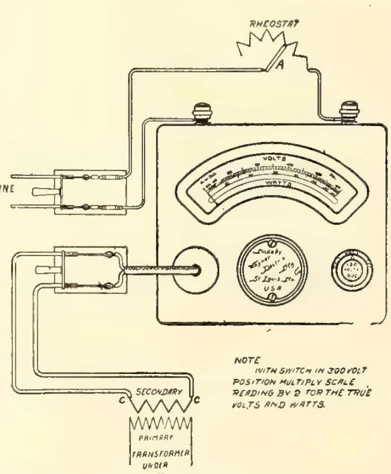
COMBINATION PORTABLE VOLT-WATTMETER

A combination portable volt-wattmeter is being introduced by the Wagner Electric Manufacturing Company, of St. Louis, that while of particular interest to central station managers is of especial value for testing and especially for determining core losses in small lighting and power transformers and for small motor testing. The instrument carries a lamp socket imbedded in the case, in which is placed the lamp or the attachment plug connected with the device under test. To the right hand is a small hard rubber switch, this switch carrying two pointers, one on each side. One of pointers is marked 110 volts or 150 volts, as the case may be, and the other pointer is marked 220 volts or 300 volts, as the case may be, the instrument being designed in such a way as to be suitable for operation on both 150-volt and 300-volt circuits, by simply throwing the switch to the proper voltage point. Each side of this switch, that is, the 150-volt side and 300-volt side, travels over an arc which has three stopping points, the first reading "Volts," the second "Watts" and the third "Off."



COMBINATION PORTABLE VOLT-WATTMETER

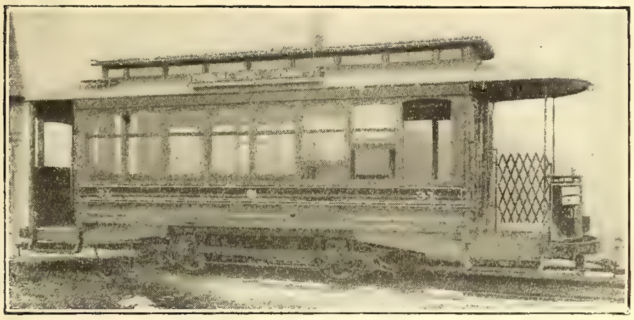
The instrument has a double scale, a voltage scale reading, say, up to 150 volts and a wattage scale reading up to 150 watts, there being one needle covering both scales. This needle is actuated by the voltage movement when the switch is on the point marked "Volts," and is actuated by the wattage movement when the switch is on the point marked "Watts." The instrument thus serves the double purpose of being a voltmeter and wattmeter combined. With the switch on the 300-volt side, the scale readings when multiplied by two give a range in both the voltmeter and the wattmeter combined. With this switch on the 300-volt side the scale readings when multiplied by two give a range in both the voltmeter and the wattmeter movement, from 0 to 300. The diagram herewith shows the method of connecting the instrument and a transformer under test to the testing circuit.



METHOD OF CONNECTING FOR TRANSFORMER TESTS

NOTES ON SHREVEPORT TRACTION COMPANY—NEW CARS

The Shreveport Traction Company recently received a number of groveless-post semi-convertible cars from the American Car Company. They will be put in service on the lines to the Fair Grounds, where an annual spring race meet is held. Aside from the new equipment the railway company operates eighteen cars, all built by the American



EXTERIOR OF SHREVEPORT CAR

Car Company; sixteen of them are of the single-truck drop-sash type; the remainder Brill full convertibles mounted on double trucks, behind which on such occasions as fairs, baseball games, etc., trail cars are operated. In seven years the road has developed from 8 miles of track with an equipment of four cars to 15 miles of track with twenty cars. The engine room is equipped with three generator sets, the largest and main unit being a 500-kw direct connected to a slow-speed engine. The boilers are of horizontal return tubular type fitted with gas burners, under which natural gas is used from the Caddo City fields, 22 miles distant from Shreveport. The boiler capacity is 900 hp

INTERIOR OF SHREVEPORT CAR

and the pumps are of 1500-hp capacity each. The original car sheds are being demolished and in their place a fireproof brick, concrete and steel building will be erected, 120 ft. x 160 ft.

The double-truck cars on the system are each being equipped with four 40-hp motors and the single-truck cars with 35-hp motors. One of the new semi-convertible cars is shown in the illustration. The front end is enclosed with stationary round end vestibules. The rear end of car has an open platform. Folding gates are installed at both entrances. The other semi-convertible car ordered was identical to the one illustrated except that the stationary round end vestibule was at both ends. The interiors are of golden oak. The slat transverse seats are of the car builder's make. The trucks are of the No. 21-E pattern. The following are the chief dimensions: Length over end panels, 20 ft. 8 ins.; length over vestibules, 30 ft. 1 in.; width over sills, including panels, 7 ft. 9½ ins.; over posts at belt, 8 ft. 2 ins.; side sills, 5 ins. x ⅜ ins., plated with 3½-in. x 6-in. angle-iron; sub-sills, 4¼ ins. x 5 ins.; center sills, 3¼ ins. x 4¾ ins.; end sills, 3½ ins. x 6⅜ ins.

LARGE ELECTRIC SIGN

The connection between electric railroading and illuminated electric signs has been pointed out on several occasions in these columns, and gives interest to one of the largest electric signs ever built. According to the electrical papers, this is a sign recently constructed by the A. & W. Electric Sign Company, of Cleveland, for the Morgan & Wright Company, owners of the Detroit Electrical Works. This sign has a length of 140 ft. and a height of 30 ft. It consists of two lines of letters, one 10 ft. in height, the other 6 ft. in height, and will be displayed on two buildings facing the Detroit River. It will require about 1400 lamps and will be ready for lighting about April 1.

ELEVATION OF TRACKS IN WILMINGTON

In the elevation of its tracks at Wilmington, Del., the Pennsylvania Railroad Company is making an effort to reduce noise and vibration. The floors of the bridges, of which there are twenty-four, are of the solid trough construction. The steel work is covered with concrete, which is thoroughly waterproofed with five layers of felt and asphalt compound. This in turn is covered with a layer of protecting bricks laid in sand and grouted. Upon the bricks is tamped the stone ballast, carrying the wooden ties and the rails forming the roadbed.

NEW CARS FOR THE SCRANTON RAILWAY COMPANY

Several new cars were recently added to the rolling stock of the Scranton Railway Company, which owns all of the lines in Scranton, Pa., and in addition operates under leases several interurban lines running out of Scranton.

The new cars, which were built by the St. Louis Car Company, are of the closed type with bodies 29 ft. 6 ins. in length. The bottom framing is especially heavy for a car of this type. On the inside of the side sills is bolted a ⅜-in. x 15-in. steel plate. This extends above the sill a sufficient distance to permit the side posts to be bolted securely to it. The remaining longitudinal sills are reinforced by 4-in. I-beams. Although this steel plate serves to stiffen the car considerably, both inside and outside trusses are provided in addition.

The interior of the car, which is finished in quarter-sawed oak, is divided into a smoking and a passenger compartment by a glass partition. All the cables of the control system are carried in cable boxes on top of the floor alongside the side sills. The seats are of the reversible type and are finished in rattan. The car is provided with a controller at each end, and it is fitted with air brakes.

The Cole law, requiring Ohio corporations to pay a tax of 1 per cent on gross receipts, resulted in the payment of $264,464.34 by street, interurban and electric railways of all kinds last year, according to the report of the State auditor.

FINANCIAL INTELLIGENCE

WALL STREET, March 13, 1907.

The Money Market

The past week has witnessed a material hardening in the local money market, rates for all classes for accommodations ruling substantially higher than those heretofore prevailing. Money on call was in fair supply, and was satisfied at rates ranging from 3 to 15 per cent. For the first time since January last, short-time money commanded a premium, funds for thirty and forty-five days being in demand at 6 per cent, and a premium making the total charge equal to 7 per cent, with practically nothing obtainable even at the high figure, while for three to six months the rate was firmly held at 6 per cent. The high rates for money are not at all surprising, in view of the heavy drafts being made up on the local institutions. Since last Friday the New York City banks have lost $3,500,000 on their operations with the Sub-Treasury, which is considerably more than the surplus reserve reported by the Clearing House Banks on last Saturday. The demand for money at interior points continued brisk, and during the week shipments of money were made to Southern points. The local demand for funds has been fair, notwithstanding the enormous liquidation in the securities market, and in addition to these adverse influences the banks will be called upon later in the week to provide upwards of $50,000,000 on account of the Pennsylvania notes, Chicago & Northwestern new stock, and the payments on the Standard Oil and the Consolidated Gas dividends. Sterling exchange has ruled weak with a further substantial decline in rates, which, under ordinary condition, would have resulted in the imports of gold from Europe. Relief from this source, however, has been removed for the time being, by advance in price of American gold coin at London of ⅝d. to 76s. 5d. Money at all of the European centers is in active demand, and the action of the Bank of England in advancing the price of American Eagles is interpreted as a warning to American bankers that that institution intends to protect its gold supply, and to adopt other restrictive measures should it become necessary to do so. For many weeks past the arrivals of gold from the Cape have been absorbed by the Bank of England, but the heavy shipments to South America and other points have prevented any considerable net gain in its gold holdings. During the week $1,000,000 gold was engaged in Amsterdam, Holland, for import to New York, but this was followed by an advance in the official discount rate at that center to 6 per cent, showing clearly enough that there is a general disposition on the part of the large financial institution abroad to prevent any inroads being made upon their gold supplies. At the close of the week there was nothing in the situation to warrant the belief of any decided easing up in rates in the near future. So far, the Secretary of the Treasury has not made any deposits of customs collections with the banks under the provisions of the Aldrich act, but the Secretary has decided to allow all depository banks to retire at their discretion circulation to the amount of $9,000,000 a month until further notice. The bank statement published on last Saturday was rather disappointing. The decrease in cash of $6,442,600 was considerably more than expected, and was due in part to the average system. Deposits decreased $18,542,700. The reserve required was $4,635,675 less than in the previous week, and deducting this from the loss in cash, the surplus was reduced by $1,806,925. The total surplus now stands at $2,051,725, as compared with $6,463,700 in the corresponding week last year, and $9,278,150 in 1905, $29,937,075 in 1904, $1,024,000 in 1903, $3,112,900 in 1902, $10,002,600 in 1901, and $5,676,375 in 1900.

The Stock Market

Price movements on the Stock Exchange during the week have been of a conclusive and disturbing character, with short-lived bullish sentiment quickly destroyed by increased monetary stringency in all parts of the world and a general disturbance of loans in the local market that at the end of the past week caused acute demoralization and much forced liquidation. A week ago there was much talk of trouble in Berlin that was indignantly denied by the most important foreign bankers, but liquidation on a large scale in that period in anticipation of an unfavorable bank statement accompanied by aggressive bear selling carried prices down before Sunday to an extremely low range. The situation before Sunday was extremely ominous and the air was then full of disquieting rumors of pending trouble, but a surprise was sprung on the Wall Street world on Monday by a cessation of both liquidation and bear manipulation, the supply of stock being replaced by what was regarded as inspired inside buying. The interview of J. P. Morgan with President Roosevelt was used as an influential bull factor, and this interview and the arrangement for a formal conference between the national executive and prominent railroad officials was made the basis for a demonstration of strength that was the feature of the market from the opening on Monday until late Tuesday afternoon, when there was a sudden and unexpected change, which, for the time, was unexplained. On Wednesday, intense weakness prevailed from the opening, and the market all through the day was in a semi-panicky condition. In fact, in other years such declines as were then sustained would have been regarded as highly sensational. There was a flood of long stock pressing on the market at all times through the day and an absolute absence of demand except that which came through moderate covering of shorts. Prices of several stocks declined 10 points during the day, and a number of important issues were forced to the lowest range reached in many years. This was notably the case in Northern Pacific, which sold below the price at which it closed on May 6, 1901, three days before the May panic of that year. Union Pacific, Great Northern preferred and Reading were among the stocks sustaining the greatest losses on this downward movement, and stocks like St. Paul and Amalgamated Copper, in which Standard Oil influence dominates, suffered as severely as those with less impressive holders. The first indication of depression came from Europe, the weak spot of the financial world being in Berlin, and from there weakness progressed in equal force to London.

Philadelphia

The liquidation in the general stock market was reflected to a great extent in the traction shares during the past week. Trading generally was in moderate volume, but it was attended with a general fall in prices. Philadelphia Rapid Transit, after selling at 20½, dropped to 19½ on sales aggregating about 3000 shares, while Union Traction declined from 56¾ to 55 on transactions amounting to 2000 shares. Philadelphia Company common was more active than for some time, but the price suffered in sympathy with the other public utility shares. From 44½ it fell to 44, while small lots of the preferred brought 47. Lehigh Valley Transportation issues displayed relative strength, the common stock selling at 10¾, while the preferred advanced from 20 to 20¾. Other sales included United Railways at 50, and Consolidated Traction of New Jersey at 73½. Little attention was paid to the report that a big local pool has been formed to support the public utility shares, although at the close this group displayed some strength and recovered part of the early losses.

Baltimore

Increased activity developed in the traction issues at Baltimore during the week, but the general trend of values was toward a lower level. United Railway issues led the group in point of activity, upwards of $35,000 of the 4 per cent bonds changing hands at 87¾ to 87⅝, while the incomes sold to the extent of $60,000 at prices ranging from 55 to 53¾ and back to 54. The refunding 5s were quiet, with sales at 83¾ to 84. The free stock was quite active, 1600 shares selling at 12 to 11, the last figure representing the lowest price of the year. The pooled stock brought 11¼ to 11¾. Other transactions included Atlanta Street Railway 5s at 103; Norfolk Street Railway 5s at 107½, City & Suburban 5s at 108, North Baltimore Railway 5s at 112; Washington City & Suburban 5s at 101½, and Knoxville Traction 5s at 107.

Other Traction Securities

The Boston market for street railway issues was quiet and irregular. Boston & Worcester sold at 26 to 26¼ for several hundred shares, but, on the other hand, Massachusetts Electric fell from 18½ to 17½, while the preferred sold from 66½ to 66. Boston Elevated was steady, with transactions at 147¼ to 147½; Boston & Suburban sold at 12, and the preferred at 57¼; West End changed hands at 94 to 93⅝ and the preferred at 109⅛ to 109. The Chicago market was extremely dull, there being little disposition to trade actively. Northwest Elevated preferred sold at 66.

Brokers did some trading in Cleveland Electric through the past week, and Monday some fractional lots sold as high as 66, but the closing price was lower. There was some demand at 64, but holders were unwilling to let it go at that. Lake Shore Electric bonds were traded in to some extent, as were Washington, Baltimore & Annapolis pooling certificates. Aurora, Elgin & Chicago showed some activity during the week.

Security Quotations

The following table shows the present bid quotations for the leading traction stocks, and the active bonds, as compared with last week:

	Mch. 6	Mch. 13
American Railways	49¾	50
Boston Elevated	148½	147
Brooklyn Rapid Transit	58¾	55
Chicago City	150	150
Chicago Union Traction (common)	4⅝	4¼
Chicago Union Traction (preferred)	14¾	13
Cleveland Electric	64	65
Consolidated Traction of New Jersey	74½	72
Detroit United	75¾	72
Interborough-Metropolitan	27⅝	24⅞
Interborough-Metropolitan (preferred)	64¾	60
International Traction (common)	54	54
International Traction (preferred), 4s	79	79
Manhattan Railway	139¼	137¼
Massachusetts Elec. Cos. (common)	18	17
Massachusetts Electric Cos. (preferred)	66	65
Metropolitan Elevated, Chicago (common)	24¼	23
Metropolitan Elevated, Chicago (preferred)	65	65
Metropolitan Street	—	—
North American	79	73¾
North Jersey Street Railway	40	40
Philadelphia Company (common)	44½	44
Philadelphia Rapid Transit	20	17
Philadelphia Traction	92¾	*91½
Public Service Corporation certificates	66	66
Public Service Corporation 5 per cent notes	95	95
South Side Elevated (Chicago)	a80	78
Third Avenue	109	103
Twin City, Minneapolis (common)	97	93
Union Traction (Philadelphia)	56½	55½

a Asked. * Bid.

Metals

According to the "Iron Age," strenuous efforts are being made to get out tonnage, now that weather conditions are improving. The indications, from the achievements thus far this month, are that the March output of pig iron and of finished products of the Steel Corporation will exceed the banner record of October last. Possibly a record tonnage may also be attained in steel. In pig iron both sides maintain a defensive attitude, and there is comparatively little business doing for delivery during the second quarter.

Copper metal displays decided strength; prices for all of the principal grades scoring further advance. Quotations are: Lake, 25⅜ to 25¾; electrolytic, 25⅛ to 25⅜; castings, 24⅝ to 24⅞.

A LARGE HOLDING COMPANY FOR THE NORTHWEST

Articles of incorporation have been filed for the Northwestern Corporation by Isaac W. Anderson and Robert E. Allen, the object being to consolidate all the electric railway lines, power plants and gas plants owned by the interests in control of the Northwestern Gas & Electric Company. The $5,000,000 for which the corporation is capitalized is divided into 50,000 shares. The life of the corporation is limited to fifty years. The first board of directors chosen to administer the affairs of the corporation are: I. W. Anderson, Robert E. Allen, R. F. Brackett, Thomas Mickelson, A. K. Dice, S. A. Scott, Otto B. Frank, Robert Breeze, Nick Lawson and Cary M. Rader. Not only will the corporation absorb all the Northwestern Gas & Electric Company, including the interurban traction line to Milton and the power plant on the Walla Walla River as well as the gas plants here and at Pendleton, but it will take over the Yakima gas plant, the Lewiston gas plant, the Baker City electric light plant, the lighting system at Athena and the Boise Traction Company, which operates the street car system in the Idaho capital as well as furnishes power. Besides these holdings the Northwestern Corporation will also take over from ten to twelve lighting plants in the Willamette Valley and other parts of Oregon, including those at the cities of Albany, Eugene, Cottage Grove, The Dallas, Roseburg and Seaside.

EASTERN CONSOLIDATED ELECTRIC

The Eastern Consolidated Electric Company reports for the fiscal year ended Dec. 31, 1906:

	1906	1905
Gross earnings Eastern Transit Co.	$326,693	$283,264
Operating exp. Eastern Transit Co.	204,025	179,910
Net earnings	$122,667	$103,354
Charges and taxes East. Trans. Co.	40,324	45,042
Net income	$82,342	$58,311
Rental Edison Illuminating Co.	30,000	30,000
Interest and taxes Edison Illum. Co.	2,583	1,983
Net income Edison Illum. Co.	$27,416	$28,016
Gross earn. Easton Cons. Elec. Co.	109,759	86,328
Operating expenses Easton Cons. Elec. Co.	3,298	3,594
Taxes unpaid and claims	....	14,790
Net earnings	$106,460	$67,493
Interest and taxes	48,500	45,500
Balance	$57,960	$22,443
Dividend	18,750	....
Surplus	$39,210	$22,443

President Joseph S. Lovering, in his annual report to stockholders, says:

"The Easton & South Bethlehem Transit Company's line, which is now in course of construction, when completed and in operation give direct service between Easton, Freemansburg, Shimersville, Northampton Heights, Bethlehem Steel Works and South Bethlehem. The line will be a little more than 12 miles in length. This work has been under way since May, 1906. The grading between Easton and Freemansburg is very nearly finished and about one-half of the track laid. The undercrossing at the Easton & Northern Railroad is nearly completed, and the undercrossing at the Central Railroad of New Jersey tracks at Freemansburg will be finished about April, 1907. The line between Easton and Freemansburg, at which point it connects with our present track, will be ready for operation about May 1.

"The claims of your company against the receivers of the Lehigh Valley Traction Company were, after careful consideration, settled by a compromise, your company receiving $37,500 in cash and 478 shares of stock in the Pennsylvania Motor Company (one of your constituent lines). This stock, together with twenty shares purchased in the market, gives your company complete ownership of the Pennsylvania Motor Company.

"Notwithstanding the increased pay granted to your employees, your constituent companies have shown a steady increase in earning capacity during the fiscal year, which has fully justified the large expenditures for the reconstruction of and additions and betterments to your property, and the outlook for the coming year is very favorable."

REPORT ON FENDER TESTS IN MASSACHUSETTS

The pamphlet report giving the record of tests of street railway fenders and wheelguards made under the direction of the Railroad Commissioners of Massachusetts, at Newton, Oct. 23, Oct. 30, Nov. 9, Nov. 16, Nov. 24, Nov. 27 and Dec. 7, has just been made public.

The following statement gives briefly the record of tests of certain of the fenders and wheelguards made under direction of the board.

TESTS GIVEN AT NEWTON, OCT. 23, 1906

1. Pfingst Platform Fender (with drop attachment underneath operated by motorman).—A small dummy in an upright position on the track was picked up at a speed of about 4 m. p. h. A small dummy lying on the track was picked up by the drop attachment (one arm under), which was tripped by the motorman at a speed of about 6 m. p. h. A small dummy lying diagonally with head towards the car was picked up by the drop attachment, which was tripped by the motorman. A large dummy lying diagonally on the track was picked up by the drop attachment, which was tripped by the motorman. A large dummy lying on its back was picked up and lay about one-half on the drop attachment. A large dummy placed in an upright position on the track was picked up on the platform, but the head was torn off.

2. Picket Fender.—A small dummy in an upright position in the center of the track had both legs broken off at the knees, but the body of the dummy was picked up by the fender. A small dummy in an upright position in the center of the track with its back towards the car was picked up. A small dummy lying on its back was struck and pushed along the track, but did not go under the fender. A small dummy lying on its back with its arms extended (one arm toward the car) was pushed along the track, one arm being caught under the fender and torn. A large dummy (headless) lying diagonally across the track, with one arm extended towards the car, was picked up, but rolled off, and cut to pieces. A small dummy lying diagonally on the track with its feet towards the car went under the fender and as far back as the lifeguard on the truck.

3. Weeden Automatic Fender.—A dummy in an upright position with its back towards the car, was picked up on the fender platform. A small dummy lying on the track on its back, with arms extended, was pushed along the fender, one arm being caught under same. A small dummy lying diagonally across the track, with its head towards the car, was pushed along by the fender.

4. Sullivan & Taylor Fender.—A small dummy in an upright position, with its back towards the car, was picked up by the fender platform, but rolled off the front of the fender and was pushed along the track with one arm under the fender. A small dummy in an upright position near the left rail, with its side towards the car, was picked up and remained on the fender platform.

5. Barnes Patent Lifeguard.—A small dummy lying diagonally on the track with its head towards the car was pushed along, with one arm under the fender. A small dummy lying diagonally on the track with its head towards the car, was pushed along, with both legs and one arm under. A small dummy placed in an upright position on the track was pushed down with its feet toward the car just before being struck, and was pushed along with legs under the fender. A small dummy in an upright position, with its back towards the car was struck by the fender, knocked down and pushed along, with one arm under the fender.

TESTS GIVEN AT NEWTON, OCT. 30, 1906

1. Sterling Lifeguard.—A small dummy lying diagonally across the track with its head towards the car was pushed along by the lifeguard. A small dummy lying across the track was pushed along by the lifeguard with one arm underneath. A small dummy lying on its back lengthwise of the track, with its head towards the car, was pushed along by the lifeguard. A small dummy lying diagonally across the track with its feet towards the car was pushed along by the lifeguard, one arm and one leg being underneath.

2. Eclipse Lifeguard.—A small dummy in an upright position was picked up and remained on the fender. A small dummy in an upright position was picked up, but the fender failed to lock; the dummy lay on the fender platform with its feet dragging on the ground. A small dummy placed in an upright position near the rail and facing the car was picked up and remained on the fender.

3. Multiple Wheelguard.—A small dummy lying diagonally across the track with its feet towards the car, was picked up by the wheelguard, which was dropped by the motorman. A small dummy lying diagonally across the track with its feet towards the car and its head resting on one rail was picked up by the wheelguard.

4. Bateson Car Fender.—A small dummy in an upright position with its back towards the car, was struck and picked up on the platform; but the head was partly torn off from contact with back of the fender. A small dummy in an upright position facing the car, was picked up by the platform, but the head was torn off from contact with back of the fender. A large dummy in an upright position with its side towards the car, was picked up on the platform, but the head was partly torn off from contact with back of the fender. A small dummy lying diagonally across the track with feet towards the car, was struck by the fender and pushed to one side and off the track and was struck on the shoulder by the lifeguard of the truck. A small dummy lying diagonally across the track with head towards the car, was pushed along with one arm under the fender.

5. Pickett Fender (Retrial).—A large dummy in an upright position with back towards the car, was picked up, but the head was torn partly off. A large dummy lying on its back across the track was picked up on the fender platform, but rolled partly off and was pushed along with the head dragging on the ground. A large dummy lying diagonally across the track with its feet over one rail and its head towards the car was picked up, and remained on the fender.

6. Smith Automatic Fender.—A small dummy in an upright position near one rail, with its back towards the car, was picked up by the fender platform. A small dummy in an upright position near one rail, with its back to the car, was picked up on the fender platform. A small dummy on the track with arms extended, was pushed along with one arm partly under the fender. A small dummy lying diagonally across the track with its head and shoulders outside of one rail, was pushed along with one arm under the fender; the head of the dummy was torn off. A large dummy lying diagonally across the track with feet towards the car, was pushed along with one leg and one arm under the fender.

7. Weeden Automatic Fender (Retrial).—A large dummy in an upright position with its back towards the car was struck and fell against the front of the car, then bounded off and went clear of the car at one side. A large dummy in an upright position and facing the car was picked up and remained on the fender platform. As the car approached the large dummy, a small dummy was thrown on the track about 20 ft. in front of the car, which passed entirely over the dummy, the motorman failing to trip the fender. A large dummy in an upright position near one rail, with its back to the car, was pushed over just before the car reached it and was picked up and remained on the fender. A large dummy lying diagonally across the track with its head towards the car was picked up and remained on the fender.

TESTS GIVEN AT NEWTON, NOV. 9, 1906

1. Parmenter Fender.—A small dummy standing vertically with its side towards the car, was picked up on the fender platform, but struck against the dashboard protector, bounded forward and lay across one corner of the fender platform, with head on the ground and one foot caught under the front of the fender platform. A small dummy in an upright position somewhat diagonally across the track with its back towards the car, was picked up and remained on the fender platform. A small dummy in an upright position, with its side towards the car, was picked up and remained on the fender, but the head was partly torn off from contact with the dashboard protector. A large dummy lying diagonally on the track with its head towards the car, was picked up and remained on the fender. A small dummy lying on the track with its head resting on one rail, was picked up and remained on the fender.

2. Parmenter Automatic Wheelguard.—A large dummy lying across the track was picked up and remained partly on the wheelguard, with head and one arm dragging in front. A small dummy lying across the track was picked up and remained on the wheelguard, which dropped automatically. A small dummy lying across the track with its head outside of one rail was picked up on the wheelguard, which dropped automatically. A small dummy lying lengthwise of the track, with its feet to-

wards the car, was picked up on the wheelguard, which dropped automatically.

3. Providence Car Fender.—A small dummy in an upright position , near one rail with its side towards the car, when struck fell against the dashboard protector, then fell forward across the corner of the fender platform. A small dummy in an upright position near one rail with its back to the car, when struck fell against the dashboard protector, then fell forward and was pushed along in front of the fender. A large dummy in an upright position in the middle of the track was pushed along in front of the fender. A large dummy in an upright position on the track fell forward and was pushed along in front of the fender with its head and shoulders outside of the rail. A large dummy lying across the track was picked up and remained on the fender. A small dummy lying on the track, with head outside of the rail, was picked up and remained on the fender. A small dummy lying on the track with its feet towards the car and head resting on one rail, went under the fender and the car wheel passed over one arm, the dummy being left on the track about 8 ft. behind the car. A small dummy lying on the track, with its feet towards the car and head on one rail, was picked up and remained on the fender.

4. Barnes Patent Lifeguard (Retrial).—A small dummy in an upright position in the center of the track, facing the car, was struck by the fender and fell on top of same. . The wings of the fender opened and the dummy dropped to the ground inside of the wings and was pushed along by the fender. A small dummy in an upright position near one rail, was pushed one side, but went under the lifeguard of the truck, being badly cut up. A large dummy lying on the track with feet over one rail and head inside, went under the fender and was pushed along, being caught under the fender and badly damaged.

TESTS GIVEN AT NEWTON, NOV. 16, 1906

1. Berg Fender.—A small dummy in an upright position on the track near one rail with back to the car, was picked up and remained on the platform, the fender being tripped by the motorman. A large dummy in an upright position on the track with its side to the car, was struck by the fender platform, fell against the dasher of the car, then fell forward off the fender and was pushed to one side, where it lay on the roadway. A large dummy lying across the track with head on one rail was picked up but rolled off the front of the fender just as the car came to a standstill. A small dummy lying on the track with its head outside of one rail, was pushed along by the fender with one arm caught under the fender platform. A small dummy lying on the track with its head outside one rail, was pushed along by the fender, with one arm caught. A small dummy lying on the track with its head on one rail, was pushed along by the fender. A large dummy lying across the track with its head on one rail, was picked up, but rolled off in front of the fender and was pushed along, rolling over twice. A large dummy lying diagonally across the track with feet towards the car and head on one rail, was picked up and remained on the fender, which was tripped by the motorman.

2. Sullivan and Taylor Fender (retrial, double-truck car).—A small dummy standing on the track was picked up on the fender platform. A large dummy in an upright position was picked up on the fender platform, one foot dragging in front of same. A small dummy in an upright position was picked up on the fender platform. A small dummy in an upright position, picked up on the fender platform. A small dummy lying on the track was pushed along in front of the fender. The fender was tripped by the motorman, and the brake was applied automatically. A small dummy lying on the track was pushed along in front of the fender, one arm and one leg under. The fender was not tripped by the motorman. A large dummy lying on the track was picked up and remained on the fender; the fender being tripped by the motorman, and the brake applied automatically. A large dummy lying on the track in front of the forward truck was passed over and one arm torn off.

3. Maxham Fender.—A small dummy in an upright position was picked up and remained on the fender. A large dummy in an upright position was picked up and remained on the fender, which tripped automatically. A large dummy in an upright position, near one rail, was picked up and remained on the fender. A large dummy lying across the track with its head over one rail was picked up and remained on the fender. A small dummy lying diagonally across the track with its head towards the car and near one rail, was picked up on the fender but rolled off just as the car came to a standstill. A very small dummy placed on the track was picked up and remained on the fender. A very small dummy placed in an upright position on the track was picked up and remained on the fender. A large dummy in an upright position was picked up and remained on the fender. A large dummy lying across the track with its head over one rail was picked up and remained on the fender.

4. Sherwood Fender.—A small dummy in an upright position, near one rail, was picked up and lay on the fender with feet dragging in front. A large dummy in an upright position was picked up and remained on the fender which tripped automatically. A large dummy lying across the track with its head on one rail, was pushed along for some distance, then rolled partly under the fender. A large dummy lying across the track with its head over one rail, went completely under the fender. A small dummy lying on the track with its head on one rail, went completely under the fender and was run over by the car. A large dummy lying on the track was picked up and remained on the fender, which was tripped by the motorman. A large dummy lying on the track went completely under the fender, and lay in front of the truck.

TESTS GIVEN AT NEWTON, NOV. 24, 1906

1. Sherwood Fender (retrial).—A small dummy placed diagonally on the track with head towards the car and near one rail, was picked up and remained on the platform. A small dummy lying across the track was picked up and remained on the platform. A large dummy lying across the track was picked up and remained on the platform.

2. Sherwood Automatic Wheelguard.—A large dummy lying across the track was picked up and remained on the wheelguard, which tripped automatically. A large dummy lying across the track was picked up and remained on the wheelguard, which tripped automatically. A large dummy lying across the track was picked up, but rolled off the front of the wheelguard, and was pushed along, one shoulder under the wheelguard, which tripped automatically. A small dummy lying diagonally on the track with feet towards the car, was picked up and remained on the wheelguard, which tripped automatically. A small dummy lying on the track with head towards the car, was picked up and remained on the wheelguard, which tripped automatically.

TESTS GIVEN AT CANTON JUNCTION, NOV. 27, 1906

Wheelock Fender.—A small dummy in an upright position with back towards the car, was picked up and remained on the fender, which tripped automatically. A small dummy in an upright position with side towards the car, was picked up and remained on the fender, which tripped automatically. A small dummy placed in an upright position with face towards the car, was picked up and remained on the fender, which tripped automatically. A small dummy in an upright position with face towards the car was knocked down and pushed along in front of the fender for some distance and then picked up on the fender. A small dummy lying on the track was picked up and remained on the fender, but rolled off one side, and lay on the ground with its head wedged under the forward truck. A large dummy in an upright position, facing the car, was struck by the fender, knocked down and went under the fender feet foremost. The fender tripped automatically but caught feet of the dummy, which prevented the fender from dropping to the roadbed. A large dummy in an upright position with side towards the car, was picked up and remained on the fender, which tripped automatically. A large dummy lying across the track was picked up and remained partly on the fender, with feet dragging in front. A large dummy lying on the track partly over one rail, was picked up but rolled off the fender and was pushed along in front.

TESTS GIVEN AT NEWTON, DEC. 7, 1906

1. Keith Fender.—A small dummy in an upright position with side towards the car, was picked up and remained on the fender, which tripped automatically. A large dummy in an upright position with side to the car, was picked up and fell with its head and shoulders over one side of the fender. A large dummy lying on its face across the track with its feet on one rail, was picked up and remained on the fender, which was tripped by the motorman. A large dummy lying on its back across the track, was picked up and remained on the fender. A small dummy lying on its face across the track, with arms extended, was picked up and remained on the fender, which was tripped by the motorman. A small dummy lying diagonally across one rail with its head towards the car, was picked up and remained on the fender, which was tripped by the motorman.

2. Haskins Automatic Fender.—A large dummy in an upright position with its back towards the car, was picked up and remained on the fender, with feet dragging in front. A small dummy placed in an upright position on the track with its face

towards the car, was picked up and remained on the fender. A small dummy lying on its back diagonally across the track, with its head toward the car, went under the fender and lay in front of the truck. A small dummy lying across the track went partly under the fender and was pushed along; the fender did not trip. A large dummy lying diagonally across the track with its head towards the car went partly under the fender and was pushed along. A large dummy in an upright position near one rail, was picked up and remained on the fender, with feet dragging over the front.

3. Hipwood Fender.—A large dummy in an upright position was picked up and carried on the fender with feet dragging in front. A small dummy in an upright position with its face towards the car, was picked up and remained on the fender, which was not tripped. A small dummy lying diagonally across the track with its head towards the car, was picked up and remained on the fender, which was tripped by the motorman. A small dummy lying face down across the track, was picked up and remained on the fender, which was tripped by the motorman. The speed of the car was about 10 m. p. h. A large dummy lying on its back across the track was picked up and remained on the fender, which was tripped by the motorman.

4. Howe Automatic Revolving Fender.—A small dummy in an upright position with its back towards the car, was knocked down, one arm going under the fender, and was pushed along some distance in front, then worked to one side of the track. A large dummy in an upright position was knocked down, one arm going under the fender, and was pushed along to one side and lay in front of the truck. A large dummy lying diagonally across the track, with its head towards the car, was pushed along in front, went partly to one side and lay beside the fender, with one foot under.

6. Maxham Fender (Retrial).—A small dummy in an upright position with side towards the car, was picked up and remained on the fender, feet dragging in front. A large dummy in an upright position with back towards the car, was picked up and remained on the fender. The dummy was almost broken apart from force of contact with the front of the car. A small dummy lying on the track with head on one rail, was pushed along in front of the fender.

7. Jenkins Automatic Fender.—A large dummy in an upright position with side towards the car, was knocked down, falling outside of the fender and lay with head partly under the car, and the head was nearly torn off. A small dummy in an upright position, with face towards the car, was picked up and remained on the fender, which tripped automatically. A small dummy lying on its face on the track with head on one rail, was pushed along, with feet on the fender, and head and shoulders dragging in front. A large dummy lying on its back across the track was pushed along in front of the fender with one arm under.

8. Seavey Automatic Fender.—A large dummy in an upright position, with side towards the car, was knocked down and pushed along in front of the fender; the head being partly torn off. A small dummy placed in an upright position, with face towards the car, was picked up and remained on the fender, which tripped automatically. A small dummy lying diagonally across the track, with head towards the car, was picked up and remained on the fender, which was tripped by the motorman. A small dummy lying on its face on the track, went under the fender and lay in front of the truck. A large dummy lying on its back across the track, was pushed along in front of the fender, which was tripped by the motorman. A large dummy lying on its back across the track, went under the fender, which did not trip.

9. Clark Automatic Wheelguard.—A large dummy lying on its face across the track was pushed along with one arm under the wheelguard. A large dummy lying on its face across the track was picked up and remained on the wheelguard. A large dummy lying across the track was pushed along in front of the wheelguard, one foot under. A small dummy lying diagonally across the track with its face down and its head towards the car, was picked up and remained on the wheelguard. A small dummy was placed horizontally on the track, and another small dummy was thrown onto the track directly in front of the car, as it approached. One dummy was picked up on the wheelguard, the other being pushed along in front of the wheelguard, with one arm under.

10. Pfingst Fender.—A large dummy in an upright position with its face towards the car was knocked down, falling in front of the fender, going under and being pushed along in front of the truck. A large dummy in an upright position on the track fell before the car reached it, went under the fender and was pushed along in front of the truck. A small dummy in an upright position with its side towards the car, was picked up and remained on the fender. A small dummy in an upright position, with its face to the car, went onto the fender, then rolled off and went under, and was pushed along in front of the truck. The fender was pushed in when it struck the dummy. A large dummy in an upright position was knocked down, went under the fender and was pushed along in front of the truck. A small dummy placed in an upright position on the track with its side towards the car, was picked up and remained on the fender. A small dummy lying on its back went under the fender and was pushed along in front of the truck. In the tests with the Pfingst fender the dummy was prevented from going under the truck, when it went under the fender, by the lifeguard attached to the truck.

ANNUAL REPORT OF THE WASHINGTON COMPANY

The Washington Railway & Electric Company, of Washington, D. C., has issued its annual report for the year ended Dec. 31, 1906. The income account compares as follows:

	1906	1905
Gross receipts	$3,133,240	$2,905,907
Operating expenses	1,613,096	1,478,466
Net earnings	$1,520,144	$1,427,441
Other income	44,595	50,553
Total income	$1,564,739	$1,477,994
Fixed charges	1,041,118	999,455
Surplus	$523,621	$478,539

The increase in operating expenses is largely due to an increased expenditure for maintenance. While the total operating expenses increased $134,630, or 9.10 per cent, the cost of maintenance increased $64,612, or 20.59 per cent. This increase in cost of maintenance is partly due to the fact that the properties have been maintained in better condition than heretofore, but more to the large increase in the cost of materials of every nature entering into the construction and operation of such properties.

The surplus after the fixed charges for the year ending Dec. 31, 1906, amounting to $523,623, has been applied as follows:

To payment of 5 per cent dividend on $8,500,000 preferred stock	$425,000
Discount on $250,000 consolidated mortgage 4 per cent bonds	35,102
Credited to depreciation reserve	50,000
Credited to profit and loss surplus	13,519
Total	$523,621

The general balance sheet of the Washington Railway & Electric Company, as of December 31, 1906, compares as follows:

Assets	1906	1905
Cost of property	$27,743,475	$27,519,358
Cos. st. and con. mtg. bonds	439,350	439,350
Construction bonds	227,000	227,000
Investments	416,071	416,071
Real estate and sundry securities	25,421	27,279
Material and supplies	72,974	63,513
Accounts received subsidiary cos.	107,558	60,671
Accounts received, miscellaneous	22,745	41,816
Prepaid insurance	5,192	6,365
Cash	361,854	283,959
Total	$29,421,640	$29,085,382
Liabilities		
Preferred stock	$8,500,000	$8,500,000
Common stock	6,500,000	6,500,000
Funded debt	12,913,439	12,647,100
Depreciation reserve	516,290	466,290
Accounts payable	63,508	65,201
Accrued interest and taxes	109,912	111,659
Reserve for renewals and damages	80,530	70,691
Profit and loss surplus	727,961	724,442
Total	$29,421,640	$29,085,382

BILL EMBODYING IDEAS OF GOVERNOR HUGHES, OF NEW YORK, REGARDING SUPERVISION OF PUBLIC SERVICE CORPORATIONS REACHES THE LEGISLATURE

A bill, which embodies the general plan of Governor Hughes for the better supervision of public service corporations throughout the State, has been introduced in the Legislature of New York. The bill abolishes the State Railroad Commission, the State Commission of Gas and Electricity, the office of State inspector of gas meters and the Rapid Transit Commission of New York City. In their place there are to be two State public service corporations. One is to have jurisdiction in New York, Kings, Queens and Richmond Counties (Greater New York), and the other in the remainder of the State. Each commission will have five members, appointed by the Governor, with salaries of $10,000 a year each, and with power to appoint counsel at $10,000 a year. Each commission is to have a secretary at $6,000 a year. The term of office of one commissioner in each district is fixed to expire Feb. 1, 1909, and the term of office of one commissioner in each district expires annually thereafter. Successors are to be appointed for a full term of five years.

The bill prescribes the duties of transportation companies, including railroads, street railroads, express companies, car companies, sleeping-car companies and pipe-line companies, and of gas and electric companies, and gives to the commission power to regulate the operations of such companies. The bill further provides that the franchise of a public service corporation shall not be assigned, transferred or leased without the approval of the commission having jurisdiction. It forbids a railroad or street railroad corporation, domestic or foreign, to purchase or acquire, take or hold any of the capital stock of any other similar corporation, unless authorized by the commission, and a similar provision is made as to gas and electric corporations. It further forbids the transfer to any stock corporation except as collateral security only, of more than 10 per cent of the total capital stock of any railroad, street railroad, gas or electric corporation; but this does not prevent the holding of stock heretofore lawfully acquired.

The commission is also given authority to approve or disapprove the issue of stocks and bonds of a public service corporation; but is forbidden to authorize the capitalization of franchises, except to the extent that the corporation has actually paid for such franchise to the State or a municipality, not including an annual tax or charge. It is also forbidden to authorize the capitalization upon the merger of two public service corporations beyond the amount of the capital stock of the two so merged, or to capitalize any contract for consolidation or lease.

Each commission within its jurisdiction is given power to fix the form of accounts and reports of public service companies, to investigate accidents, to fix just and reasonable rates, to order adequate service as to cars, motive power, time schedule, safety devices, employees and other instrumentalities. Its orders are to be in force until modified or abrogated by the commission, or unless declared by a court of competent jurisdiction to be unauthorized by this or by any other act, or to be in violation of a provision of the constitution of the State or of the United States.

Penalties ranging from $1,000 to $5,000 are imposed upon public service corporations violating the act or failing to obey any order of the commission, and their officers, agents and employees violating the act or any order of the commission, or aiding or abetting the corporation in doing so, are guilty of a misdemeanor. Shippers violating any provisions of the act are also liable to a penalty.

Theodore P. Shonts, president of the Interborough-Metropolitan Company, issued a statement Monday, in which he said that the corporation he represents will not oppose the Public Utilities Commission bill, and that it was the intention of the Interborough to give satisfactory service and have satisfactory relations with the public. The statement follows:

"In order that there may be no misapprehension in regard to our position, I wish it to be distinctly understood that there will be no opposition to Governor Hughes's Public Utilities bill on the part of the interests which I represent, nor will we oppose any bill which will accomplish more harmonious relations between the public and the public service corporations. I took hold of my present work with a firm determination to do all I could to bring about a better understanding between the public and our corporations, feeling certain that in the long run the corporations could prosper only by giving satisfactory service and by having satisfactory relations with the public and the municipal authorities.

"I believe that the public authorities, whether those now existing or such as may be created, should have broader powers in dealing with the complicated traffic conditions in Greater New York. We will do our best to render effective any plan which the Legislature in its wisdom may adopt with that end in view. I assume the Legislature will welcome suggestions in aid of the purposes of the bills which further discussion and study may develop. I may add that the directors and principal owners of the company are in entire accord with me on this subject."

STRIKE IN LOUISVILLE

Some 700 employees of the Louisville Railway Company, comprising those men in the company's service who are members of the local branch in Louisville of the Amalgamated Association of Street and Electric Railway Employees of America, are on strike. Their demands for a 10-hour workday with 22 cents an hour, 45 minutes for meals, pay for extra work to begin when reporting for duty is made, time and a half for overtime, subsequent employees to be compelled to join the union, and a board of arbitration to settle all differences between the company and the men, were presented last week and refused by the company. As a consequence a meeting was held Saturday night, at which it was decided by the union to declare a strike, and so no cars were operated on Sunday. On Monday, however, the company resumed service with the 300 men in its employ not members of the union, but the running of cars had to be abandoned, because of insufficient police protection.

President Minary's letter to the union setting forth the position of the company is appended:

Louisville, Ky., March 9, 1907.

Mr. S. L. Wilson, City.

Dear Sir: Your letter of March 8, 1907, duly received.

We understand that you come to us, not as a committee from our employees, but you ask us to arbitrate with an outside party. We understand that, among the things which you ask us to arbitrate, are the following:

First—That we shall agree that, whenever one of our employees is suspended or discharged for a violation of the rules of this company, or a failure on his part to perform his duties, such employee must be reinstated by us if the union says so.

Second—That we shall agree that, whenever one of our employees is dismissed from or loses his membership in the union, we are to be required to discharge him from our service without regard to the fact that he has been a faithful and capable employee.

Third—That we shall agree that every man we hereafter employ must be required to become a member of the union.

The board of directors of this company cannot for a moment entertain the proposition that an employee who has violated our rules, and whose conduct endangers the safety of the public, cannot be suspended or discharged without our asking permission from some outside body.

The board of directors of this company cannot entertain the proposition that if one of our employees violates a rule of some outside body, we must, on this account, discharge him from our service, notwithstanding he has been and is a faithful and competent employee; and

Our board of directors cannot entertain the proposition that we must require all persons whom we hereafter employ to become members of the union, whether they desire so to do or not.

This is objectionable enough, but its evident consequence will be that you will require all old as well as new employees to join. This coercion of old or new men we will not undertake. It would be most unjust to our present employees, and unwisely limit the choice of new men.

The board of directors are clearly of the opinion that to entertain a proposition to agree to such terms as these would be to violate the duty which the board owes to the company and to the public. The safety and convenience of the public absolutely require that the men who operate our cars shall be employed and discharged solely with a view to their being able and willing to promptly and efficiently perform their duties.

The plain English of these demands is as follows:

First—We are not to be allowed to suspend or discharge any of our employees.

Second—You are to be allowed to discharge any of our employees you see fit.

Third—We must not have any employee not a member of your union and subject to your absolute control.

We respectfully decline to consider a proposition leading to such results.

This response is sent by unanimous action of the board of directors had this day.

LOUISVILLE RAILWAY COMPANY,
By T. J. Minary, President.

ANNUAL BANQUET OF THE NEW ENGLAND STREET RAILWAY CLUB

The annual banquet of the New England Street Railway Club will be held at the Hotel Somerset, on Thursday evening, March 28, and a large attendance is expected. Among the after-dinner speakers will be John I. Beggs, Esq., president American Street and Interurban Railway Association, of Milwaukee, Wis.; Hon. George Tate Blackstock, K. C., of Toronto, Can.; Samuel J. Elder, Esq., of Boston, and Rev. Willard Scott, D. D., of Worcester, Mass. The price of tickets is $2.50. They can be purchased from the secretary at 12 Pearl Street, and members are requested to order tickets early so as to make sure of seats. Tickets may be purchased by members for their guests, and this privilege will be allowed until the committee considers that it is being done to such an extent as to exclude members.

The business meeting will be held at 3 o'clock in the afternoon of March 28, at Hotel Somerset, Boston. Balloting for officers will begin at 3:30 o'clock, and the polls will close at 5:30 o'clock. By holding the annual meeting during the afternoon the entire evening can be devoted to the banquet.

MARCH MEETING OF THE AMERICAN SOCIETY OF MECHANICAL ENGINEERS

The American Society of Mechanical Engineers will be addressed on Thursday evening, March 21, by John Lieb, Jr., vice-president of the society. The subject will be "Vesuvius and Pompeii," and will be illustrated by lantern slides from original photographs taken by F. A. Perret, who was in the Vesuvian Observatory during the last eruption, and from photographs taken by Mr. Lieb during a visit to Vesuvius and Pompeii shortly after the eruption. A series of lantern slides, showing the state of the mechanical arts in Pompeii have been especially prepared for this lecture. Through the courtesy of E. Burton Holmes, the well-known travelogue author, a series of original moving pictures of Vesuvius in eruption, and of a flowing stream of lava will be shown by Oscar B. Depue.

The meeting will take place in the auditorium of the Engineering Society's building, at 29 West Thirty-Ninth Street. As this is a subject of general interest it is hoped that the members will bring ladies to the meeting. If members who wish to invite friends will address the secretary, invitations will be sent promptly. Persons who are not members of the society and wish to attend this meeting will receive tickets of admission by addressing the secretary.

INDIANA UNION TRACTION COMPANY EARNS NEARLY TWO MILLIONS

The annual meeting of the directors and stockholders of the Indiana Union Traction Company and its allied companies was held at the home offices of the company in Anderson, March 5. That the year just closed was an unusually profitable one is evidenced by the gratifying report, which shows that the gross earnings for the year were $1,943,101.83; operating expenses, $995,266.25; gross earnings, $947,835.58; fixed charges, taxes, interest and stock dividends, $832,332.75; surplus, $115,502.83. Directors were elected as follows: For the Indiana Union Traction Company, J. Levering Jones, Randall Morgan and H. H. Kingston, of Philadelphia; W. Kelsey and Jacob Schoepf, Cincinnati; George F. McCulloch, Muncie; A. W. Brady, Anderson, and Hugh J. McGowan, Indianapolis. It was announced that the directors would meet in Philadelphia on call to elect the officers for the company. The following officers were elected for the Union Traction Company: Philip Mater, of Muncie, president; E. C. Carpenter, Anderson, vice-president; W. C. Sampson, of Anderson, secretary and treasurer. The same officers were chosen to serve the Indianapolis & Northern Traction Company. For the Muncie, Hartford City & Fort Wayne Traction Company the following officers were elected: J. A. Van Osdel, president; E. C. Carpenter, vice-president; W. C. Sampson, secretary and treasurer.

Improvements and betterments were discussed, but no action taken.

NEW SUBWAYS APPROVED FOR NEW YORK

The Board of Estimate at its meeting, last week, approved the Lexington Avenue subway route, the Bridge subway route and the franchise of the New York Connecting Railway. When the proposed contract for the Lexington Avenue subway came up for consideration, Borough President Color, of Brooklyn, said that he was opposed to the contract. He said that there would be but one bidder—the Interborough Company—under the present conditions. He said that Brooklyn would get no benefit from the subway. The board approved the contract, Mr. Coler, alone, voting against the proposition. The Rapid Transit Commission had already approved of the New York Connecting Railway franchise. The company is to construct a railway under and over certain streets in the boroughs of Brooklyn, Queens and the Bronx, and over Ward's Island and Randall's Island.

The Board of Rapid Transit has made public its proposed contract for the new West Side subway. A public hearing will take place March 25, after which, the specifications must be favorably passed upon by the Board of Estimate and the Corporation Counsel. Like the contract for the Lexington Avenue route, the proposed one provides for bids by section, and for bids for construction alone, or for construction, equipment, and operation together. The most important feature is the alternative route upon which bids will be received, which would form a connection with the present subway at Forty-Second Street and Seventh Avenue.

According to the contract proposed, the new West side subway will begin at the Battery, continue north under Greenwich Street to Morris Street, thence under West Broadway, Washington Square, and Greenwich Avenue to West Eleventh Street; thence under private property to West Twelfth Street and Seventh Avenue, and then under Seventh Avenue to Fortieth Street, where the line will pass under the existing subway at a point near Forty-Third Street and continue north to Central Park West, under that thoroughfare and Eighth Avenue to 149th Street, thence under Macomb's Lane, the Harlem River, 162d Street, and Jerome Avenue to a terminal near Woodlawn Cemetery.

It is proposed that there shall be four tracks from the Battery to 150th Street. The lease is for twenty years, and the road must be in full operation within four years, with a bonus of 1 per cent on every month saved. Advertisements are forbidden in the stations, and all business except news stands. The burden of proof clause, to which the Interborough objected, is retained, making it necessary for the operating company to go to court in order to be freed from directions given it by the Board of Rapid Transit.

Express stations are provided for at Christopher and Murray Streets, and between Thirty-Third and Thirty-Fourth Streets, Fifty-Seventh and Fifty-Eighth Streets, Eighty-Sixth and Eighty-Seventh Streets, 124th and 125th Streets, and 148th and 149th Streets.

It became known Tuesday, March 12, that the contract for the construction of the first section of the so-called bridge loop will be let about April 11, a little more than three weeks hence. The advertisement asking for bids for the construction of the line will appear on Saturday, March 16. Thereafter it will be published twice a week until April 11, when, at noon, the bidding will be declared closed. Under the law, the board has ten days in which to make the award. In any event, there will be a session of the Commission on April 11, and then it will be decided when the bids shall be opened. Conditions under which the bids may be made will be set forth at length in the advertisement. One of them is that a bid, once put in the box for their receipt, may not be withdrawn for correction or other purpose. Each bid must be accompanied by a certified check for $25,000, made payable to the Controller, and the successful bidder must deposit securities to the value of $300,000. Actual work on the construction of the road is to begin within sixty days after the contract is finally signed, and the section indicated is to be finished within twenty-one months. Should the contractor succeed in finishing the work ahead of time, he will receive a bonus of 1 per cent of the amount due him at the time the work is finished. Should he take longer than twenty-one months to complete the work he will have to pay a penalty.

It is reported that the New York, New Haven & Hartford Railroad may bid for the Lexington line, but this on rumor only, the company having made no statement as to its purpose.

MR. BICKNELL ELECTED PRESIDENT OF THE HAVANA COMPANY—WILL GO TO HAVANA TO STUDY CONDITIONS THERE

The changes in the personnel of the Havana Electric Railway Company, forecasted in the Street Railway Journal of March 2, were effected at the meeting of the company held in New York last week, when a new board of directors was elected, comprising Warren B:cknell, of the Cleveland Construction Company; David T. Davis and Robert Mather, of the Rock Island Railway interests; Walter G. Oakman, of the Guarantee Trust Company; James Rattray, San Miguel, Henry Runken, Carlos Zaldo and Frank Steinhart, of Havana. San Miguel is editor of "La Tucha," Carlos Zaldo is president of the Bank of Havana, Henry Runken is president of the banking house of Upham & Company, and Mr. Steinhart is the American Consul at Havana.

The following officers were elected: Warren Bicknell, president; David T. Davis, vice-president, and Mr. Ashley secretary and treasurer.

Mr. Bicknell will go to Havana this week, and will spend about a month there studying conditions governing the operation of the property. He says the company has as yet formed no plans for extensions or improvements other than those that would come about through the natural depreciation of the plant. Mr. Bicknell served for a number of years as president of the Lake Shore Electric Railway Company, which he brought up to a high standard. Since resigning that position he has been president and manager of the Cleveland Construction Company, which has under way some large contracts, principal among which are the Youngstown & Southern and the Cleveland, Ashland & Mansfield Railway lines.

IMPROVEMENTS IN SALT LAKE SYSTEM

The plains for the new car houses and machine shops of the Utah Light & Railway Company, in Salt Lake City, have been carefully revised, and it is expected that ground will be broken early in April for the new buildings. The site chosen is the old exposition block at Fifth South and Seventh East Streets. The car house will face on Seventh East, but there will be also an entrance from Fifth South Street. There are to be sixteen tracks in the car house, divided into four sheds, each with four tracks and each compartment separated by a brick wall, as protection against fire. The car house can accommodate 150 cars, and will be built either of brick or concrete. On the southwestern portion of the block the machine shop, carpenter and paint shops will be erected, all modern in detail and equipped with the latest machinery and tools.

On Fifth South the offices of the operating department and quarters for the men will be erected. This will be a two-story structure; the ground floor will be occupied by the officials, the second floor by the employees. According to present plans it will embrace a gymnasium, a lounging room, shower and tub baths and a small restaurant, where light meals will be served the employees at a minimum cost.

Work on the rehabilitation of the city system, under the new Harriman management, will be undertaken energetically in the spring. Improvements have already been completed on the First, Third and Sixth Street lines, and the line to Wandamere will be next, especially that portion beyond Liberty Park, and it will be in proper condition before the amusement season opens. The same applies to the line to the Salt Palace, work on which is now under way. By November it is expected that almost the entire system will have been renovated. It is the intention to remove all the poles from the middle of the street and suspend the wire from poles erected at the side. This improvement is also made necessary by the fact that the fifty large vestibuled cars to be ordered could not be operated on the lines with the center poles remaining in place.

It is not anticipated that the new power house will be completed for a year yet. This new steam station will be located on the Jordan River, in the Western part of the city, near the present sub-station, where the transmission systems of the Utah Light & Railway Company and the Telluride Power Company are tied in together.

For some time a corps of engineers has been at work running a survey from the city limits to a point in the vicinity of Garfield Beach, on Great Salt Lake, for an interurban line. Evidently it is the intention to build on the lake shore, probably at a point north of Black Rock, an amusement resort of large proportions and with all equipment found at modern, up-to-date places of pastime.

CONCRETE TIES AND RAIL CORRUGATION TO BE INVESTIGATED

The way committee of the American Street and Interurban Engineering Association has issued two question sheets, which are being sent to the members of the association. The committee this year consists of Fred. G. Simmons, chairman, superintendent construction and maintenance and way, Milwaukee Electric Railway & Light Company; Thos. K. Bell, chief engineer, Interstate Railways Company, Philadelphia; C. A. Alderman, chief engineer, Cincinnati Northern Traction Company, Hamilton, Ohio. The letters relate to concrete ties and rail corrugation, and are presented herewith:

CONCRETE RAILWAY TIES

Gentlemen:—It is a well-known fact that the available supply of wood for railway ties is becoming less year by year, and that the cost thereof is increasing in proportion. The question of the future means to be employed in providing substitutes therefore is rapidly becoming an acute one. Numbers of experiments are being made and various materials used. The possibility of using concrete has appealed to many, and experiments with concrete ties are now undoubtedly under way. The committee of the American Street and Interurban Railway Engineering Association having charge of way matters desires to assist all who may require information upon this subject, and is to this end sending out this circular letter with the request that all roads which have been or now are engaged in experiments with concrete ties, kindly notify the committee that they have been or are so doing, with information as to the method of construction used in the manufacture of the tie and the cost thereof, and forward a statement of results obtained and conclusions arrived at on account of these experiments.

If no result has yet been obtained, the committee suggests that a careful record of all phases of the experiments be kept so that the result may be used later for the benefit of all concerned.

Trusting you will be able to assist us, and assuring all that the results obtained will be available to you, we are, respectfully yours, Committee in Charge of Way Matters.

RAIL CORRUGATION

If you have had any experience with the phenomenon commonly called rail corrugations, will you please furnish the following information:

Type of rail affected.

Are different types of rail affected where conditions are similar?

Length of section affected.

Length of time rail was in service before corrugations appeared.

Length from center to center of corrugations.

Depth of corrugations.

Please describe rails most affected, giving the type, weight, manufacturer, date rolled, date laid and composition of rail if possible.

Please describe the track construction, giving the rigidity, drainage, condition of paving and general method of construction, and specify as between track in paved streets and track laid on earth and loose stone or gravel ballast.

Please describe location of corrugations, both on straight tracks and as to inner or outer rails on curves, with degrees of curvature; as to grades and their percentage; as to points where brakes are applied and all other locations tending to indicate a cause. Are opposite rails always corrugated?

Please describe the traffic conditions at points of corrugation, giving frequency of car service, weight, type and speed of cars, type of brake used, type of truck employed, etc.

Please state what remedies have been applied, if any, and what result has been obtained therefrom; also the cost of applying such remedies, if possible.

Please give your general conclusions in the matter and such other information as you may think pertinent.

Replies to both communications should be sent to Fred. G. Simmons, chairman Way committee, Public Service Building, Milwaukee, Wis.

SAN FRANCISCO ARBITRATION AWARD

The board of arbitration that has had the differences between the United Railroads of San Francisco and the employees of that corporation in respect to wages and hours under consideration for several months, filed its various opinions and made its award on Feb. 28. There was an opinion by Chief Justice Beatty by which the carmen were given an increase of wages ranging from 20 to 24 per cent, the great majority of the increases being in the lower percentage. The schedule is based on the hour, and a day's work is fixed at 10 hours. The employees of the other departments, including electricity and construction, are given, as a rule, the increase in wages they asked and an 8-hour day. There is a concurring opinion by Major Frank McLaughlin, in which this arbitrator agrees with Chief Justice Beatty in the matter of the awards, and expresses his individual views in the case. Rev. Peter C. Yorke filed a dissenting opinion, in which he favored giving the carmen a flat rate of $3 for an 8-hour day. In the matter of the other awards he agreed with his associates. Chief Justice Beatty then wrote an opinion in reply to the dissenting views of Mr. Yorke, whereupon the latter presented a second dissenting opinion in response to Mr. Beatty's last paper.

The awards as agreed up by the majority, in detail, are:

Case of the electrical workers—wages. Armature winders and electrical machinists in the power house. Journeymen to receive not less than $4 per day. Apprentices to receive not less than $2.50 per day during their first year. Thereafter, so long as they continue in the employ of the company, their wages to be increased not less than 37½ cents per day as often as once in six months until they equal journeymen's wages. Wages of apprentices in special cases may be more readily advanced at the option of the company.

Journeymen, shopmen and lamp repairers to receive not less than $3.50 per day. Apprentices to receive not less than $2.50 per day during their first year. Thereafter, as long as they continue in the employ of the company, their wages to be increased not less than 25 cents per day as often as once in six months—the company to have the same option to make a more rapid advance in special cases.

No award is made to station construction and wire men, for the reason that the company employs none who are members of the union.

Station operators are paid by the month, and the rates in the different stations have been $80, $85 and $90. These rates are advanced from $80 to $96, $85 to $102, $90 to $108. Each operator is to have one day off in each month, with full pay.

Dynamo tenders and wipers. In each class the wages to be not less than $2.50 per day. No award is made to the underground men, because none are employed by the company.

Foremen linemen to receive not less than $4.50 per day. Journeymen not less than $4 per day. Apprentices to receive not less than $2.50 per day during the first year. Thereafter, so long as they continue in the employ of the company their wages to be increased not less than 37½ cents per day as often as once in six months until they equal journeymen's wages, with the option to the company to make a more rapid advance in special cases.

Car house and truckmen who were members of the union on Sept. 6, 1906: Foremen are to receive not less than $110 per month. Journeymen now paid $2.80 per day to receive not less than $100 per month. Journeymen now paid $2.50 per day to receive not less than $85 per month. All employees in this class to have one day off in each month, with full pay.

With two exceptions, eight hours shall constitute a day's work for all electrical workers. The exceptions are:

First—In the case of the station operators who work upon three shifts during a twenty-four-hour day. The shifts are changed every eight hours, but it appears to be established by the evidence that it is necessary for the safe operation of the stations that the retiring operator shall remain on duty for a time with the operator who takes his place. This extra time is known as the overlap, and has heretofore been one hour. The board is unwilling to wholly set aside this arrangement, and has sought to compensate the operators by an increase in their wages.

Second—In the case of the linemen employed in making repairs as distinct from construction work. The board is satisfied that repair work should be conducted upon the system known as shop to shop, in which the actual working time in a nine-hour day does not materially exceed eight hours.

Upon these conditions a nine-hour day is retained in the case of the linemen engaged in repair work and working shop to shop, and the overlap for the station operators is fixed at a half hour. Men working overtime are to receive time and a half wages up to 12 o'clock midnight; after midnight they are to receive double-time wages. Work on holidays is to be paid for at double-time rates. The following days shall be reckoned as holidays: Sundays, New Year's Day, Admission Day, Thanksgiving Day, Labor Day, Decoration Day, Fourth of July, Christmas Day. When any holiday falls on Sunday, the following Monday shall be considered a holiday. These provisions as to extra pay for overtime do not apply to station operators or car house and truckmen who receive monthly wages, nor to dynamo wipers or dynamo tenders who have heretofore been paid by the month. Transportation to be furnished linemen. This award takes effect and is in force as of the 6th day of September, 1906.

Case of stationary firemen. Wages—Water tenders to receive $3 per day; wipers to receive $2.50 per day. Hours—When a station is operated throughout the twenty-four hours the shifts are to be eight hours, and for each shift a day's wages is to be paid. When a station is operated less than twenty-four hours and upon less than three shifts, time in excess of eight hours shall be reckoned as overtime. All overtime is to be paid for at time-and-a-half rates. All work on holidays shall be reckoned as overtime and compensated accordingly.

Laborers are to receive not less than $2.25 per day during the first month of their employment. After their first month, not less than $2.50 per day. Handy men to receive not less than $2.75 per day. Pavers to receive not less than $3 per day. Night watchmen not less than $2.50 for eight hours. Work on holidays is to be paid for at time and a half rates. Eight hours constitutes a day's work.

The award in the case of platform men for the period between Sept. 6, 1906, and May 1, 1907, is as follows:

For the time within their first year of service, conductors, motormen and gripmen shall receive pay at the rate of 31 cents per hour and for overtime, 37 2-10 per hour.

For the time within their second year of service the same employees shall receive 32 cents per hour, and for overtime 38 4-10 per hour.

For time within their third year or longer years of service, the same employees shall receive 33 cents per hour and for overtime 39 6-10 cents per hour, overtime to be reckoned with the same allowance for leeway heretofore made.

As to the hours, we make no change in the existing arrangements based upon the ten-hour division. This award does not hold after the first day of May next, and after that time the whole subject of hours and wages is left for adjustment to those concerned.

As to the other employees of the company belonging to the Amalgamated Association of Street and Electric Railway Employees of America, Division 205, the evidence is too indefinite to enable us to make the specific award in dollars and cents.

We have agreed that, as there is no positive evidence that the members of the board, other than the carmen, having been compelled to work under conditions with any considerable degree more onerous than before the fire—except the increased cost of living—they shall receive, in addition to the wages they were to receive under the contract, an addition of 15 per cent in all cases. For those who are employed and paid by the day or month, eight hours shall constitute a day's work. While employed and paid by the hour, they are to have only the 15 per cent advance.

This award takes effect and is in force as of the 6th day of September, 1906.

All sums due the men by the terms of these awards shall be payable within sixty days of this date.

In answer to the finding of the arbitration board, Assistant President Thornwell Mullally, of the United Railroads, issued a public statement, presenting the effect of the decision. He said in part: "The United Railroads considers the decision as a sweeping award in favor of the employees. The award calls for a division of back pay among the employees of about $417,000. It calls for a division among the employees of the company of about $1,044,000 a year in addition to the wages now paid, based on the present pay roll, of which additional amount about $319,000 will be divided among the carmen. This total increase means interest at 5 per cent per annum on $20,880,000. This amount will be reduced in some measure when the reconstruction work is completed. The carmen of the United Railroads are now the best paid in the world (except in Butte, Mont., where certain abnormal local conditions prevail). Oakland has recently sought to equal this award. A comparison of the rates will show that it has not done so. The carmen of the United Railroads get a higher average wage than the carmen of the Oakland Traction Company. In March, 1902, the wages of some of the carmen were raised, making the wages of all the carmen employed by the United Railroads higher than those on any similar system in the world. Within one month thereafter the carmen's wages were again raised. The following year the carmen's wages were again raised. In January, 1905, a contract was made with the carmen, running by its terms to May 1, 1907, providing for wages, hours and arbitration. Aug. 26, 1906, the carmen struck. Sept. 6, 1906, the company entered into an agreement for arbitration with the Carmen's Union and certain other unions. Sept. 6, 1906, the carmen returned to work, any increase given by the arbitrators to date from that day. The award effects an increase of 50 per cent in the carmen's wages within the past five years. We believe that the public will consider it more than fair to the employees of the company; we believe the fair-minded employee of the company will consider it as being more in their favor than in favor of the company. Earnest consideration of these facts is asked of the people of San Francisco, who are interested in transportation and whose interests the company and its employees alike should consider."

A NEW COMPANY FOR CHIHUAHUA, MEXICO

A company has been formed at Chihuahua, Mex., composed entirely of local capital, to take over the present horse-car system operated in that city, the electric light and power plant of the Cia Industrial Mexicana and the Mineral Railroad, which runs from Chihuahua to Santa Eulalia. The reported plans of the company include the building of 5 miles of new line in the city proper, the construction of an extension of 10 miles to Nombre de Dios, the conversion of the Mineral Railroad into an electric line, and the enlarging of the Cia Industrial Mexicana power house. Among those interested in the new company are: Hon. Enrique C. Creel, embassador from Mexico to the United States; Maximo Krakauer, of the firm of Krakauer, Zork & Moye, and Juan A. Creel, general manager of the Banca Minero.

THE STRIKE AT PORTSMOUTH, OHIO, FINALLY SETTLED

The strike of the employees of the Portsmouth Street Railway Company, begun two weeks ago, has been settled. The company has agreed to re-employ all the old men within thirty days, the whole controversy to be settled by three disinterested arbitrators. While a few cars were operated at irregular intervals last week not many passengers were carried.

THE SITUATION IN CLEVELAND

President Andrews, of the Cleveland Electric Railway Company, and President Du Pont, of the Municipal Traction Company, have kept steadily at their work in fixing a valuation for the Cleveland properties through the past week, and it is probable that they will arrive at some conclusion within a short time. The valuation of unexpired franchises has proved a hard task, as so many considerations enter into the question. It is said that the valuations are bound to be much higher than was expected. Whether this will have any effect on the plans for operating on a 3-cent fare remains to be seen.

President Du Pont, of the Municipal Traction Company, has intimated that if the Cleveland Electric Railway system is turned over to a holding company he will take steps to improve the down-town terminals. He says that the city has grown too large to expect all lines to terminate at the Public Square. Further, he believes that there should be a subway system for the down-town terminals, in order to facilitate the movement of the cars. Some of the routes, he says, should be so arranged that the cars will have a clear run through. In order to do this he thinks that high-level bridges could be built directly over the present Cuyahoga River viaduct, and that they could be used by the street cars exclusively. This would do away with delays caused by the passage of boats and other things of the kind.

INDIANA, COLUMBUS & EASTERN COMPANY IMPROVEMENTS

Bids are being received by the Indiana, Columbus & Eastern Traction Company for the construction of the London cut-off on the Columbus and Springfield division, work on which will begin early in the spring, and for a number of other improvements on that division. The cut-off will be a single track with one turn-out, 5 miles long, between Lafayette and Summerford, in Madison County, Ohio, and will shorten the main line of the division 7 miles. A. F. Schoepf, superintendent of the Columbus and Springfield division, has been instructed to rejuvenate the division by replacing 20,000 of the ties and reballasting the line. Last year 20,000 ties were replaced on the Columbus end of the division, and with the new work this year the division will be placed in good condition for high-speed running. The capacity of the sub-power station at Brighton, near Springfield, is to be doubled, and a portable sub-station has been ordered for use on the Columbus end. Passenger stations are also to be built at Lafayette and Summerford to accommodate transfer passengers from London, which will cease to be on the main line when the cut-off is in operation. A shuttle or tripper service will be operated around through London. Superintendent Schoepf is preparing a new schedule for limited and local service to be put in effect with the opening of the cut-off. It will reduce the time between Columbus and Springfield 25 minutes on the limited service, and about 22 minutes on the local service. The limited cars will make stops at all the towns on the line but no intermediate stops, and will make the run of 45 miles in an hour and 30 minutes flat. Every alternate hourly car will be a limited. It is possible the local service will continue on its present schedule and will run around by London for the remainder of this year.

PENNSYLVANIA'S REPORT ON ELECTRIC OPERATION

The report of the Pennsylvania Railroad for the year ended Dec. 31, 1906, has just been issued as has also the record of transportation lines owned and operated by and associated with the company, compiled from official data on file with the chief engineer of maintenance of way. The detail figures of operation of the company and its constituents contain little of interest to electric railway interests, except so far as the report of the West Jersey & Sea Shore Railroad may be concerned. The operation of this line by electricity was not begun until the middle of the summer, however. This report shows:

	1906	1905
Gross receipts	$5,206,283	$4,652,405
Operating expenses	3,956,914	3,388,728
Net earnings	$1,249,369	$1,263,677
Other income	40,086	48,667
Total income	$1,289,455	$1,312,344
*Charges	1,014,727	1,251,249
Surplus	$274,728	$61,095

* Includes interest, rentals, dividends and other charges, including extraordinary expenses and extraordinary expenditure funds.

Of especial interest are the remarks of President McCrea in reference to the New York tunnel extension. He said:

"The progress upon the tunnel extension has been quite satisfactory, and while the work under the East River is somewhat slower in progress, that under the Hudson River was pushed forward so successfully that on the 12th of September the laying of one of the tubes was completed through from Weehawken to Manhattan, and on the 9th of October the second tube was in place. The work of lining these tubes with concrete is now under way.

"On the section between Harrison, the point east of Newark, where the tunnel leaves your United New Jersey Division, and the Hudson River, many of the bridges have been constructed, and that over the Hackensack River largely completed, while the excavation on the approach to the Bergen Hill tunnel and in the tunnel itself has made substantial progress. The excavation for the station site in New York between Seventh and Eighth Avenues is practically finished, and the foundations for a number of the columns necessary to support the station and the steel viaducts are being put in place.

"The work under the streets between the North and East Rivers and in Long Island City beyond the East River is about two-thirds finished, and also about one-fourth of the excavation and lining for the four tunnels under the East River.

"By reference to the balance sheet, it will be seen that the amount carried on your books, on account of the tunnel extension, is $28,835,033.26."

After recounting that all of the many and heavy works of enlargement and addition declared in the report of 1902 to be absolutely necessary to the performance of the company's duty to the public have either been completed or are rapidly approaching completion, President McCrea continues:

"There is no question that but for the policy pursued by your management in this direction it would have been impracticable to handle the enormous traffic seeking an outlet over your system; and the wisdom of making the expenditures necessary to accomplish this result has been clearly demonstrated. It must be borne in mind in this connection that in the five years from 1902 to 1907, the tonnage of the main line and branches has increased from about 77,000,000 tons to over 101,000,000 tons, and that of the four grand divisions east of Pittsburg and Erie, which are operated directly by your company, from about 134,000,000 tons to over 172,000,000 tons."

CENTRAL ELECTRIC INTERCHANGEABLE COUPON TICKET AGREEMENT

The Marion, Bluffton & Eastern Traction Company, Bluffton, Ind., has become a member of the Interchangeable Coupon Ticket Agreement, and is accepting coupon tickets on its road. The above company will be known as Company No. 18, taking the number of the Detroit, Monroe & Toledo Short Line, which has just withdrawn from the agreement. The Toledo & Chicago Interurban Traction Company, of Kendalville, Ind., has also become a member, and books will be put on April 1.

POSTAL RATES ON PERIODICALS TO CANADA

The present postal treaty between the United States and Canada expires on May 7 next. The Canadian Government has before it a proposition to increase the rate of postage on periodicals from the United States to such an extent as to render it necessary for American publishers to raise their subscription prices to Canada from 50 to 100 per cent. If Canadian subscribers of the STREET RAILWAY JOURNAL object to such an increase of prices it will be well for them to make known their objections at once to the Canadian postal authorities.

THE MISSISSIPPI VALLEY ELECTRIC RAILWAY COMPANY'S PLANS

The Mississippi Valley Electric Railway Company, which has been incorporated to build an electric railway between Keokuk and Fort Madison, Ia., and Nauvoo, Ill., from there to Carthage, a total of about 46 miles, has secured an option on the Fort Madison Electric Railway, and is negotiating now with the Santa Fe Railway for trackage agreement across the bridges between Niota and Fort Madison. An engineering corps of sixteen are now in the field making the necessary location surveys and requisite franchises have been applied for. The financial arrangements have been perfected for the construction of the project, and the same syndicate will also build a system of waterworks at Nauvoo. Major W. A. Calhoun, of Buffalo, is the consulting engineer for the syndicate.

MINNEAPOLIS COMPANY SEEKS TO RESTRAIN LOW FARE ORDINANCE

The Minneapolis Street Railway Company has secured a temporary restraining order from Judge William Lochren, in the United States Circuit Court, prohibiting the City Council of that city from publishing the recent ordinance passed for the purpose of reducing car fares to six rides for a quarter.

The following statement has been given out by the company in which its side of the affair is given:

The officers and directors have very carefully considered the ordinance recently passed by the Minneapolis City Council and approved by the Mayor, requiring our company to sell six tickets for 25 cents, and in applying to the court for an order restraining the city officials from its enforcement it is proper that the company should give its reasons for declining to accept this ordinance.

Our franchise contracts with the city of Minneapolis give us the legal right to collect a five-cent fare. From 1875 to 1889 the Minneapolis Street Railway Company was operating its system by animal power. At that time electricity began to be talked of as a motive power for street railways, and during the year 1889 considerable agitation arose in the city with reference to changing from animal to electric power. Just prior to this time we had also been urged by the City Council to build several cable lines, and had already begun to do so when we were informed by the City Council that unless we changed our existing system so as to operate by electricity the grant would be made to some other company to construct electric lines in the city.

We urged upon the Council the need of further investigation of the use of electric power as applied to street railways before spending so much money in making the change, and asked that the matter be delayed for a year in order that more thorough tests and development in this new power might be made. The Council, however, insisted that the company should begin at once to change its system, and should within two years not only convert all existing lines, but should also build numerous additional lines, and operate the same by electricity.

The company finally agreed to this and at once began making the change. The system which we then installed was the best known at that time and after making the change we operated with some difficulty for a period of about seven years. This first change was a very expensive matter for the company.

In the meantime the development in electrical equipment changed to such an extent that we found the system we had installed so imperfect and inadequate that we found it necessary to rebuild and reconstruct our entire system. This we did without request from the Council or public discussion or complaint. To-day none of the first equipment and hardly 5 per cent of the trackage first built is in use. In addition to these changes, we have also built new power houses and stations, and have equipped these as well as the entire system, with the most approved and modern appliances.

It is a safe statement to make that there are no better electric cars in the world than those of this company.

The comfort of trainmen has always been given the highest thought and consideration. Conductors are protected from inclement weather by vestibules, and the motorman's cab, warm and roomy, provides him with exclusive quarters, in which he can competently operate his car with perfect comfort to himself and security and safety to the patrons.

Nowhere in the world are the street railway trainmen provided with such modern appliances to insure them comfort in their work as in the Twin Cities.

The area covered by our lines, approximately 55 square miles inside the corporate limits of the city, with a population of 270,000, is very much in excess of that of most cities of equal size throughout the country.

Baltimore, with a population of 650,000, has an area of 30 square miles; Cleveland, with a population of 465,000, has an area of 41 square miles; Milwaukee, with a population of over 300,000, has an area of 23 square miles; Detroit, with over 300,000, has 36 square miles; Cincinnati, with 400,000 population, has 43 miles; Louisville, with 338,000, has 20½ square miles; Kansas City, with 200,000, has 26 square miles; Indianapolis, with 215,000, has 30 square miles.

IMPROVEMENTS IN ATLANTA

The details are now available of the general improvements proposed by the Georgia Railway & Electric Company, of Atlanta, Ga., of which mention has been made before briefly in the STREET RAILWAY JOURNAL. The work planned includes the rebuilding of a considerable portion of the trackage in the city proper, the extension of several city lines, the construction of a new line to Hopeville, and the erection of new car houses and a repair shop. This work it is intended to complete this year.

The most important improvements will be the construction of new car houses at the Fulton County plant. These car houses will be of brick and steel construction and fireproof, with a capacity of sixty cars. The new repair shops will also be fireproof and of the same material and include a blacksmith shop, machine shop, carpenter shop and planing mill. Forty-seven cars will be added to the service, some of which are being built at the Atlanta shops, while others are being built in Cincinnati.

It is expected that the new Hopeville line will also be completed by Aug. 1. It has been decided to cross the tracks of the Atlanta & West Point Railroad between College Park and East Point by an underpass. Rails have been laid from the center of Hapeville to the outskirts of the town, leaving some 2 miles of construction to be done between the outskirts of Hapeville and East Point. Work on this line will be started within thirty days, a large force being employed in the work.

Among the many lines extended will be that of the Capitol Avenue line. This line will be extended from Bass to Haygood Streets, and double-tracked a distance of more than half a mile. The Luckie Street line will be extended to the mills of the Atlanta Steel Hoop Company, a distance of some three-quarters of a mile. The Stewart Avenue line will be extended to Dill Avenue, a distance of more than a mile. This work is now under way. The West Hunter Street line will be entirely rebuilt. Double-tracking of the West Peachtree Stret line will be extended from Pine Stret to North Avenue. This will permit of a 5-minute schedule as soon as completed. The Georgia Avenue line will be double-tracked for a distance of some 2300 ft., which will permit of a 5-minute schedule, rather than the present 10-minute schedule. The Ponce de Leon Avenue line will be rebuilt from Ponce de Leon Springs to Myrtle Street, and this, with the double-tracking of Pine and Jackson Streets will represent new construction to the amount of 7900 ft. The main Decatur line will be double-tracked for a distance of more than a mile. This will mean the complete double-tracking of this line. The South Decatur line will be double-tracked to Bell Street, a distance of some three-quarters of a mile. The line to East Lake Junction will be rebuilt with heavy rail for a distance of over 4 miles. This will make possible the cutting down of the present schedule to the new country houses of the Atlanta Athletic Club and other points from 45 minutes, as at present, to about 30 minutes. The Old Soldiers' Home line will be rebuilt, representing construction work of nearly 2 miles.

PROGRESS ON THE INDIANAPOLIS, CRAWFORDSVILLE & WESTERN TRACTION COMPANY

The power house of the Indianapolis, Crawfordsville & Western Traction Company, located at Crawfordsville, Ind., is completed, and the installation of the machinery is progressing rapidly. The boilers are erected and ready for operation. Steam and electrical machinery is arriving daily. The overhead trolley and feeder line will be finished March 15, and the track will be ready for through operation of cars on June 1, the date set for opening the line. The road will be known as the "Ben Hur Route," consent of the family of Gen. Lew Wallace having been obtained to the use of this name. The two limited cars will probably be named "Ben Hur" and "Messala," and will make the run between Indianapolis and Crawfordsville, 45 miles, in 78 minutes. The annual meeting of the stockholders was held at the company's office, Indianapolis, Tuesday, March 5, and the following directors elected: P. C. Summerville, Eli P. Baker, A. E. Reynolds, C. N. Van Cleave and E. C. Voris, of Crawfordsville; Edward Hawkins, O. P. Ensley, A. M. Glossbrenner, A. A. Barnes and H. A. Mansfield, of Indianapolis; George P. Haywood, of Lafayette; A. A. Swartz, of Jeffersonville; W. O. Ford, of Madison, and A. M. Hewes, of Chicago. The old officers were re-elected, viz.: A. F. Ramsey, of Crawfordsville, president; A. E. Reynolds, of Crawfordsville, vice-president; Edward Hawkins, of Indianapolis, secretary; Oliver P. Ensley, of Indianapolis, treasurer. The Electrical Installation Company, of Chicago, are the engineers and contractors.

WEST SHORE TRACTION COMPANY GETS PERMISSION TO BUILD

The State Railroad Commission has granted permission to the proposed West Shore Traction Company to construct a high-speed electric railway, 25 miles long, from Tompkins Cove down along the Hudson River to the State line at Cartaret, Rockland County, passing through ten villages. The company has a capital of $250,000, and is being promoted by Searing & Company, of New York City, who were the backers of the new Delaware & Eastern Railroad, which was granted authority to construct a line from the Pennsylvania coal fields to Schenectady recently by the State Commission. It is reported that the West Shore Traction Company will extend its line from the State line 15 miles through the State of New Jersey to Jersey City, and will eventually enter New York City through the McAdoo tunnel. G. P. Fall, of 76 William Street, New York, is one of the directors of the company.

RECENT CAR ORDERS

Announcement was made Tuesday, March 12, by the Brooklyn Rapid Transit Company that contracts had just been awarded for 200 new passenger cars for the system at an aggregate cost of $2,000,000. The cars will be evenly divided between surface and elevated lines. The John Stephenson Company, with works at Elizabeth, N. J., will build the hundred surface cars, which will follow the established Brooklyn type, while the contract for the elevated coaches has been divided between the Jewett Car Company, of Newark, Ohio, and the Laconia Car Company, of Laconia, N. H., each building fifty. Delivery on the surface cars will be made in July of the present year, while the elevated cars will come during the late fall, the first shipments being due to arrive in October. Both elevated and surface cars are to be equipped with air brakes. The surface cars also will be equipped with storm-proof vestibules of the latest design. Seating arrangements in the elevated cars will consist of longitudinal seats along the side save in the center of the car, where four transverse benches will be introduced.

The Washington, Baltimore & Annapolis Electric Railway Company has recently placed an order with the J. A. Hanna Company, of Cleveland, of twenty-five heavy interurban cars and fifty-three heavy Baldwin trucks. Nineteen of the cars are 60-ft. exclusive passenger type, four are 54-ft. combination passenger and baggage type, and two are 54-ft. express or locomotive type. The trucks are 90-40 class, that is, 90-in. wheel base and for 40,000-lb. center plate load, and are to be fitted with Standard Steel Works 38-in. steel-tired wheels bolted to cast steel centers. The electrical equipment is General Electric A-603-A motors, and the cars are geared to 75 m. p. h.

THE CLEVELAND, SOUTHWESTERN & COLUMBUS RAILWAY COMPANY

The Cleveland, Southwestern & Columbus Railroad Company, of Cleveland, Ohio, which was incorporated last week with a capital stock of $10,000,000, as has been stated in these columns, will take over the Cleveland & Southwestern Traction, the Cleveland, Ashland & Mansfield, and the Ohio Central Traction properties, with a combined mileage of 207 miles. Of the capital stock of the new company $7,500,000 will be common and $2,500,000 will be 5 per cent preferred. The directors of the company are authorized to issue $10,000,000 twenty-year 5 per cent bonds, with which to take up the stock of the merged companies. In exchange for the Cleveland & Southwestern preferred stock and accumulated dividends $2,000,000 preferred and $200,000 common stock and $200,000 bonds will be given. For the Cleveland & Southwestern common stock $3,000,000 of the new common stock will be given. Cleveland, Ashland & Mansfield bonds will be exchanged for $1,000,000 bonds and $1,000,000 common stock of the new company, while $400,000 preferred stock will be given for the preferred stock of the Ohio Central, and $500,000 common stock for its common stock. For the bonds of the Cleveland & Southwestern, $3,110,000 of the new bonds will be held in escrow, and $400,000 will be held in escrow for the bonds of the Ohio Central.

For the immediate use of the company, $290,000 bonds will be set aside. This will leave $5,000,000 bonds, $100,000 preferred stock, and $2,800,000 common stock to be used in building new road or acquiring roads for future extensions. Nothing has as yet been decided in regard to a Columbus connection. One of the officers said that the company would have all it cared to do in getting the Cleveland, Ashland & Mansfield completed and in working order within the next year, and until that is done they will make no move toward a Columbus connection. The completion of this road will enable the company to reach Bucyrus. F. T. Pomeroy will probably be the president of the new company, and the other officers will be chosen from among the staff of men that have been active in the construction and management of these roads.

STREET RAILWAY PATENTS

[This department is conducted by Rosenbaum & Stockbridge, patent attorneys, 140 Nassau Street, New York.]

UNITED STATES PATENTS ISSUED FEB. 26, 1907

845,188. Railway Signal System; Francis M. Myers, Windsor, Mo. App. filed March 22, 1906. Provides plates spaced along the roadway with which specially constructed spring shoes on the train contact, said shoes having a mechanical connection by which their movement closes a special circuit in the locomotive.

845,220. Block Signal System; Fred. B. Corey, Schenectady, N. Y. App. filed Feb. 16, 1904. A block signal system in which alternating current may be used with its attendant advantages and in which all the advantages of the direct-current system without wires may be obtained.

845,353. Ring for Connecting Wires; Ralph E. Noble, Chicago, Ill. App. filed Sept. 1, 1906. The trolley wires at a switch are hooked into a ring which centers or guides the trolley wheel in passing from one wire to another.

845,265. Automatic Air Brake Coupling for Railway Cars; Frank H. Rutherford, Chicago, Ill. App. filed April 14, 1906. Comprises a body having a plurality of independent continuous passages there through, and valves located within said body for controlling the closure of the passages and movable to a position at an angle to the line of draft of the car.

845,323. Trolley Pole; Charles F. Wensinger, Fremont, Ohio App. filed Oct. 31, 1906. The trolley wheel is pivotally mounted upon a horizontal platform, which is constantly maintained in such horizontal relation by a pair of trolley poles constituting virtually a parallel link motion.

845,335. Motorman's Valve; Fred. B. Corey, Schenectady, N. Y. App. filed March 17, 1906. One feature of the invention relates to valves of the rectilinear reciprocating type. Other details of construction.

845,353. Fluid Pressure Brake System; Maury W. Hibbard, Chicago, Ill. App. filed Feb. 25, 1903. Relates to that class of brake in which the braking pressure is determined by the car load.

845,496. Insulated Rail-Joint; George W. Whiteman, Philadelphia, Pa. App. filed Sept. 14, 1905. The fish-plates are provided with inclined channels or cavities on their inner faces which co-operate with weighted blocks to tightly clamp the rails and at the same time permit longitudinal adjustment.

845,497. Insulated Rail-Joint; George W. Whiteman, Philadelphia, Pa. App. filed April 11, 1906. Relates to modifications of the above.

845,500. Car Brake Apparatus; Robert J. Wilson, Pittsburg, Pa. App. filed Nov. 16, 1905. In order to prevent the severe application of the brakes whenever the train pulls apart, or the train-pipe breaks, the train-pipe or train-pipe connection on each car has a valve which acts automatically upon an excess rush of air out of the train-pipe to throttle said train-pipe, and thus prevent quick reduction of pressure therein.

845,504. Brake-Shoe Adjuster; James S. Ashworth, East St. Louis, Ill. App. filed Sept. 17, 1906. Means for automatically adjusting the brake-shoes to compensate for wear.

845,524. Pleasure Railway; William J. Citron, San Francisco, Cal. App. filed Oct. 1, 1906. A stationary car is vibrated so as to convey the impression of rapid travel to passengers. Means for producing a rumbling sound and moving scenery past the car windows.

845,682. Car Motor; Benson Bidwell, Chicago, Ill. App. filed July 5, 1906. The armature of the motor has a hollow shaft through which air is impelled into the interior of the motor for cooling purposes.

845,683. Signaling System for Electric Railways; Charles P. Breese, Norfolk, Va., and Adoniram J. Wilson, Westfield, N. J. App. filed May 5, 1902. A sectional trolley, each section of which is fed through a relay magnet. The power current is thus utilized for the operation of the block signal apparatus.

845,727. Safety Device for Railroads; Philip Dewitt and Edward J. Clarke, Scranton, Pa. App. filed March 10, 1906 Provides automatic means for simultaneously actuating the locomotive throttle-lever to close the throttle-valve, the engineer's brake valve to apply the air brakes on the train and a whistle or other signal to warn the engineer.

PERSONAL MENTION

MR. F. P. BOAS has recently been appointed superintendent of field work by the Eureka Automatic Signal Company, of Tamaqua, Pa.

MR. ROBERT E. JENKINS, formerly president of the Metropolitan Elevated Railroad Company, of Chicago, Ill., is dead. Mr. Jenkins held many offices of honor and trust in politics and in legal and religious organizations. He was at one time president of the Chicago Law Institute, was treasurer of the Chicago Bar Association for seven years, and was chairman of the Bar Association committee which drafted and secured the passage of the Chicago jury commission law.

MR. A. J. J. PFEIFFER has just been appointed general manager and chief engineer of the Calcutta Tramways Company, Ltd., succeeding in the former position the late Mr. Martyn Wells. Mr. Pfeiffer has had an extended electric railway experience, commencing with the Thomson-Houston Company in this country, and has had charge of the equipment of a number of important roads on the continent of Europe. Mr. Pfeiffer has been connected with the Calcutta system for some time.

MR. L. W. HARRINGTON, who was recently appointed soliciting passenger and freight agent of the Columbus, Delaware & Marion Traction Company, with headquarters at Columbus, Ohio, has had added to his duties the work of acting claim adjuster. Mr. Frank Talmadge, who has the work of claim adjusting for a number of the traction lines entering Columbus, had charge of the Columbus, Delaware & Marion claims, but the company has now decided to have its own officials look after the claims.

MR. JOHN CRAIG HAMMOND, for some time at the head of the publicity department of the Denver Gas & Electric Company, and later associated with the electrical interests of Mr. H. L. Doherty, with headquarters in New York, has now been appointed press representative of the New York Central lines, with headquarters at the Grand Central Station. Mr. Hammond in his new responsibilities will find a large opportunity for his skill, diplomacy and savoir faire as an exponent of the railroad systems' ideals, methods and relations with the public.

MR. CHARLES M. JACOBS, chief engineer of the Hudson Companies, and his assistant, Mr. J. V. Davies, gave a dinner to the men who are actually engaged in building the tunnels under the Hudson, at Sherry's, New York, on Monday, March 11. Besides the engineers, rodmen, walking bosses, draftsmen, drillers and sandhogs, there were present Mr. W. G. Oakman, president of the Hudson Companies; Mr. W. M. Barnum, of the executive committee; Mr. Pliny Fisk, of the Wall Street banking firm which financed the building of the North River tunnels; Mr. Andrew Freedman, and the officials of all the lighting, power and supply companies furnishing material for the tunnel; Chief Engineer Noble, of the Pennsylvania Railroad East River tunnel; Mr. Lincoln Bush, chief engineer of the Lackawanna Railroad, and nearly every man of prominence in tunnel building in and around New York. Chief Engineer Jacobs, Mr. Pliny Fisk, Mr. Wilbur Fisk, Mr. Barnum and President Oakman made speeches. Mr. Jacobs said that trains would be running through the Morton Street tunnel under the North River by Sept. 1.

MR. R. E. HUNT, general superintendent of railways of the Norfolk & Portsmouth Traction Company, of Norfolk, Va., which operates the street railway lines in Norfolk, Portsmouth and Berkley, a line to Ocean View and Old Point Comfort, in connection with its steamer service, the Norfolk & Ocean View Railway and the Norfolk & Atlantic Terminal Company, to Pine Beach and Newport News, Va., in connection with its boat service, has been appointed assistant to President Bancroft, of the Utah Light & Railway Company, of Salt Lake City, Utah, to succeed Mr. F. L. Morse, resigned, who, as noted in the STREET RAILWAY JOURNAL last week, returns to New York. Prior to his connection with the Norfolk & Portsmouth Company, Mr. Hunt was general manager of the Augusta-Aiken Railway & Electric Company, of Augusta, Ga., which owns and operates the Augusta Railway & Electric Company, Augusta-Aiken Railway, North Augusta Electric & Improvement Company, and North Augusta Hotel Company, and before becoming connected with that company was general manager of the Lexington Railway Company, of Lexington, Ky., which operates the railway, electric light, gas and ice plants. Before being appointed general manager at Lexington, Mr. Hunt was identified with both construction and operating work.

MR. J. R. LOVEJOY has been appointed general manager of the sales department of the General Electric Company. Mr. Lovejoy has long been known to the electrical fraternity, and this title is a formal recognition of the responsibilities with which he has practically been charged for the last two or three years. Mr. Lovejoy was born at Columbus, Ohio, in 1863. After a post-graduate course at the Ohio State University, from which he received the degree of B. Sc., he entered the employ of the Thomson-Houston Electric Company, at Lynn, Mass., August, 1886. Here he gained his practical experience and graduated from what was then known as the "Expert Course," to take up engineering work in the Boston office of the company. Later his time was devoted to executive duties at headquarters, and when the Thomson-Houston Company was merged into the General Electric Company, in 1892, he became general manager of the supply department. In 1900 he was made also manager of the railway and lighting departments of the General Electric Company. He is an officer and a director in several subsidiary companies. Mr. Lovejoy is a director and a member of the executive committee of the Schenectady Trust Company, and was one of the organizers of that concern. He is also a member of the American Institute of Electrical Engineers, the Franklin Institute, and the American Society for the Advancement of Science, as well as several organizations pertaining to electrical science. In addition to his diversified duties, Mr. Lovejoy finds time to take an active part in promoting the welfare of the Mohawk Golf Club, of Schenectady, of which he is president. He is also a member of the Mohawk Club, of Schenectady, and the University Club, of New York. For many years Mr. Lovejoy has been interested in the subject of archæology, so far as it is related to implements of the stone age, particularly Indian arrow heads, of which he has made a noted collection. Mr. Lovejoy's home and principal office are still situated, as for several years past, at Schenectady.

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BACK COPIES.—No copies of issues prior to September, 1904, are kept on sale, except in bound volumes.

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NOTICE TO ADVERTISERS

Changes of advertising copy should reach this office by 10 a. m. Monday preceding the date of publication, except the first issue of the month, for which changes of copy should be received two weeks prior to publication date. New advertisements for any issue will be accepted up to noon of Tuesday for the paper dated the following Saturday.

Of this issue of the Street Railway Journal 8500 copies are printed. Total circulation for 1907 to date 98,150 copies, an average of 8179 copies per week.

The News Service of the Street Railway Journal

With this issue the Street Railway Journal has adopted a system of classification of its Construction Notes which, it is believed, will make this information much more readily available than heretofore. The news section of this paper is considered by its editors of the greatest importance, and as much time and energy is put upon this department as upon any other. We have never believed in simply waiting for the news to be sent in. We have gone after it.

While a few news items are published in the early pages of each issue, the department proper consists of the shorter articles with captions in the concluding pages of each issue and of the briefer notes published under the headings of "Construction Notes," "News Notes" and "Financial Notes." A prompt, reliable and complete service in this department costs money as well as a large staff for collecting and editing these notes. The Street Railway Journal possesses the latter, and in the interests of its subscribers has never stinted the former. The great development of the electric railway field during the last few years has naturally brought about an increase in the number of items published each week, and has suggested the adoption of a classification in addition to that already followed. Up to this time the items under the heading "Construction Notes" have been grouped alphabetically by States and then by cities in the State. This arrangement, which has been followed for a great many years, makes it possible for any subscriber who is interested in any particular section of the country to locate readily all of the news items relating to new roads or extensions in any city or State. This arrangement will be continued; in addition, however, and for the convenience of those interested in special portions of the work, a key has been added which will make apparent at a glance the nature of the items. This key provides for three grand classifications, viz.: proposed roads not previously mentioned; additional information regarding new roads; extensions and new equipment for operating roads; the signs are respectively the asterisk, the letter "o" and the dagger. In addition, there will be numerical designations, as follows: (1) for items relating to track and roadway; (2) for items relating to cars, trucks and rolling stock; (3) for power stations and terminals; (4) for car houses and sub-stations, and (5) for parks and amusement enterprises. In short, the new plan combines in one the essentials of both the subject and geographical classifications without any sacrifice of either, and will, it is believed, result in the even more extended use than ever before of that part of the paper devoted to the "News of the Week."

The Electrification of Railways

The literature on the subject of electrification of steam railroads received another important addition in Mr. Stillwell's letter which was published last week, and which seems to clear up in a very satisfactory way the question of relative fuel consumption on steam and electric railways so far as present knowledge permits. It is true that no direct comparison of operating results can be made between electricity and steam under normal trunk-line conditions, because as yet the former power has not been applied to that class of service. For this reason Mr. Stillwell was obliged

to fall back upon the results secured on the Manhattan Elevated Railway, but explains why he considers these figures, when reduced to a ton-mile basis, to be comparable with those which might be expected in trunk line service with 300-mile sections. Of course, the conditions in elevated and trunk line operation are quite different, but a large factor of safety is provided in applying the elevated figures on account of the frequent stops made in the Manhattan service. Against this comparison the steam railroad advocates may claim that the estimate, however favorable to electric operation, is based throughout on a combination of the advantages of single-phase distribution with the favorable conditions of performance actually found in d. c. operation. They may admit the conclusions provided the single-phase system should meet all the expectations of those who are now engaged in its development, but they can very properly say that at the present moment concrete data on the performance and even the construction of big single-phase motors are not generally available. Moreover, when made public, these figures will still involve the uncertainty inseparable to the passing from test conditions to commercial performance. We mention this condition simply on account of the great importance to those who wish to see the single-phase system accepted of issuing promptly all the definite information possible relating to this subject.

Independent of the question of single-phase operation, however, we think that all will agree that electrical conditions are constantly improving. The possibility of direct generation of potentials as high as 15,000 volts in some cases and in others of transmission under commercial conditions at 60,000 volts has introduced economies in this branch of the work alone which were not considered in the comparisons of a few years ago, so that it is not surprising that estimates of the saving from electric operation should grow more optimistic. In the matter of saving fuel, therefore, the electric locomotive may be confidently expected to meet reasonable expectations. Fuel cost, however, is not a relatively large item in the cost of railway service, and any delay which may occur in extending electric operation to trunk lines, in our judgment, will lie elsewhere. The greatest obstacle is partly a lack of general realization of the advantages other than economical possessed by the electric system, but more than this to the heavy cost of equipment. The conditions, as recent events have shown, are not favorable to the issue of new securities. Whether the railroads are over-capitalized or not, and this is denied by those who claim that it would be impossible to duplicate the present properties with the par value of the present obligations, there is no doubt that the security market is in a super-saturated condition. The gain to be accomplished by a change of motive power must be very big and very certain to win the necessary public confidence. A new line can afford to take a bolder stand than one hampered by existing equipment. It is to this class of road, therefore, rather than to the older ones, that we look for immediate demonstration of the full advantages of electric operation, now that some of the more conservative older systems have begun to show the way. Missionary work such as Mr. Stillwell has been doing is a very important factor in putting this work on a proper basis and of establishing the practicability and economy of electric traction.

Electric Locomotives

As might reasonably be expected at this particular time, the discussion at the recent meeting of the New York Railroad Club, which is reported elsewhere in this issue, turned in the main toward the matter of the Woodlawn catastrophe, on which we have already commented. The fact that an electric train was the victim has certainly drawn public attention to the case to an unusual and unfortunate extent. As Mr. Sprague very pertinently intimated, accidents of similar character have often happened and have since occurred in ordinary railroad service. In this instance it is at least an open question whether the track would not have failed had the train been drawn by an ordinary steam locomotive. The calculations of strain which have already been published show that, upon the whole, considering the speeds and forces, an electric locomotive is rather easier on the track than its older rival. But, undeniably, the strains are differently distributed in the two cases, so that the factors of safety must be shifted accordingly to give equal security at the weakest point. The lateral strain due to the lower center of gravity of the electric locomotive as at present built, and the relatively lessened downward component tending to hold the rail in place demand special consideration, even if the computed values show that the factor of safety against shearing is not seriously impaired.

Mr. Vauclain's judgment in such matters is entitled to very great weight, and he touched upon one consideration that seems important in calling attention to the fact that a locomotive, be it steam or electric, takes a curve in a series of broken tangents. No computation of the stresses as static pressure can take account of this condition, although it has a vital bearing on the factors of safety in the track. The problem of safety in heavy electric traction, however, is no more difficult than in case of steam locomotives. In either case the track is the important thing. The ideal railway should have few and slight curves and grades. Curves in particular have been danger spots ever since the beginning of modern transportation, and they are not likely to become the safer as weights and speeds increase, whether through steam or electric operation.

Park Problems

Besides the general discussion of park problems and descriptions of electric railway pleasure resorts which appear from time to time in the STREET RAILWAY JOURNAL, it has been the custom of the publishers of this paper to devote a considerable part of two issues during the early part of the year to this department of electric railroading. For this reason the issue of Feb. 23 was devoted to various articles connected with the construction and management of electric railway pleasure resorts. The subject is continued in this issue by the publication of descriptions of attractive park resorts at Seattle, Trenton and Newark, discussions on some of the problems in park management, and a review of a number of attractions which are offered this year for the entertainment of patrons and which were not described in the issue of four weeks ago.

If a canvass of the sentiments of managers in all parts of the country should be taken in reference to the park ques-

tion, the evidence in favor of creating and maintaining summer parks would be overwhelming. There is no room to doubt the wisdom of making efforts to stimulate pleasure and recreation traffic, but as soon as detailed methods begin to be discussed, great differences in opinion appear. The particulars of park design and operation are entirely unstandardized. We desire, however, in this place to call attention to one or two points in connection with park operation which seem worthy of consideration.

Some interesting and frequently perplexing power distribution questions sometimes present themselves in connection with park business and summer pleasure travel on electric railways. It is the peak load problem over again, but it is a yearly peak that is to be cared for, in addition to the usual daily variations in the station load curve.

In the design of electric railway power stations one of the so-called "necessary evils" is that a considerable portion of the station capacity must lie idle during the greater part of each twenty-four hours in order to have available a sufficient capacity to care for the daily peak. The amount of investment in such apparatus of course varies with the particular case, since the shape of the load curve changes with the requirements of the patronage served. The summer load usually brings about largely the same conditions; that is to say, a considerable additional investment, either in station capacity or feeder copper or both, to care for the annual peaks incident to summer park or pleasure travel. This annual peak, when it exists, may last from two to six months, according to climatic conditions, although it may be balanced to some extent through the year, in many cases, by the loads occasioned by winter weather, such as bad track conditions, electric heaters, etc. But even when the summer and winter total power station peaks balance fairly well, it is rarely the case that the heavy load is distributed in the same manner during the two seasons. In most cases the winter load comes proportionately from all parts of the road, while the load during the summer peak is generally concentrated on the particular parts of the system where parks are served or where pleasure riding is greatest. This means, at the least, that a considerable investment must be made in the trolley feeders which is unnecessary during the winter season, and, in the case of interurban roads served from more than one station, may also require a large investment in power station or sub-station machinery which is non-productive during the greater part of the year.

In cases of high tension alternating-current distribution to rotary converter sub-stations from a central power station, this idle investment in station apparatus, and to some extent in trolley feeder, can be, and in some cases has been, avoided by the use of portable sub-stations. In some instances, where practically no load or very little load exists on these park lines during the winter months, the portable sub-station may be complete in itself, and may be operated during the summer months either on a siding or in a house provided for it near the peak load center of distribution. In other instances, the portable sub-station may be used to increase the capacity of a permanent sub-station whose fixed apparatus is only sufficient to care for the regular winter loads. In this latter case, of course, no saving is made in trolley feeder, which must be sufficient to care for the heaviest loads, and part of the investment is practically idle during the lighter winter loads. Where the portable sub-station is used at a distance from a permanent sub-station, the low-tension copper necessary for distribution from it at short distances during the heavier summer loads can also be used advantageously in many cases for the lighter winter loads on account of the longer low-tension transmission from the nearest fixed sub-station. There would, of course, in this case, be an idle investment in high-tension transmission copper. This investment, however, would usually be small in comparison with that required in the low-tension circuit.

These portable sub-stations, used as described to help out during summer loads at some parts of the system, might be employed to advantage at other points during the winter. They are of particular advantage for such double use where a company operates interurban service as well as local service in intervening cities on its lines. In such case, the winter peaks will occur at the cities, on account of electric heaters, worse track conditions and more frequent stops in the cities, and the sub-stations can be located at these points, while in summer, due to pleasure riding and park loads, the load is more likely to come in a greater proportion on the sub-stations serving interurban loads almost wholly.

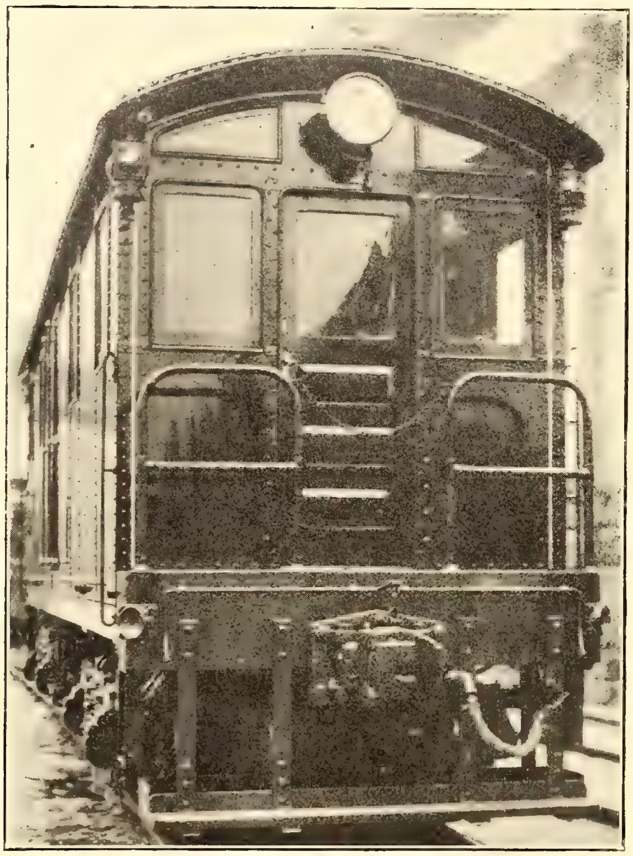
The portable sub-station, which was first designed purely for emergency use to avoid the idle investment which otherwise would be required for spare units in each station, has been found most useful in caring for these annual and semi-occasional peaks, and it may well be considered in planning power distribution systems where such irregularities in the load are expected.

As the labor item is one of the heaviest sources of expense in the operation of a street railway park, any legitimate reduction in it is well worth securing. Obviously, the number of employees on hand should vary with the patronage, and in case regular uniformed men are kept in service all day, regardless of whether the park is largely visited or practically empty, the cost is likely to be very large.

In some towns students can be employed profitably in the late afternoon and evening hours, on Saturdays and Sundays, as well as holidays, in connection with street railway park service. The peak loads of the park usually come at times when the students are relatively free, and in the summer season the balance of the day is generally available for other uses. Students have long found it profitable to work in the summer on trolley cars as motormen or conductors, in summer hotels or in shops. In some cases where a knowledge of boating and swimming is required, vacation work at a street railway park may be thoroughly profitable to both health and pocket. As a general thing, college students make excellent employees in dealing with the public; their address and courtesy are valuable assets, and whether such men are utilized as ticket takers, supervisors of concessions, engineers of steam launches, or caretakers of the property, there is not much doubt of their usefulness to the company, and often at rates which are less than would be required to maintain a regular force at the park throughout the entire week.

ELECTRIC FREIGHT LOCOMOTIVE BUILT BY THE BROOKLYN RAPID TRANSIT COMPANY

The Brooklyn Rapid Transit Company has just completed what is probably the largest electric locomotive thus far built by a city railway. It will be used for hauling as many as twenty standard freight cars from the Bush freight terminal docks and warehouses in South Brooklyn to Coney Island, about 5 miles distant. Although all of the company's freight haulage to Coney Island is over rights of way covered by its steam railroad charters, the steam haulage service has been abandoned to reduce operating and maintenance expenses, besides avoiding any further necessity of operating noisy steam locomotives through a highly-developed suburban territory.

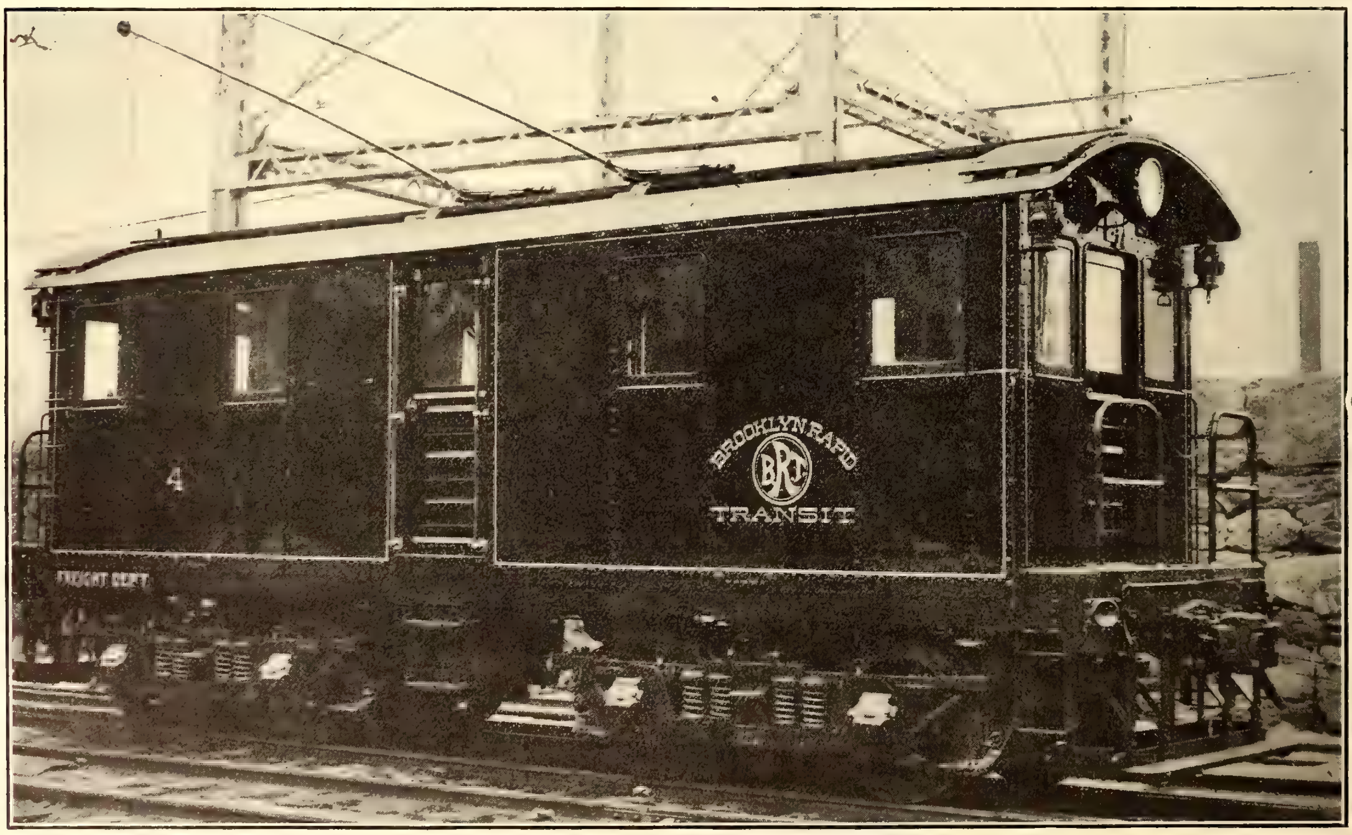


END-ON VIEW OF BROOKLYN FREIGHT LOCOMOTIVE

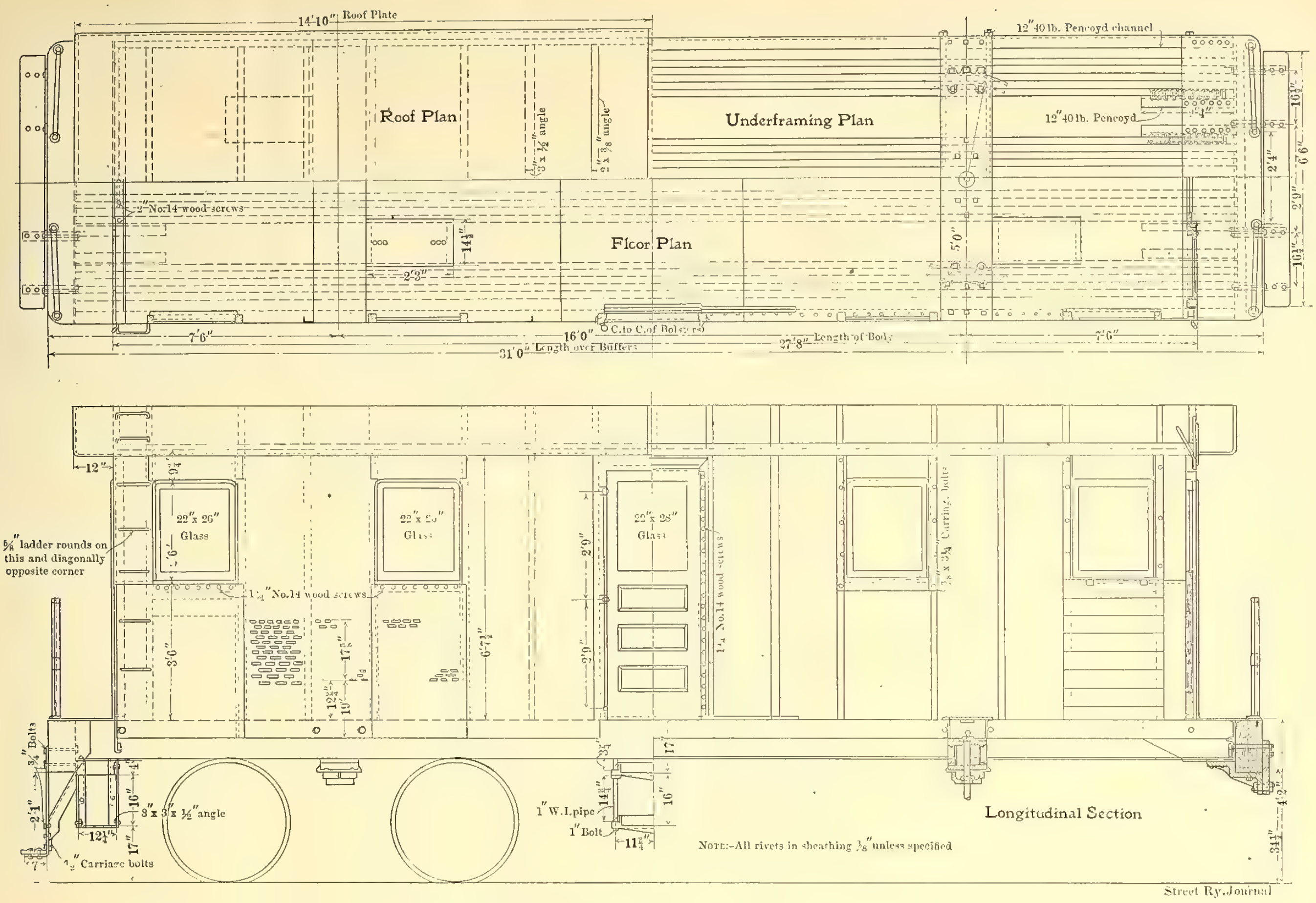
In general appearance the new locomotive is a distinct departure from the sloping-end type, and resembles in exterior appearance the New Haven Railroad's single-phase locomotives for passenger operation. It is 31 ft. long over all and 7 ft. $3\frac{1}{4}$ ins. wide over the side sheathing. The total weight including the apparatus is about 57 tons. The underframe is made up of $2\frac{1}{4}$-in. x 6-in. bar iron used for the double purpose of insuring sufficient strength and adhesion. The bars are fastened at the end by being bolted together with 2-in. rods, the outside bars having a 12-in., 40-lb. Pencoyd channel riveted to it. This channel in turn is riveted to the top and bottom end sill plates.

The side sills are built of 12-in., 40-lb. channels of special Pencoyd section; the end sills consist of $\frac{3}{8}$-in. plates 16 ins. wide, tied to both the side and center sills and protected by a buffer beam made up in sections of 3-in. x 8-in. oak laid on top of each other. The end sills are tied at the top by a $\frac{1}{2}$-in. x 24-in. plate which extends clear across the buffer, and at the bottom by a $\frac{1}{2}$-in. x 16-in. plate. The side and end framing consists of angle iron and No. 10 sheet steel. The latter is also laid on the floor and roof. To prevent all possibility of grounds from contact with the trolley wire, the roof has another covering, consisting of $\frac{5}{8}$-in. whitewood topped with canvas. The body of the locomotive is painted black outside and green inside.

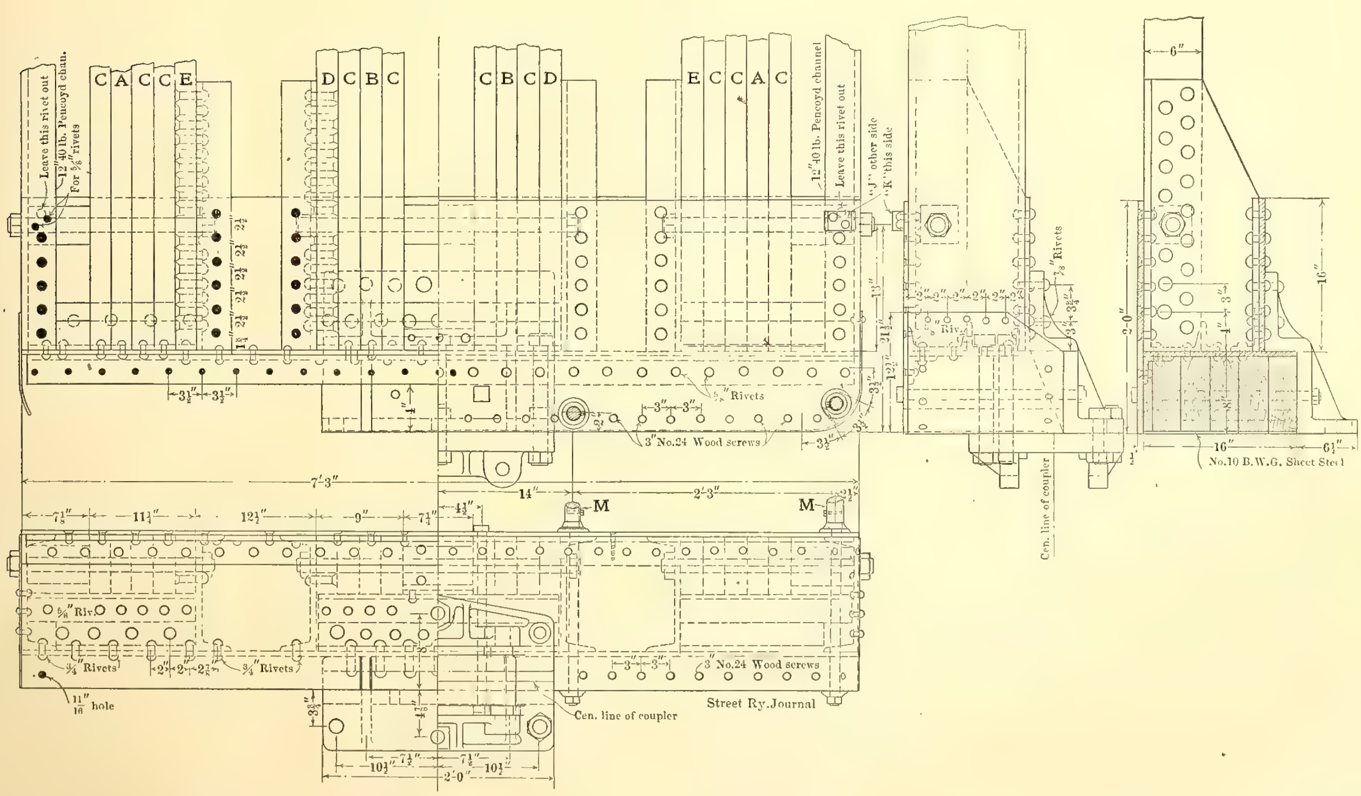
The bolster consists of flat bar steel with a top plate $1\frac{1}{4}$



SIDE VIEW OF THE BROOKLYN RAPID TRANSIT COMPANY'S ELECTRIC FREIGHT LOCOMOTIVE



PLANS AND ELEVATION, SHOWING CONSTRUCTIONAL FEATURES OF BROOKLYN FREIGHT LOCOMOTIVE

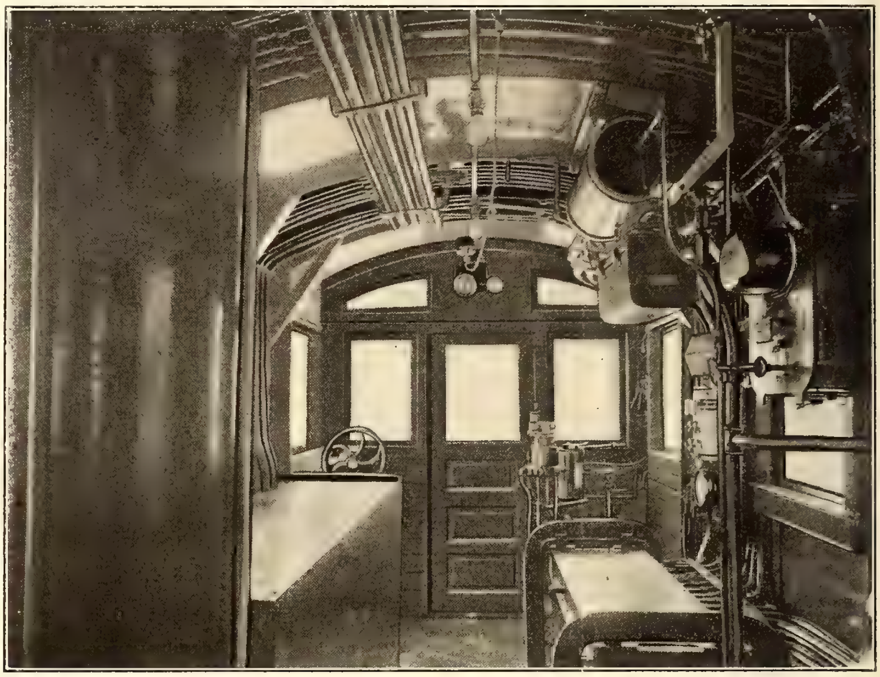


BUFFER ASSEMBLY OF BROOKLYN FREIGHT LOCOMOTIVE

ins. x 12 ins. and a bottom plate 1½ ins. x 12 ins. The filler is not a pressed shape, but consists of a 6-in., 13-lb. channel cut at the ends and reinforced with angle iron. The center plates are of steel and have machined lugs fitting into the bottom of the bolster plate, as well as lugs extending over the sides. Both ends are furnished with Gould automatic couplers No. 870. The locomotive is furnished with a hinged door and two windows at each end and four windows and a sliding center door on each side.

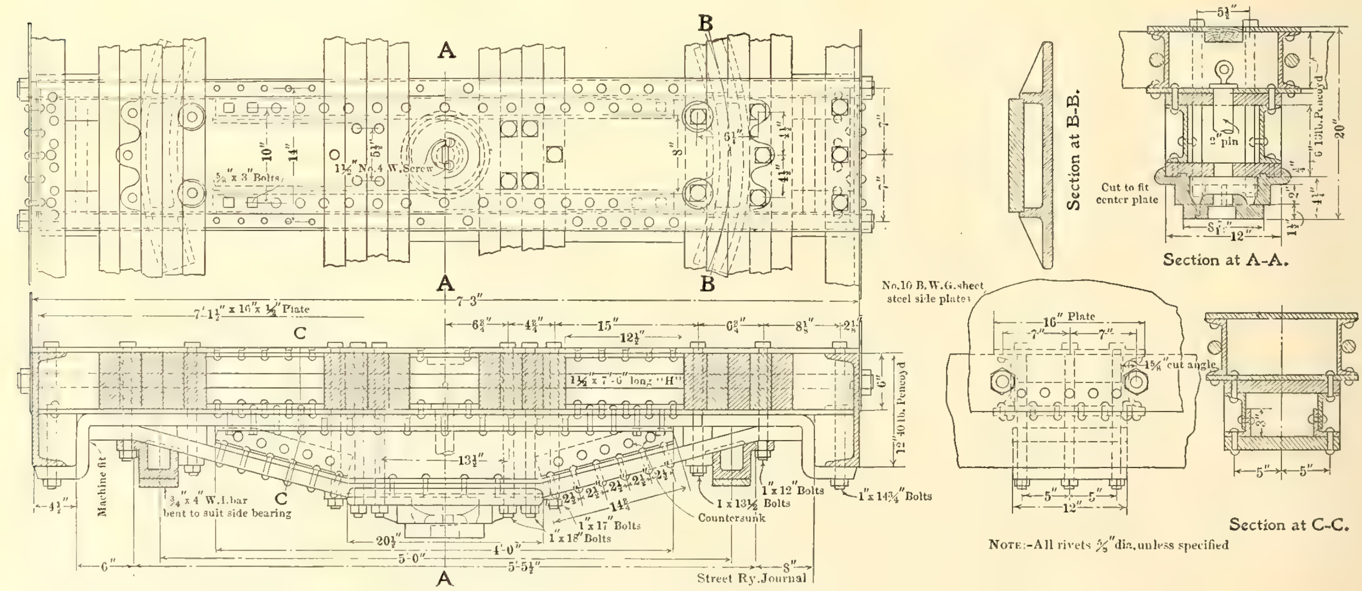
The two trucks are of the Baldwin type with 37-in. diameter steel-tired wheels. The truck wheel base is 5 ft. 10 ins., and the distance between truck centers is 16 ft., which is 1 ft. 6 ins. more than the New Haven locomotive. Each truck carries two 50-B Westinghouse motors rated at 150 hp each and geared 15:54. Two trolley wheels are required to collect the current.

All of the machinery, air reservoirs, etc., except the motor compressor, are placed inside the car. Special precautions were taken to prevent grounds. All suspended material is insulated from the hangers with insulated bolts, and the wires are run in loricated conduits. The motorman's sections, which are in diagonally opposite corners, have a raised floor covered with a rubber mat, and a similar rubber covering will be laid down the center aisle of the locomotive.



INTERIOR OF BROOKLYN LOCOMOTIVE, SHOWING ONE OF THE RESISTANCE BOXES AND STORAGE RESERVOIRS AT THE LEFT, CONTACTOR BOX AT THE RIGHT, SWITCHBOARD, MOTORMAN'S STAND, ETC.

The control system is of the unit-switch 251-A type. Manual control has been retained and the limit switch and line relay omitted because for a great portion of the time the locomotive will be used for switching service. The first notch of the controller gives the "coupling" position when it is intended to move the locomotive a few inches in coupling cars. On this notch two extra resistance frames are inserted; in addition there are seven more series and seven multiple positions. The resistances are mounted on each side of the locomotive, and are enclosed in sheet-iron boxes. They are cooled through slits made in the side of the locomotive. The contactors are also mounted in the car. The reversers and automatic line switch are hung from the angle-iron carlins, and the main line switch is hung on brackets suspended from the ceiling. The two motor cut-outs used in connection with this switch (each for one pair of motors) are hung from the ceiling in metal boxes on opposite sides of the car.

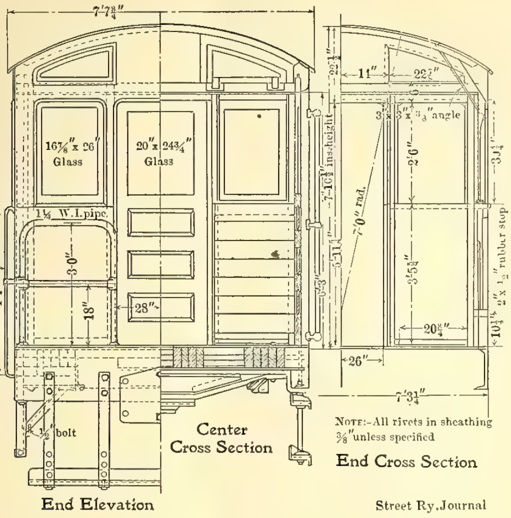


DETAILS OF BOLSTER OF BROOKLYN RAPID TRANSIT COMPANY'S FREIGHT LOCOMOTIVE

There are three main lighting switches and two change-over switches. The former are for the 50-cp headlights, gage and marker lamps, and on the center circuit are five 16-cp. incandescent lamps. One change-over switch changes the marker and gage lights and the other the headlight. These switches are mounted on a side wall panel at one end of the locomotive.

The battery-charging current comes through the compressor motor circuit but no current can flow to the batteries until the energizing of a relay which closes the battery circuit. This prevents the current to the compressor from reaching the battery until the opening surges have been smoothed down. This feature is a change in the practice of the Brooklyn Rapid Transit Company, as the other equipments charge through the lighting circuit.

The air-brake equipment is of the Westinghouse E. T.



END ELEVATIONS AND SECTIONS OF LOCOMOTIVE

graduated release system with a straight-air attachment for the locomotive. This makes it possible to apply brakes on the locomotive alone, which is particularly convenient for switching, while all the automatic features of the brake system are fully retained. The two air storage reservoirs are mounted vertically inside the locomotive near the center. They are 1 ft. 8½ ins. in diameter by 6 ft. 6 ins. in height and have a storage capacity of 14.9 cu. ft. The air is used also for operating the locomotive bell located under the car body, the air whistle at each end, the electro-pneumatic control and the air sander.

From the accompanying half-tone illustrations it will be noted that there are two grab-handles and steps in the center and at each end; side ladders to the roof, and receptacles under each bumper for loose links. These receptacles are made of two steel plates turned up at the sides.

This locomotive was designed by W. E. Johnson, under the direction of W. G. Gove, superintendent of equipment of the Brooklyn Rapid Transit Company.

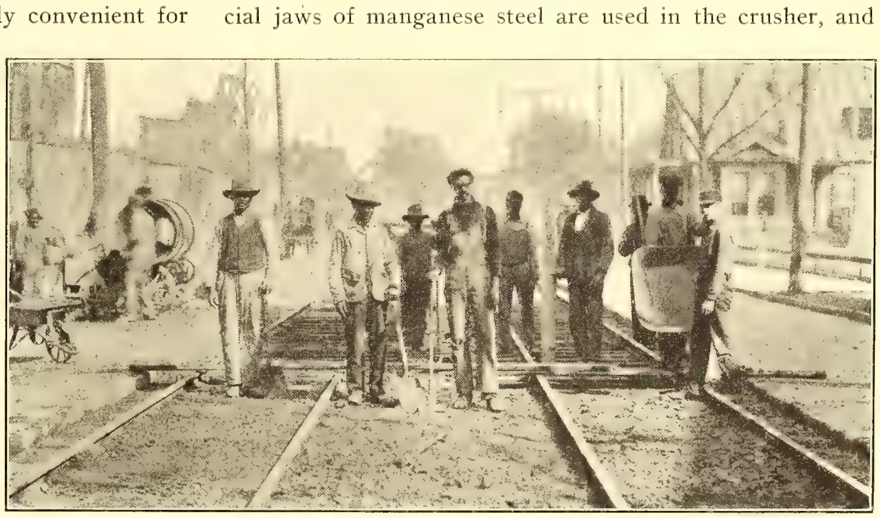
SCHOOL OF RAILWAY ENGINEERING

The University of Illinois has recently organized a School of Railway Engineering with three engineering courses, viz: civil, mechanical and electrical, all arranged especially to provide training for railway service. In addition the department of economics of the College of Literature and Arts has added to its courses of training for business a course in railway administration. In this course special attention is given to corporate and financial organization, economic location and traffic management, including rate making, and to railway accounting and auditing.

It is expected that these courses will prepare men to become efficient workers in the departments of motive power and maintenance of way and in the financial, traffic, and operating departments. In the three engineering courses more than the usual time is given to economics, and the course in administration comprises enough work in engineering to give students an understanding of the technical problems.

TRACK CONSTRUCTION AT HOT SPRINGS

Practically all of the tracks of the Hot Springs Electric Railroad, Hot Springs, Ark., are being reconstructed. In paved streets creosoted ties are laid on a 10-in. bed of crushed stone and the ties are then tamped and the space between them is filled with a soft grout. This grouting sinks through to the lower bed and makes it solid for several inches below the ties. The concreting is carried only to the ends of the ties, as the United States Government, which has charge of the paving in the reservation, places against the ties stone stringers 18 ins. high and 4 ins. thick. All of the space between the stringers is paved with brick laid on a 2-in. cushion of sand. Cement is poured into the cracks between the bricks. The company is fortunate in having an unlimited supply of rock. The bluffs on either side of the main street of the town are composed of "evaculite" rock which is the material from which the Arkansas whetstones are made. All of the rock used in track construction is quarried from property owned by the company on this main street. A steam-driven crusher, together with elevators and storage bins, is located on this property. Because of the flinty nature of the rock special jaws of manganese steel are used in the crusher, and even these are worn out after about one month's use.



TRACK UNDER CONSTRUCTION, SHOWING STONE STRINGERS AT THE OUTSIDE

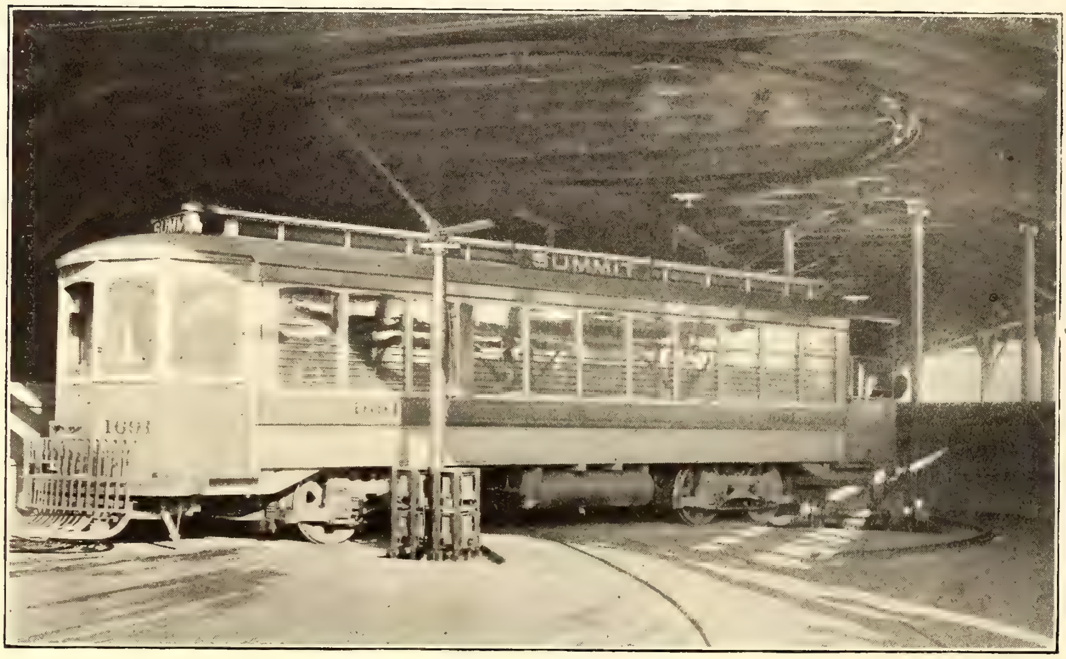
In mixing the concrete an electric portable concrete mixer is used. This was formerly driven by a gasoline engine, but has lately been equipped with a 500-volt motor. The motor and drum are mounted on a two-wheel truck provided with a handle at one end by which it is pulled along as the work advances. The motor, which is of 5-hp capacity, is suspended underneath the top frame. It has reducing gears and drives the drum by a sprocket chain. The mixer is provided with a 200-ft. reel of wire so that the machine may be moved as the work progresses without changing the trolley. Ed. Hardin, superintendent of the system, reports that with the mixer a crew of nine men and a foreman can lay 566 sq. yds. of concrete in nine hours, tamping all the ties. This brings the labor cost down to 2½ to 2¾ cts per yard.

SINGLE ENDING CARS WITH A NOVEL TURN-TABLE AS RECENTLY INSTALLED BY THE PUBLIC SERVICE CORPORATION AT HOBOKEN, N. J.

BY MARTIN SCHREIBER

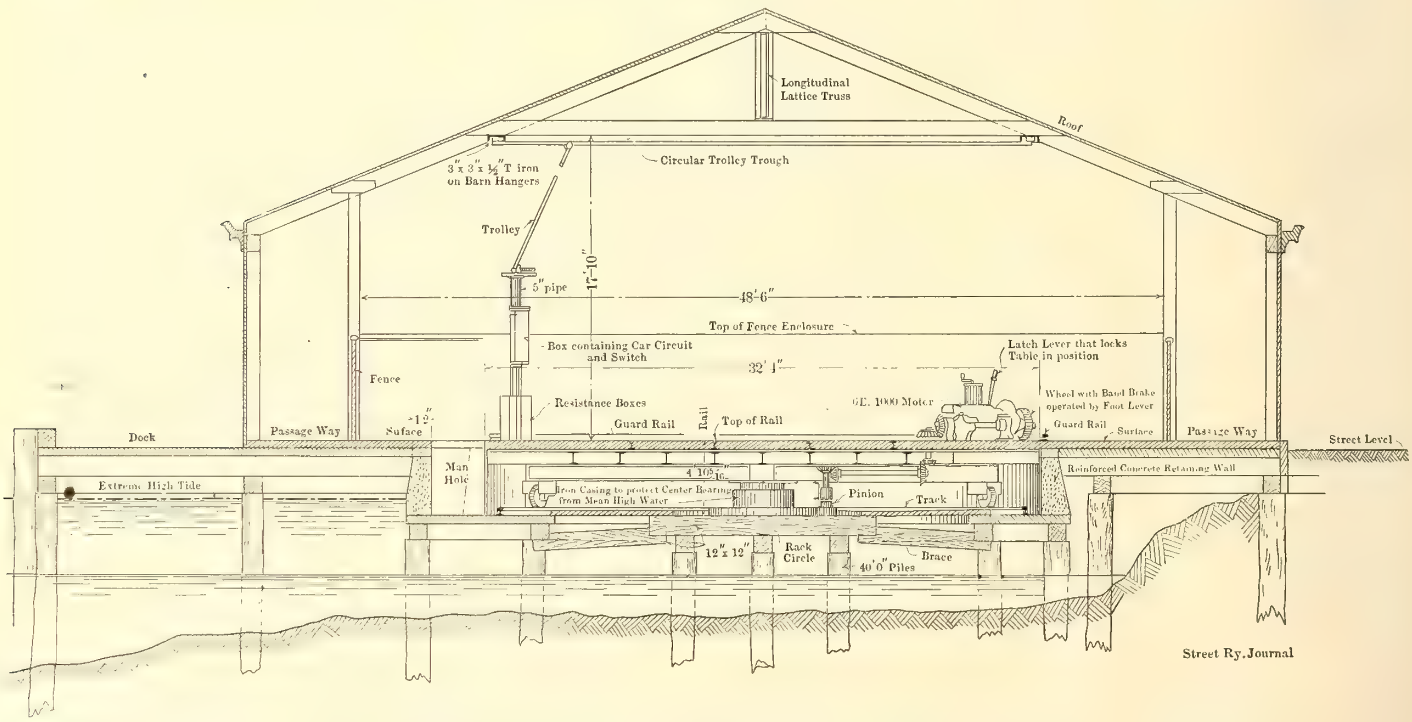
The terminal of a number of lines of the Jersey City, Hoboken & Paterson Street Railway Company is at the Fourteenth Street Ferry, Hoboken, N. J. The lines included are the Union Hill, Bergen Turnpike, Bergenline Avenue, Washington Street, Summit Avenue, North Bergenline Avenue and Willow Avenue. The ferry terminal is the property of the Delaware, Lackawanna & Western Railroad Company, and on account of the peculiar physical conditions it was impossible to install loop tracks that were not objectionable.

The only available space at hand was an area on the dock proper, that has a total width of 60 ft., and part of this space had to be reserved for a passageway for those patronizing the lines to go to and from ferries. On the north side of the fence, as shown in general layout, is a ferry slip, and on the south side of line of approach is a wagonway to the ferry. Neither of these areas could be encroached upon in any way.



VIEW OF CAR ON TURN-TABLE. THE RESISTANCES WILL BE NOTED ON THE LEFT, AND THE OPERATING MECHANISM ON THE RIGHT

After considering several schemes to overcome the situation, the management of the company decided to install a special turn-table, as the ordinary type was not applicable, because in the rush hours it would be necessary to turn three or four cars per minute. The turn-table adopted is electrically-driven, with three sets of tracks crossing at an angle of 60 degs., so arranged that the entering and leaving tracks to the table approach at the same angle. It will be seen that this track layout allows a car to be single-ended by turning the table through only 120 degs.; and also that when the table is in position to receive a car advantage of the same position can be taken to remove one.



CROSS-SECTION OF TURN-TABLE, FOUNDATION AND COVERING, SHOWING PARTICULARLY THE PROTECTION AGAINST HIGH TIDES

The problem was complicated further by the necessity of installing the table on piling. How this was done is shown

in the accompanying section of the foundation as well as of the table proper. The roof over the dock also had to be removed temporarily while the installation of foundation was carried out.

A cluster of sixteen 40-ft. piles was driven to refusal with 12-in. x 12-in. yellow pine capping to form the foundation of the main bearing for the table. Outside of this a ring of forty-two piles was driven in the same manner, with 12-in. x 12-in. capping. On this piling a circular 6-in. plank floor was placed to hold the run-rail of the table. This planking also formed a footing for the reinforced concrete retaining wall as shown.

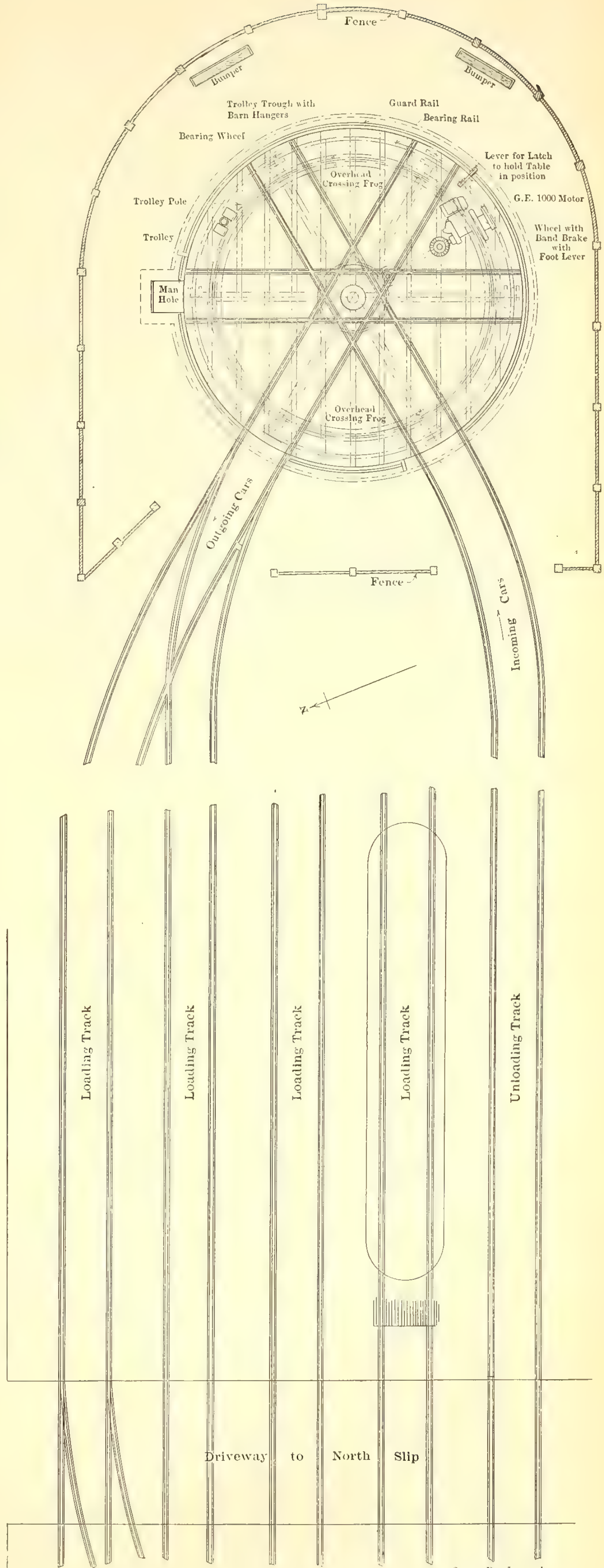
The table was built by the American Bridge Company. It is 32 ft. in diameter and is made up structural steel framing, covered with a ⅜-in. steel plate. It turns on a center bearing and 8-in. pivot resting on three discs, two of them of hardened steel and the center one of phosphor bronze The balance wheels are six in number and run on a circular T-rail fastened to foundation. The gears and pinions of train connecting the motor to the rack circle are of cast steel and the shafting is of hammered steel.

From observations on the site it was ascertained that at high tides the water would rise to within 17 ins. of the floor line. This condition thwarted the original scheme of placing the motor under the table and forced the abandonment of feeding the motor from underneath with a ring and brush arrangement, as is done ordinarily with drawbridges. However, the high water was avoided by placing the motor on top of the table. On account of the number of tracks and allowance for the necessary overhang of the cars it was possible to get barely enough clearance with the motor placed as shown in the illustrations. The center bearing of table was set in a water-tight receptacle made of sheet iron and built in the form of a cylinder.

The motor, which is of the regular G. E.-1000 type as used on the cars, is fed from an overhead wire through a standard trolley pole fixed to a 5-in. pipe. The latter is held by a base casting, bolted to the floor of the table in opposite position between tracks from where the motor is placed. Current is fed into a 3-in. x 3-in. x ¼-in. T-iron, which is bolted by barn hangers to a circular trough attached to the roof trusses. The circular trough is of a radius 2 ft. less than the outside rim of the table. The bottom is made up of two thicknesses of ⅞-in. maple, cut to the required curvature and with overlapping joints, while the sides are of ⅞-in. x 4-in. white pine. A trolley wire is placed directly over the leaving and entering tracks and crosses the T-iron, being snubbed on the roof in the rear. Where the trolley wire crosses the T-iron standard crossings were placed. It was possible to use the regular 90-deg. crossing, as the rail enters on a tangent with a circular trough; then a special crossing had to be placed where the two trolley wires crossed directly over the center of table.

Originally it was intended to operate the motor with a controller on the outside of the table between the entering and leaving tracks, but this idea was given up, as it would have been necessary to reverse the motor, which would have involved the unfavorable condition of having four lead wires from the controller to the motor on the table and four contacts with the trolley. The controller then was placed on the table near the motor, and instead of using the brake that was to be employed on the outside rim of the table, the same purpose was accomplished by using a rim brake on the countershaft of the motor and operating it with a foot lever.

Besides changing the brake it was necessary to reverse the latch that holds the table in the proper position when it



PLAN OF TURN-TABLE AND TRACKS. ALL FOUR LOADING TRACKS ARE PROVIDED WITH ENTRANCE CURVES

is in place for taking or receiving cars. A latch lever also had to be placed near the motor convenient for the operator This is simply a bell crank, the bottom of which rests in a recess on the outside of the table.

The special work used is bolted directly to plate over the I-beams that cross one another in the construction of the table proper; the centerpiece is made up principally of two castings manufactured by the New York Switch & Crossing Company, of Hoboken, N. J. The latter company advises that these castings are the largest ever sent out from its works.

LOADING PLATFORM AND CARS READY FOR THE RACE-TRACK CROWD

The rail in the entire layout, consisting of crossing frogs on the table and special work on the outside of the table, is made up of 80-lb. T-rail with bolted rolled guard. The guard near the extreme edge of table is widened at the throat to make it about 2½ ins. wide.

It will be noted from the general layout that the switches of the trucks on the outside of the table approach the rim very closely. It was impossible to make their radius longer to give them more easement, on account of the necessity of getting as much tangent track as practicable.

To operate the arrangement, it is only necessary, when the table is in place, to run a car directly upon it. The crew of the car remain in their ordinary positions as when on the road. As the crew take a position relative to the bumper block at the head of track, the conductor immediately pulls down his trolley when the signal is given to the man operating the turn-table to revolve it. The table is then turned through 120 degs. The conductor then allows the trolley to return to the wire on outgoing track and gives the go-ahead signal for the motorman.

By actual test this procedure has been accomplished in 20 seconds, and it is expected that with a little practice even this brief time will be greatly reduced to much shorter time, and from trials already made the scheme appears to be very satisfactory.

HANDLING TRAFFIC AT THE HOT SPRINGS RACES

The limited number of cars owned by the Hot Springs Street Railroad, together with the fact that all those people attending the races want to go to the grounds and return to the city at practically the same time, necessitated the adoption of some unusual methods in handling passengers.

At the race track there is a loading yard 800 ft. long by about 125 ft. wide, enclosed in a picket fence 8 ft. high. At one end is built a loading shed 180 ft. long and 35 ft. wide, and from which several gates give entrance to the grounds. The loading yards contain storage tracks for twenty-five cars. All the cars going to the races are put in special service and no fares are collected on them. Instead, the fares are collected as the passengers go through the gates leading into the grounds. At the termination of the races about twenty-five cars are waiting in the loading yard and fares are collected as passengers pass through the gates. Four cars are drawn up to the loading platform at a time and are started out at close intervals. The method has the great advantage of securing all fares without trouble.

ACCIDENT FRAUD RUN DOWN IN PENNSYLVANIA BY CENTRAL PENNSYLVANIA TRACTION COMPANY

The Central Pennsylvania Traction Company, of Harrisburg, has caused the arrest of William Wingrove, a traveling salesman, at his home in York, on a charge of being a party to a conspiracy to defraud the company out of $3,200. This sum was the amount of a claim awarded by the Dauphin County Court as the result of injuries alleged to have been sustained by his wife in a fall from one of the cars belonging to the complainant. The arrest followed the arrest of a witness in the case for the prosecution, who is alleged to have made a confession disclosing the conspiracy.

LOADING YARD AND LAY-OVER TRACK AT THE HOT SPRINGS RACE TRACK

ELECTRICAL NIGHT AT THE NEW YORK RAILROAD CLUB

The third annual electrical night of the New York Railroad Club was held on March 15 in the Engineering Building. Instead of the usual technical paper, President Vreeland announced that a number of electric traction experts and others had been invited to give ten-minute talks on different phases of heavy electric traction.

The first speaker was W. J. Wilgus, vice-president of the New York Central Railroad. Mr. Wilgus' remarks related largely to the recent wreck of an electric train on the New York Central Railroad near Woodlawn. He felt that the true relation of electric power to this catastrophe should be thoroughly known, especially in view of the gross exaggerations and unjust attacks, both in the daily papers and even in some of the technical publications. He said that too much stress had been laid on the lower center of gravity of the electric locomotive. It might not be amiss, he thought, to call attention to the long and careful series of tests which were made with the locomotives of this type before they were placed in regular passenger operation. The original locomotive was tested for over two and one-half years, during which period it covered over 50,000 miles at high speed in all kinds of service and without a single derailment. The thirty-five locomotives finally ordered for the electric zone service were of the same type and were given extended tests at Schenectady and in the New York zone to prove their acceptability before being placed in regular service. One technical feature which he wanted to bring out in connection with the Woodlawn accident was the ignoring by the District Attorney's expert of the effect of the pony trucks in connection with the shearing of the spikes. In conclusion, Mr. Wilgus took up some of the criticisms made in daily papers with reference to the third rail and the non use of overhead construction. He pointed out that there were three reasons why overhead collection was impracticable in the Park Avenue tunnel, through which all trains must go to reach the Grand Central Station. First, the clearance in the tunnel prohibited the overhead construction. The minimum clearance is 2 ins., since the highest car is 14 ft. 10 ins. high and the total height of the tunnel only 15 ft. from the head of the rail. Second, a legislative act prohibits any additions in the way of overhead construction to the Park Avenue viaduct, and any such construction could be stopped by injunction from abutting property owners. Third, and most important, the city of New York absolutely forbids the use of overhead current collection at high voltages.

Geo. Gibbs, chief engineer of electrical traction of the Pennsylvania, New York & Long Island Railroad, then presented some figures on electric traction with special reference to heavy work. He felt that engineers should not be misled by the enthusiasm of the public for electricity. The electric items that go to make up the equipment of an electrified steam road are half the cost only, the rest being made up of the cost of physical changes in the property. In many cases the electrification of long lines would mean doubling the invested capital, and there were very few railroads that could stand such a burden. The present field of electricity he felt was its application to terminals in very large cities, to tunnels, on heavy grades and in mountain districts where water power is available. "Getting there quickly" was a growing vice. Low maximum speed, he said, is a function of safety, and while the higher average speed obtained with electric operation in suburban service is an advantage it is due not so much to high maximum speed as to the great saving during the time of acceleration.

Walter C. Kerr, of Westinghouse, Church, Kerr & Company, then gave a brief talk on the conduct of electrification work. He discussed the different methods that the steam railroads could pursue in taking up the electrification of a part of its system, either by contract or by conducting different parts of the work by a special department of the railroad itself or by engaging a firm of engineer-contractors whose personnel and resources would become a part of the railroad company's organization for the time being. His own experience inclined him to favor the last method, particularly as few individual contractors or railroad companies could afford to get together the complex variety of talent needed.

Frank J. Sprague, the next speaker, said that he would go back further into the history of the electric locomotive than Mr. Wilgus. On May 5, 1903, the New York Central Electric Traction Commission issued preliminary specifications covering electric locomotives to ten domestic and foreign manufatcurers. Ample latitude was given as to the use of either a. c. or d. c., the only material restriction being that they must be capable of use with multiple-unit control in suburban service. It was also requested that the bidding companies should seek the assistance of experienced steam locomotive designers before submitting bids. The maximum speed for the locomotives was placed at 75 m. p. h., and five months were allowed for the construction of a test machine. Bids were received from only one foreign and two American companies, the General Electric and Westinghouse. The General Electric included in its bid a proposal for single-phase repulsion electric motors, which were not seriously considered, but really recommended direct-current gearless locomotives. The Westinghouse submitted no bid for a. c. motors, a description only of gearless locomotives, and also recommended d. c. locomotives, but of the geared type. After careful consideration the commission unanimously decided upon the gearless d. c. locomotive. The center of gravity of this locomotive is 44 ins. above the rails, higher than any other electric locomotive with the same diameter of driving wheels. The d. c. geared locomotive design submitted was similar in many respects to the half-unit type common to single-phase locomotive propositions except that it had four instead of three pair of drivers. In November, 1903, the contract was placed for a trial locomotive; October, 1904, the first test was made, and since then the locomotive in question had covered between 60,000 and 70,000 miles without a derailment. Referring to the Woodlawn accident, he explained that the third rail had nothing to do with the disaster. It was immediately and automatically cut out of service. He also showed that accidents of this character were by no means confined to electric lines by quoting the reports on some dozen which occurred on steam lines within the last two or three weeks. In conclusion he said that, while the exact cause of the Woodlawn accident was still a question, there were enough possible causes for the catastrophe without off-hand assumptions that it was due to the application of electricity as a motive power, and that the latter was entirely unjustified by the known facts.

The next speaker was Theodore Varney, of the Westinghouse Electric & Manufacturing Company. Mr. Varney spoke on the development of catenary line construction, and said that in general his company adopted 22-ft. clearance. Speaking about the New Haven Railroad construction, he said that the signal bridges over which the catenary cables

are carried on insulated supports are placed 300 ft. apart, but that every 2 miles extra heavy bridges are installed to which the catenary cables are anchored. These bridges also carry the circuit breakers.

W. B. Potter, chief engineer of the railway department of the General Electric Company, then gave a brief talk on the responsibilities that confront the designing engineer in heavy electric traction work. He described the experimental track at Schenectady, where many of the test runs on the New York Central locomotive were made, to give some idea of the care taken to insure the reliable working of apparatus before it was turned over to the buyer. He said he had something interesting to tell the members about the experiment of the General Electric Company with gasoline electric cars. The original car which the company had built was for the Delaware & Hudson River Railroad. It weighed 65 tons and had a gasoline consumption of approximately 1 gal. per mile. The success of the early experiments was such that his company has undertaken the development of a car with a steel body, every detail of which is laid out with reference to the use of gasoline as fuel. This car is still incomplete, but it can be stated that, while the carrying capacity is as great as the first, it will weigh only 30 tons, or less than half of the original car; in fact, the engine and generator of the new car weigh no more than the engine of the first one. The pioneer car was capable of a speed of 30 m. p. h. and occasionally of 40 miles. The new car, with its larger capacity engine and lighter weight, will undoubtedly be able to maintain a speed of 50 m. p. h. and quite possibly 60 miles. By reason of the lighter weight the gasoline consumption will not be much more than ½ gal. per mile. The car lighting will be accomplished through a storage battery operated from the exciter which controls the generator voltage. As in the former car the speed will be regulated by varying the voltage of the exciter of the generator, which in turn controls the motor. The advantage of electric transmission is that it permits a speed control with infinite gradations. The air brakes will be operated by a direct connection with the cylinder of the gas engine, which will be tapped at a point on the expansion curve, a certain amount of gas being taken out and a check valve introduced to hold this exhaust gas from the cylinders. This is believed to be more efficient than to use an electric compressor, etc.

Samuel Vauclain, of the Baldwin Locomotive Works, expressed the opinion that the driving wheel diameter of an electric locomotive should be as large as a steam locomotive for the same service. Proportioning the driving wheel for speed accomplishes two things: It avoids the annoyance from heating and it raises the center of gravity. At first it was thought by steam locomotive designers that a high center of gravity was a detriment to high speed, but practice developed that this was not the case. He also referred to the motion of a locomotive called nosing. When this action takes place the higher the center of gravity the less effect will there be upon the track. Another feature that tends to the easement of tracks on curves or bad tangents is that the larger proportion of the steam locomotive is supported on springs and has freedom to roll or move independent of the driving wheels themselves. In an electric locomotive the greater percentage of the total load is carried below the springs and upon the trucks. These two features, namely, high center of gravity and spring support, must be taken care of on the electric locomotive just as on the steam locomotive. In his experience with the designers of an electric locomotive he had often suggested that the motors should be placed in about the same space and position now occupied by the boiler on the steam locomotive, and that the drive should be through a system of rods and levers. This was practicable, as has been demonstrated in the electric locomotives used in the Simplon tunnel. If the arrangement was of this character the number of problems to be settled would be less, for then the experience of steam locomotive designers could be more closely applied to electric locomotive design.

Mr. Wilgus was given the floor again to reply to the points made by Mr. Vauclain. He said that as to nosing, they had had no trouble whatever on curves and only a little at first on tangents. This locomotive had been operated on curves of 2 degs. 17 mins. to 11 and 12 degs., at all kinds of high speeds. During the 2½ years it ran back and forth over the 2-deg. 17-min. curve it had given no indication of nosing, although Mr. Wilgus said he had personally run the locomotive at 77 miles an hour over the curve, which was elevated for a speed of slightly under 60 miles. The early troubles with nosings on tangent track were no different from what he had had with the regular Atlantic type of steam locomotive, but corrective measures were taken before the final acceptance of the locomotive. An instance of what this electric locomotive could do on curves was shown on the occasion when the locomotive was brought to the New York Central yard hauling eight Pullman cars. In passing into the yard it was necessary to coast 1200 ft. over an unelectrified portion of the track on a 1½ per cent grade with a reverse curve of 11½ degs. in one direction and 10 degs. in the other, with two switches and the centers of parallel tracks 14 ft. apart. The locomotive went over this stretch at 30 m. p. h.—very much faster than he would have cared to do with a steam locomotive in the same situation.

Angus Sinclair followed Mr. Wilgus with a few remarks relative to the desirability of electric locomotive designers taking advantage of steam railroad experience. He referred particularly to the change from a low to a high center of gravity.

Mr. Sprague concluded the discussion by saying that there possibly might be changes in electric locomotive design, but that in steam locomotives it was necessary to deal with piston speeds and unbalanced parts. The center of gravity question was not so important in electrical work. There were plenty of cars running in the country with their center of gravity only 16½ ins. above the rail, yet derailment was very rare indeed. The center of gravity of the New York Central locomotive is 44 ins. above the track, that of the New Haven about 55 ins., and that of a standard passenger steam locomotive 72 ins. to 73 ins. He held that the multiple-unit train with its motors distributed on the trucks was the best ultimate solution for high-speed passenger service.

NORUMBEGA PARK FOR 1907

During the fall and winter the Norumbega Park Company (controlled by the Boston Suburban Electric Company) has cleared and beautified a large section of its famous park on the river front. This the company has termed "The River Court," and believes it will meet with the hearty approval of all patrons. Aside from this the company is making some slight changes in the general layout of the park, adding a few small features here and there with an idea to beautifying the park still more.

THE BROADWAY CAR HOUSE OF THE INTERNATIONAL RAILWAY COMPANY

BY THOMAS PUMFREY,
Engineer, International Railway Company

Although the rolling stock of the International Railway Company, of Buffalo, N. Y., has kept pace with its rapidly growing traffic, the company's car house facilities are still inadequate, despite the fact that a new car house at Cold Spring (a description of which was published in the STREET RAILWAY JOURNAL for July 7, 1906) was completed within the past year. It is not surprising, therefore, that the International Railway Company has found it necessary to erect during this year another car house which will hold 108 cars, each 46 ft. long, with an open storage yard along the south side of the building which will accommodate 135 cars, each 46 ft. long, over which an extension of the car house will be built at some future time. The standard city cars of the International Railway are 46 ft. in length. The total capacity of the new station will be 243 cars.

The new structure will be located on the south side of Broadway, east of Bailey Avenue, in the city of Buffalo. It will be used solely for car storage and ordinary inspection work. As this car house is to form an important division headquarters for the Buffalo lines, it will be provided with offices, and trainmen's rooms for the traffic department; also heating plant, storerooms, oil rooms, etc.

GENERAL DIMENSIONS AND TRACK ARRANGEMENTS

The property on which this car house will be located has a total length of 698 ft. 4 ins. fronting on Broadway, with a uniform width of 270 ft. 8 ins. running back to Stone Street. This car house is 561 ft. long and has a total width of 148 ft. It is divided longitudinally into two equal bays each 56 ft. wide, with the offices and storerooms, 32 ft. wide, running along the Broadway front. The car house is divided once in its length by steel rolling fire doors, thereby dividing the building into four sections, so that a fire could be confined to any one section. The driveway from Broadway in the center of the building would allow the ready entrance of fire fighting apparatus to all sections of the building.

Cars will enter the house at the east end, pass over the pits, where they will be inspected and cleaned, and then pass to the storage tracks in the west end of the house ready to send out when needed.

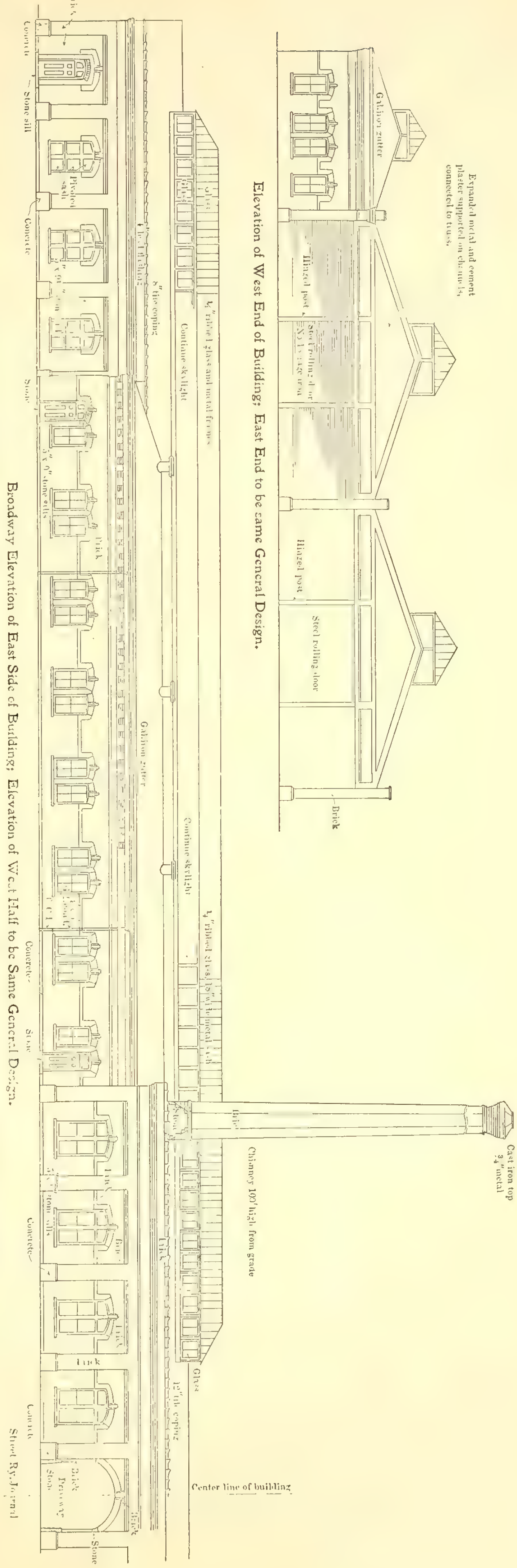
The special work from the street to the property line, also the crossover in Broadway, will all be 9-in. girder work built by the Pennsylvania Steel Company, and will be paved with block stone. All special work on the property will be 60-lb. T-rail guarded, and to be paved with old common stone. The straight rail over the inspection pits will be 9-in. girder rail, Lorain Steel Company's section 94-313. The rail in the west section of the building will be 60-lb. A. S. C. E. T, and that in the storage yard will be old 6-in. girder rail turned backward.

The track throughout the house is level and there is a uniform height of 18 ft. to the bottom of the roof trusses. The track spacing over the pits is 11-ft. centers, that in the west half of building 10-ft. centers, and the storage track in yard 10-ft. 6-in. centers.

CONSTRUCTION FEATURES OF THE CAR HOUSE

All foundation walls are of concrete projecting 6 ins. above grade. Those in the storage half of building are 4 ft. deep, and in the pit end they are 5 ft. and 9 ft. deep. The pit walls, floors and piers are all concrete; also all floors, except

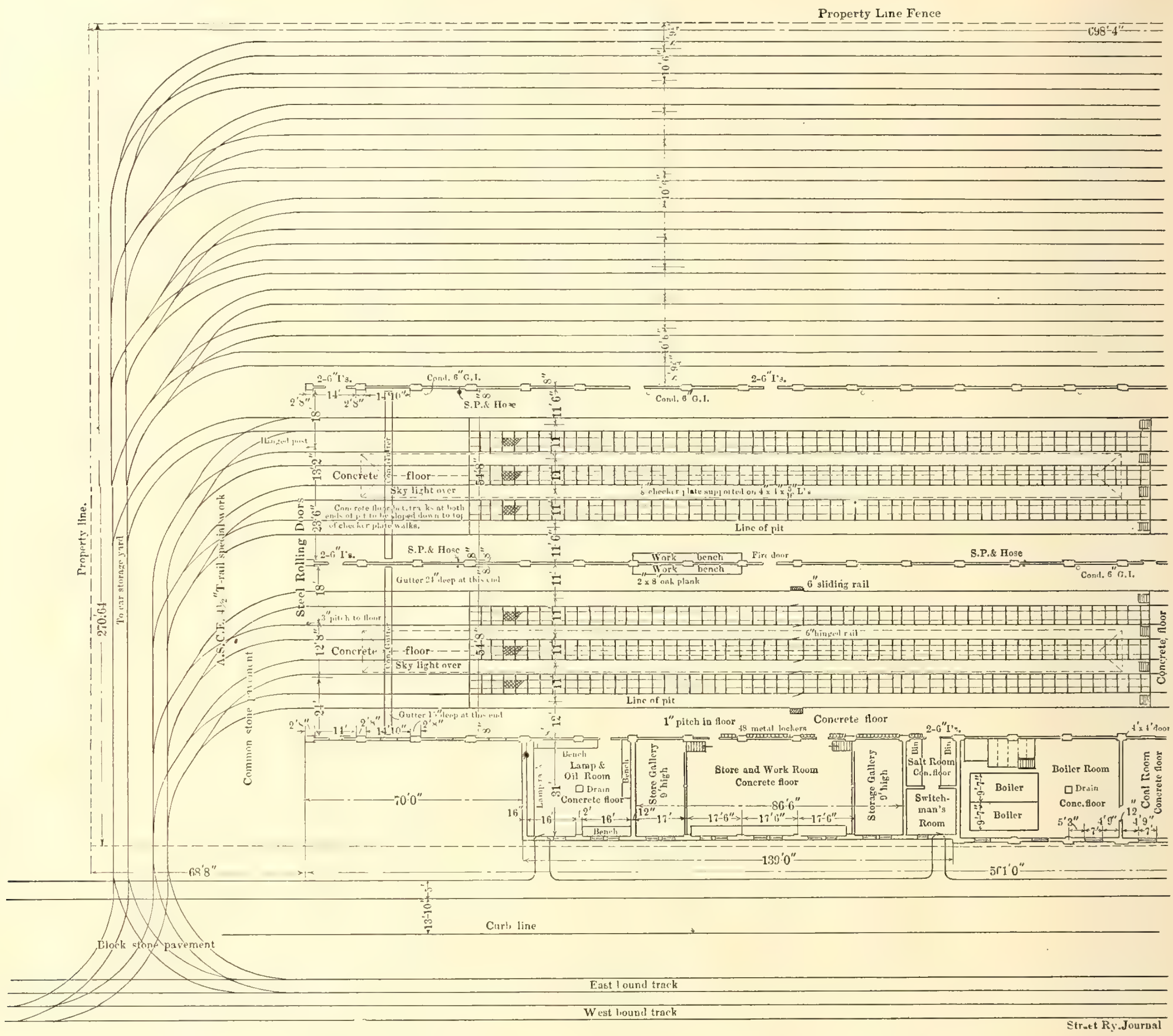
SIDE AND END ELEVATIONS OF THE BROADWAY CAR HOUSE OF THE INTERNATIONAL RAILWAY COMPANY



in office and trainmen's room. The office has a 1⅛-in. maple floor, and the trainmen's room an iron spotted buff brick.

All roof trusses are spaced 17 ft. 6 ins. centers and are carried on brick piers 2 ft. x 2 ft. 8 ins. in size. These piers all have cap stones and two binder blocks 12 ins. thick. The brick wall between the piers is 8 ins. thick and all dividing walls are carried up as fire walls 3 ft. above light. All sash in sides are pivoted and operated in groups from the side walls near the floor.

Lighting and ventilating car houses by means of a lantern skylight has been found very satisfactory, the car house being well lighted with practically no dark corners. The general lighting of the car house at night is with six 50-cp incandescent lamps placed on the bottom of each truss and controlled from a switch box on the side walls of the



PLAN SHOWING THE TRACK ARRANGEMENT IN THE BROADWAY CAR HOUSE AND STORAGE YARD OF THE INTERNATIONAL TRACTION COMPANY, BUFFALO, N. Y.

the roof and capped with 8-in. glazed tile coping. The brick used in wall and pier construction throughout the building is a first quality red shale.

The roof construction is with 6-in. x 12-in. and 4-in. x 12-in. yellow pine purlins, and 2-in. matched hemlock roof plank with a roofing of five-ply felt and ¼ in. of actinolite. The gable ends of building, also gables over steel rolling doors in center of building, are filled in with expanded metal and cement plaster 1 in. thick. The lantern skylights on the roof are all made with structural iron frames covered with No. 24 galvanized iron; the glass is ¼-in. ribbed in sheets 18 ins. wide by the full length of side pitch of sky-building. All lighting wires are run in metal conduit and lamps hung with condulets.

The building is enclosed at each end and divided in the center by steel rolling doors made by Kinnear Manufacturing Company, of Columbus, Ohio. These doors vary in width from 14 ft. to 28 ft. and are 15 ft. high. They are fitted at top with trolley wire hangers which allow the car to enter or leave the building without removing the pole from the wire. Each set of doors across the building at the two ends and in the center are raised and lowered by a 3-hp motor, each door being raised by a friction clutch and a forged link chain.

DRAINAGE AND WATER SUPPLY

All conductors for roof drainage will be standard 6-in. cast-iron pipe fitted at top with copper heads and wire strainers; at the bottom and below floor they will connect with a tile drain running along the foundation wall from each end of the center of building, where they connect into a 15-in. tile drain which empties into the Broadway sewer. This 15-in. tile drain has been kept low enough to take care of the pit drainage in any future extension of the building.

The drainage of the floor of the car house and of the large inspection pits is by grading the floors to a concrete gutter 12 ins. wide across the pits and car house floor. This gutter is connected at one end to the sewer by means of 4-in. iron pipe projecting 4 ins. above the bottom of the gutter, thus allowing all dirt to settle and only the water carried into the drains.

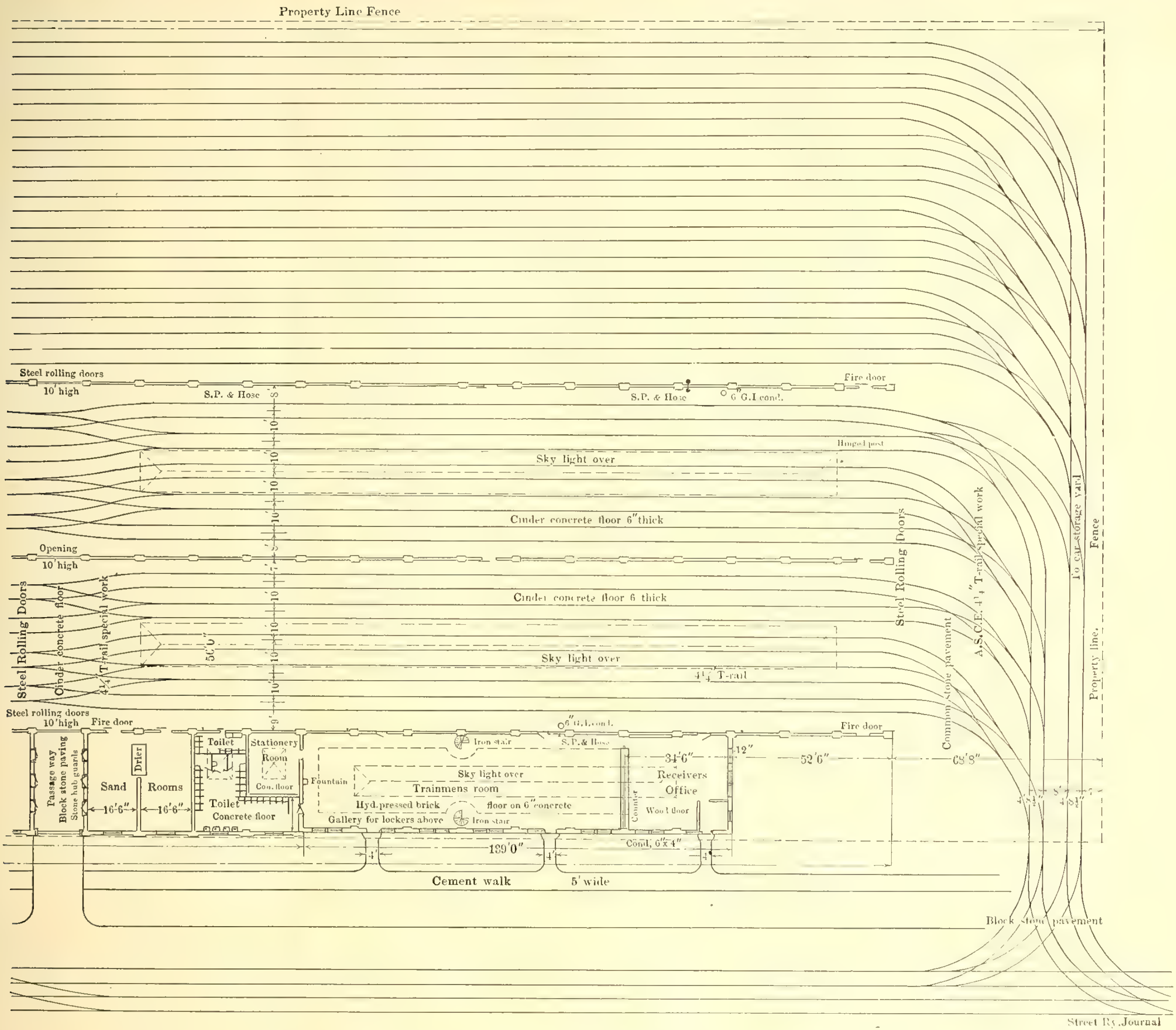
The trench is covered with ½-in. perforated wrought-iron plates in long sections. There are small concrete catch basins with wrought-iron covers in the oil room, boiler room, pump pit and toilet rooms. All drains under the inspection pits or office and work rooms are of cast iron.

The sewer from toilet rooms has a separate connection to the street sewer with a 10-in. cast-iron pipe, the inner end of the 10-in. sewer coming up to the floor of the toilet room and covered with a brass floor plate. The trap outside of the building is placed in a concrete manhole, thus making it very easy to clean the sewer if ever necessary.

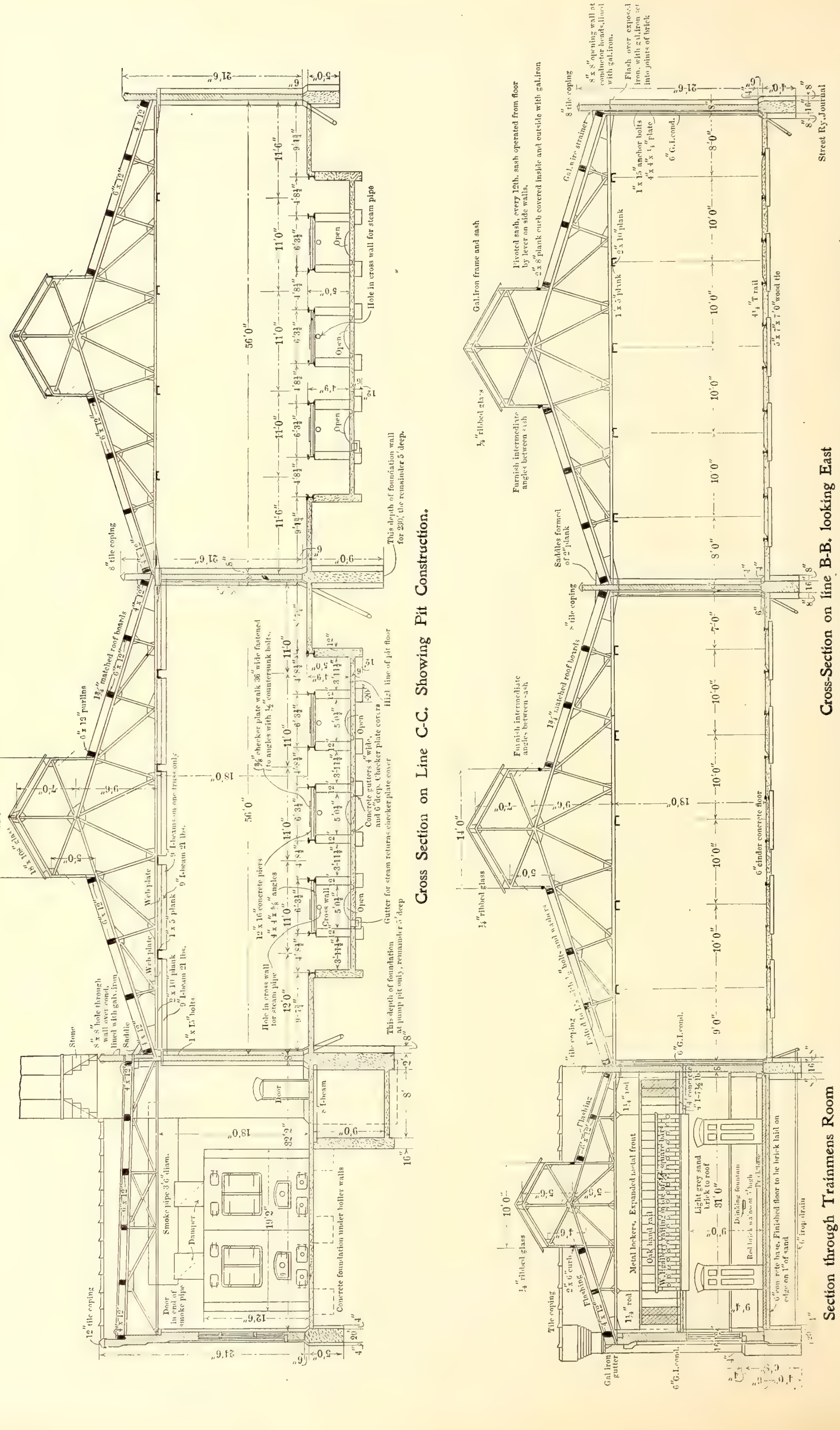
The toilet fixtures are more substantial and better ventilated than those usually found in a car house. All fixtures are Mott's Colonial earthenware. The closets have no wooden seats and are set up in three ranges of seven, five and three; each range has a ventilating extension with a 14-in. pipe carried up above the roof and fitted with a globe ventilator. There are two urinals 16 ft. and 8 ft. long respectively. All partitions between closets and urinals are of iron, painted.

There are four separate wash basins, each 18½ ins. x 24 ins., also two blue enameled sinks and one earthenware slop sink. In the east end of the trainmen's room will be placed a porcelain drinking fountain with crystal stream nozzle; with this nozzle it will not be necessary to use cups.

The city water main in Broadway is tapped twice, once



PLAN SHOWING THE TRACK ARRANGEMENT IN THE BROADWAY CAR HOUSE AND STORAGE YARD OF THE INTERNATIONAL TRACTION COMPANY, BUFFALO, N. Y.—(CONTINUED)



Cross Section on Line C-C. Showing Pit Construction.

Section through Trainmens Room

Cross-Section on line B-B. looking East

TWO SECTIONS OF THE BROADWAY CAR HOUSE OF THE INTERNATIONAL TRACTION COMPANY, BUFFALO, N. Y., SHOWING TYPE OF CONSTRUCTION, PRINCIPAL DIMENSIONS, ETC.

with a 2-in. pipe for general purposes and with a 4-in. pipe exclusively for fire purposes. The 2-in. pipe takes care of the toilet room, boiler room and car washing. The 4-in. supplies all fire hydrants, of which there are four in each section of the car house, two in trainmen's room, one in boiler room and one in the storeroom.

These standpipes are of 2-in. wrought-iron pipe, galvanized and fitted with Chicago hose valves and 50 ft. of unlined linen hose on an improved hose reel.

PIT CONSTRUCTION

The pits are what is known as open construction, it being possible to pass from under one track to another. They vary in depth from 4 ft. 9 ins. to 5 ft. below top of the rail. The walls are concrete, 12 ins. thick, and the piers concrete, 12 ins. x 16 ins. in size with an extra width for footing of 6 ins. all around.

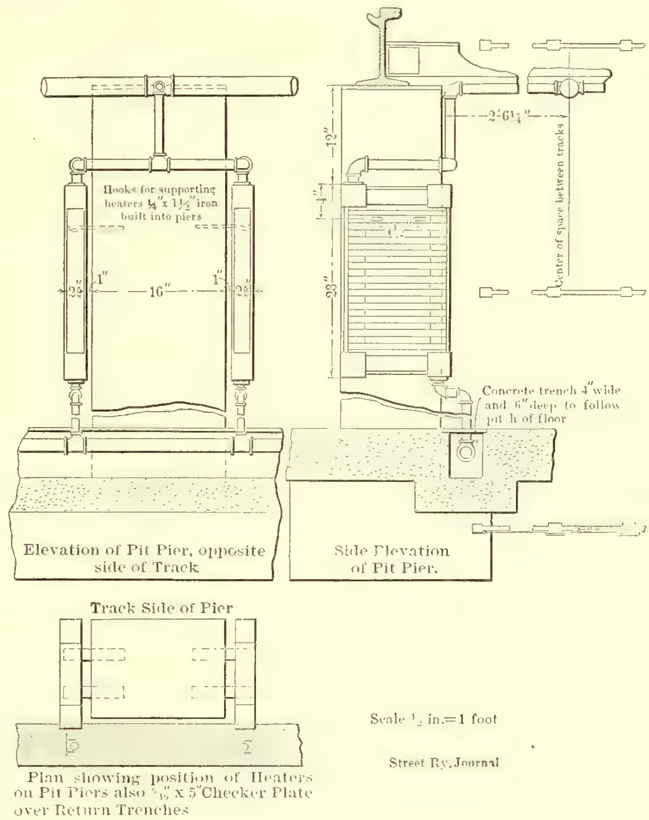
There are placed in these piers anchor bolts for holding the rail down, hooks for supporting the radiators, ¾-in. conduit for running lighting wires through, and ½-in. twisted steel rod in each corner of pier. The rail is supported directly on top of piers, and the walk between tracks is made with ⅜-in. checker plate 36 ins. wide, supported on 4-in. x 4-in. x 5-16-in. angles attached to the rail, the walk being 4 ins. below top of rail.

The pits are heated by placing on two sides of each pier a Colonial wall radiator of 7 sq. ft. heating surface; these are supplied by steam mains carried under the checker plate walk. The return pipes carrying condensation from the heaters are placed in 4-in. x 6-in. concrete trenches at the back of the piers. These trenches are covered with ¼-in. checker plate.

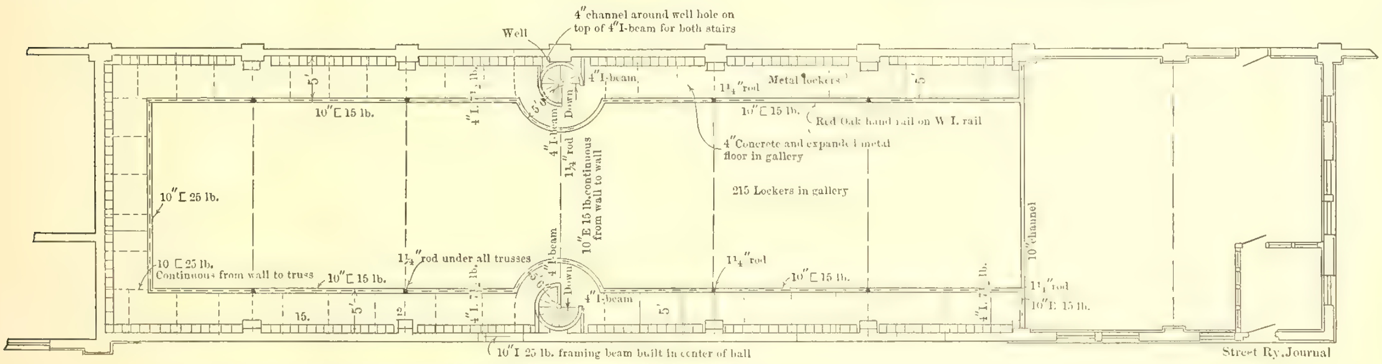
The lighting of the pits is secured by placing a 16-cp lamp on two sides of pier above the heaters and below the rail base. All wires are lead-covered, run in ¾-in. conduit through piers to cast-iron junction boxes in the floor at various points where they connect and then run to switch boxes on brick wall of car house above the main floor. Access to the pits is by steps at each end of each track made with ½-in. plate stringers and checker-plate treads.

HEATING PLANT

Steam for heating the pits, offices and work rooms and for drying sand is supplied from a boiler plant consisting of two 120-hp boilers which can be used separately or together, as the severity of the weather demands. All condensation is returned to the boilers by two pumps located in a pump room 9 ft. below the boiler room floor; fresh water is also supplied to the boilers through these pumps. A brick chimney for the boilers is conveniently located, being octagon in shape, 3 ft. 6 ins. diameter and 100 ft. high,



DETAIL OF PIT HEATERS



PLAN OF MEZZANINE FLOOR OR LOCKER GALLERY IN THE BROADWAY CAR HOUSE

Water supply for car washing over pits is arranged for by placing five ¾-in. hose connections across each end of pit and across the center brought up alongside the piers to the top of the rail.

About the center of each pit will be placed 6-in. hinged rails in each track to allow the ready removal of wheels, armatures, etc., these being lowered by using telescopic hydraulic motor lifts. Directly over these hinged sections of track a 1½-in. ton electric hoist will operate on the bottom of a roof truss which has been reinforced for carrying the extra load. This hoist will be used to carry heavy material to any track on which cars are being repaired.

partly lined with fire brick and fitted outside with ladder, cast-iron cap and lightning conductor. The coal is delivered by team or car to the coal room located directly in front of the boilers. The steam mains for the trainmen's room, etc., are suspended from the bottom of the roof trusses and insulated therefrom.

STOREROOM

A storeroom 32 ft. x 86 ft. in size has been conveniently located to the inspection pits and will be used for a workroom and storage for repair material.

There are also two galleries, one at each end of the room, used for storing sash, stops and other materials which are

used on the cars only in winter. These galleries are reached by an iron stairway. There are also placed near this room forty-eight metal lockers made by Merritt & Company, of Philadelphia, which will be used by the repair men. A small direct-driven lathe will be placed in this room for the truing of armature, axles, etc.

The oil room has been placed near the east end of the building on the Broadway front and is thoroughly fireproofed. It is to be fitted with metal lamp racks and barrel stands; also a testing apparatus for electric headlights.

Sand will be delivered either by car or team to the wet sand room located near the center of the building, and dried by a steam coil drier made of about 2000 ft. of 1-in. pipe run at boiler pressure, the dry sand being stored in a room provided for that purpose where shown. This drier will be taken care of by the fireman who tends the boilers.

OFFICERS' AND TRAINMEN'S QUARTERS

As this car house will form an important division headquarters, accommodation has been provided for a division superintendent's, receiver's and trainmen's quarters. The division superintendent's office is 10 ft. x 10 ft. in size, located in one corner of the receivers' office, where all cars leaving or entering the house or operating on Broadway can be watched. The receiver's office is 31 ft. x 34 ft. in size.

The partition dividing the receiver's office and trainmen's room is built of brick under the counter. This counter is of white Carrara glass, 3 ft. wide x 27 ft. long and 2 ins. thick. Above the counter a wrought-iron grille is placed having a total height of 9 ft. above the floor. Under the counter are placed money drawers, stationery cupboards, etc. A large cabinet for the storage of one week's supply of transfers is conveniently placed along the south wall of this office, the main supply of transfers and stationery being kept in a room provided for that purpose at the east end of the trainmen's room. The floor of the receiver's office is of 1¼-in. maple laid on sleepers imbedded in a sub-floor of concrete.

The trainmen's room, 31 ft. x 105 ft. in size, and the locker galleries around this room are placed where all parts can be seen from the office. The floor of this room is made with an iron spotted buff colored brick laid in sand on a sub-floor of concrete. The walls have a wainscot of dark red pressed brick with a repressed gray brick above this to the roof. A lantern skylight over the center of this room will provide plenty of light and ventilation; there are also windows along the Broadway front. The underside of the roof plank will be painted three coats of white oil paint.

The locker gallery around this room is of iron and concrete construction, reached by two spiral stairways, one on each side of the room. This gallery is provided with 215 metal lockers, 12 ins. x 12 ins. square and 60 ins. high. They are all numbered consecutively and have Yale & Towne locks master-keyed.

These rooms will be heated with floor radiators 26 ins. high placed under the windows, supplied from a steam main under the roof trusses, with return pipes under the brick floor in split tile. General lighting will be by placing 50-cp lamps on bottom of roof trusses and also around under side of the locker gallery. There will be pool tables, card tables, writing and reading tables, seats, etc., in the trainmen's quarters.

All windows, except the division superintendent's office, are glazed with obscure glass, and the windows of the office are covered outside with iron grilles.

GENERAL

All of the above work was designed and the erection will be in charge of the writer, who is engineer of the company, under the direction of T. W. Wilson, general manager of the International Railway Company.

ILLINOIS RAILROAD REPORT

Although it will be some little time before the completed report of the Illinois Railroad & Warehouse Commission for the year ended June 30, 1906, is ready for distribution, the introduction to the report has been made available through the courtesy of the secretary of the commission, William Fitzpatrick. The work of the commission as concerns the electric roads covers only the elevated and interurban roads and does not include street railways, which were specifically exempted by law. In the opinion of the commission, however, the surface and elevated electric railways are getting to be such a very important factor in the transportation problem of the State that all the steam railroad statutes should apply to the electric railways.

The total mileage, main line and branches of surface and elevated electric railways for the year was 935.76 miles, which is an increase for the year of 173.07 miles. The total mileage of second, third and additional main track was 190.70 miles, being an increase of 12.55 miles over the previous year. Mileage of yard tracks and sidings, 56.84 miles, an increase of 19.01 miles. The total mileage of all kinds of tracks is 1187.43 miles, being an increase of 204.63 miles over the previous year.

The capital stock and funded debt of this class of roads was $160,587,228. This is an increase of $7,664,609, accounted for by the increased mileage put in operation. The average capitalization per mile of road of surface and elevated electric railways was $171,782. The average capitalization per mile of surface roads was $75,868. The average capitalization per mile for elevated roads was $2,035,289. The total income from the operation of surface and elevated electric railways was $12,280,192, an increase over the previous year of $1,925,633. The total dividends paid were $742,969, an increase over the previous year of $112,595. The total assets and liabilities were: Assets, $173,724,598, an increase of $7,258,189 for the year. Liabilities, $169,726,314, an increase for the year of $6,113,907, showing a net surplus of assets over liabilities of $3,998,284.

The total amount of income from passenger service, including mail, express, advertising, etc., was $11,016,920, an increase of $1,587,790 over the previous year. The total amount of income from freight service was $446,320, an increase of $82,732 over the previous year. The total earnings and income from all sources was $12,805,420, an increase over the previous year of $2,050,539.

The total expenditures for maintenance of way and structures, maintenance of equipment, conducting transportation and general unclassified expenses and fixed charges amounted to $10,900,208, an increase of $1,111,849.

The number of passengers carried earning revenue was 183,650,979, an increase over the previous year of 21,001,944. The number of tons of freight carried earning revenue was 1,277,566 tons, an increase over the previous year of 641,823 tons. While both the passenger and freight earnings per mile of road were less than the preceding year, the operating expenses per mile of road were less than the preceding year and the net earnings per mile $74 more.

The number of officers and employees was 6,726, an increase of 1603 over the previous year. There was paid in salaries to these employees the sum of $3,965,761.53, an in-

crease over the previous year of $622,399.39. A table containing a classification of the officers and employees, with the average daily compensation for each class, shows the total daily average for all classes was $2.12, an increase of 0.04 cents per day over the previous year.

During the year 4117 tons of steel rails and 80,755 new ties were laid. There are 351 stations on the roads, an increase of 34 over the previous year. The number of highways crossed at grade is 2146, an increase of 96 over the previous year. The number of under highway crossings is 458 and the number of overhead highway crossings is 7. The number of electric railways crossed at grade is 54, an increase of 11. The number of steam railroads crossed at grade is 123, an increase of 5. The number of overhead crossings of steam railroads, 40. The number of overhead electric railway crossings, 12. Total overhead crossings, 52. The increase of mileage of ballast, such as gravel, stone, cinders, etc., shows a disposition to place the properties in the best condition for careful handling of the business. These lines have 10 bridges of masonry, 15 of iron, 97 of steel, 4 of wood and 2 combination, with an aggregate length of 15,499 ft. The number of passengers killed was 7, and employees 10; other persons, 31, an increase of 12. The total number of passengers injured was 306, a decrease of 29; employees injured, 97, an increase of 20; other persons, 65, a decrease of 14. The total number killed, all classes 48, an increase over the previous year of 19. Total number injured, 468, a decrease of 23 from the previous year.

The accident reports for steam railroads show that one passenger was killed for every 1,659,314 passengers carried, and that one passenger was injured for every 96,744 passengers carried. The accident reports for steam railroads also show that one employee was killed in every 359 employed, and one employee was injured in every 29 employed. The accident reports for surface and elevated electric lines show that one passenger was killed for every 26,235,854 passengers carried, and one passenger was injured in each 600,166 passengers carried; and that one employee was killed in every 672 and one injured in every 69 employed.

The following is a comparison of the capitalization of surface and elevated electric railway companies representing the entire mileage of such companies as report to this commission, ending June 30, 1905 and 1906, respectively:

YEAR.	Capital Stock.	Funded Debt.	Total.
1905	$77,765,600	$75,157,019	$152,922,619
1906	78,539,500	82,047,728	160,587,228
Total increase	$773,900	$6,890,709	$7,664,609

The following is a comparison of capitalization per mile of road ending June 30, 1905 and 1906, respectively:

CLASSIFICATION.	1905.	1906.
Average amount of capital stock per mile of surface roads	$41,010	$34,917
Average amount of funded debt per mile of surface roads	......	40,951
Total	......	$75,868
Average amount of capital stock per mile of elevated roads	$1,061,133	$1,037,933
Average amount of funded debt per mile of elevated roads	991,734	997,356
Total	$2,052,867	$2,035,289
Average amount of capital stock per mile—surface and elevated roads	$99,335	$84,014
Average amount of funded debt per mile—surface and elevated roads	96,003	87,768
Total	$195,338	$171,782

The following statistics are gathered from the income account table, and a comparison is made with the fiscal years as of June 30, 1905 and 1906, respectively:

CLASSIFICATION.	1905.	1906.
Gross earnings from operation	$10,354,559	$12,280,192
Operating expenses	5,758,623	6,573,261
Income from operation	4,595,936	5,706,931
Income from property and other sources	472,883	682,845
Total income	5,068,819	6,389,776
Expenses assignable to fixed charges	4,097,925	4,423,277
Net income	970,894	1,966,499

The following is a comparative statement of assets and liabilities for the years ending June 30, 1905 and 1906:

	1905.	1906.	Increase.
Total amount of assets	$166,466,409	$173,724,598	$7,258,189
Total amount of liabilities	163,612,407	169,726,314	6,113,907
Net surplus	$2,854,002	$3,998,284	......

COMPARATIVE SUMMARY OF EARNINGS AND INCOME

CLASSIFICATION.	1905.	1906.
Passenger service:		
Passenger revenue	$9,269,135	$10,811,182
Mail	3,301	3,608
Express and package freight	80,692	41,743
Advertising in cars	......	135,480
Total, including miscellaneous	$9,429,130	$11,016,920
Freight service:		
Freight revenue	363,588	446,320
Total freight earnings, including miscellaneous	$363,588	$446,320
Other earnings from operation:		
Sale of light, heat and power	......	52,116
Advertising (not in cars)	......	79,872
Total, including miscellaneous	$489,307	$659,421
Total earnings from operation	$10,282,025	$12,122,661
Income from property owned	472,856	682,759
Total earnings and income	$10,754,881	$12,805,420
Increase for the year ending June 30, 1906	......	2,050,539

TABLE VI.—COMPARATIVE SUMMARY OF EXPENDITURES—ILLINOIS.

CLASSIFICATION.	1905.	1906.
Maintenance;		
Way and structures	$498,588	$564,470
Equipment	749,801	921,832
Transportation:		
Operation of power plant	1,231,870	1,359,872
Operation of cars	2,217,876	2,377,785
General expenses	994,991	1,255,219
Unclassified expenses	15,091	29,752
Total operating expenses	$5,708,217	$6,508,930
Total fixed charges	4,080,142	4,391,278
Total operating expenses and fixed charges	$9,788,359	$10,900,208

SUMMARY OF TRAFFIC STATISTICS FOR YEARS ENDING JUNE 30, 1905 AND 1906

CLASSIFICATION.	1905.	1906.
Passenger traffic:		
Passengers carried earning revenue	162,549,035	183,650,979
Passenger and mixed car mileage	......	51,849,607
Average receipts per passenger per mile	......	......
Passenger earnings per car mile	......	$0.212
Average amount received from each passenger	$0.057	$0.059
Passenger earnings per mile of road	$12,030.00	$11,771.00
Transfer passengers carried	3,383,124	6,397,108
Freight traffic:		
Tons of freight carried earning revenue	635,743	1,277,566
Freight and mixed car mileage	......	689,950
Average receipts per ton per mile	......	$0.048
Freight earnings per car mile	......	$0.656
Average amount received from each ton of freight	$0.540	$0.350
Freight earnings per mile of road	$1,144.00	$751.00

The following shows a comparison of the average daily compensation paid to all employees in Illinois during the fiscal years of June 30, 1905 and 1906, respectively:

Classification.	Rates.	
	1905.	1906.
General officers	597	777
Other officers	471	521
General office clerks	185	192
Train clerks and dispatchers	236	257
Station agents	151	163
Other station men	...	159
Conductors and yard foremen	206	211
Other trainmen and switchmen	178	248
Guards	...	180
Motormen	229	233
Starters	214	189
Switch tenders, crossing tenders and watchmen	172	194
Roadmen	173	179
Hostlers	163	172
Linemen	190	204
Engineers	326	340
Firemen	197	191
Other power house employees	193	192
Electricians	249	246
Machinists and mechanics	223	227
All other employees and laborers	165	163
Average rate per day for all employees, excluding officers	$1.98	$2.03
Average rate per day for all employees, including officers	2.08	2.12

CORRESPONDENCE

NOTES ON SPEED-TIME CURVES

CHICAGO, March 8, 1907.

Editors STREET RAILWAY JOURNAL:

I am much interested in Mr. Mailloux's discussion of my article, "Notes on Speed Time Curves," in your issue of March 2, 1907, page 390.

Mr. Mailloux states that several of the supposedly new features of my method of plotting speed-time curves had been used by him in his early work and were discarded for better ones. Up to the time of reading Mr. Mailloux's letter, I was not aware that any one had plotted these curves using just the procedure as indicated in my article; and I think there was nothing in available technical literature to so indicate. Unfortunately, the notes in Mr. Mailloux's excellent lectures at various technical schools were not available. My attention has now been called to them for the first time.

The whole theory underlying speed time curve plotting is so extremely simple that it seems unnecessary to burden either the theory or the method of application with any great amount of refinement. Refinement in stating the theory by means of calculus notation, for instance, is of no value unless some equation can be fitted to one or more of the various curves. As this is admittedly a point-to-point method, it is out of place and undoubtedly confusing to some. Refinements in method, such as Mr. Mailloux's "Chart of Reciprocals," only lead to greater accuracy than the slide rule method of solving the general equation. Here again exactness is unnecessary, in addition to making the method somewhat more cumbersome and not of as general application as the slide rule method, as I shall presently endeavor to show. The closeness with which a plotted speed time curve indicates the exact conditions of an equipment in service is dependent primarily upon the accuracy of the train friction curve. Even after considerable study, the proper train friction curve can not be estimated to within 3 or 5 per cent. What is the use, then, of adopting a refinement that would perhaps add 1 per cent to the accuracy, when the original assumptions are liable to be 3 or 5 per cent in error? These considerations led me to use the method as outlined in my article in your issue of Feb. 9, 1907.

Regarding Mr. Mailloux's chart method: He states that the same "chart of reciprocals" can be used again and again, provided the same scale of "acceleration coefficients" is used on both the "chart of reciprocals" and the "chart of coefficients." This last was my chief objection to it. In order to have the same ordinate scale of "acceleration coefficients" on the "chart of coefficients" for all cases, it is necessary to consider the weight of the car in plotting each curve of "coefficients." This obviates any attempt to have a "chart of coefficients" of perfectly general application, applying to different weights per motor, plotted on one sheet.

For instance, in my Fig. 1, according to Mr. Mailloux, a simple division of the scale of ordinates by 91.1 would give acceleration coefficients that could then be used on his "chart of reciprocals" and the speed-time curve plotted therefrom. This is not true, because the scale of ordinates is pounds per motor instead of pounds per ton. If I had used the term pounds per ton, Fig. 1 could not be said to be "General."

This is apparent from another view point. If I should convert the scale of ordinates of Fig. 1 to "acceleration coefficients" by first changing to pounds per ton and then dividing by 91.1, it is apparent that the curves as they stand would be for only one value of tons per motor. This is an absurd condition, because obviously a gear ratio of 4.00 would not be used with the same tons per motor as would a gear ratio of 1.42. The curves would be valueless. Even admitting that the same tons per motor would be used, the acceleration with the 4.00 gear ratio would prove to be so large a quantity (3.1 at starting) that it would be beyond practice or beyond the range of the "chart of reciprocals."

Mr. Mailloux has apparently confused the term "pounds per motor," which gives the curve (Fig. 1) a broad general application, with "pounds per ton," which necessitates a definite weight of car being considered. Any use of the terms "equivalent acceleration" or "acceleration coefficient" on the curves prohibits their application to anything but the specific case where the pounds per motor correspond to the pounds per motor for which the curves were originally plotted. This will indicate why I believe the chart method is not so generally applicable as might be presumed from Mr. Mailloux's discussion. The "chart of reciprocals" in itself is valuable, but it necessitates a special "chart of coefficients" being plotted for each gear ratio and each weight per motor.

The "general speed tractive effort" curves in my possession are blue prints consisting of diagrams similar to Fig. 1, without the friction curve. The friction curve is drawn in red ink for each particular case considered, making a very flexible arrangement. As to the novelty of styling the ordinate scale of Fig. 1 as pounds per motor, permit me to say this same notation was used by F. W. Carter and also by J. C. Huffman, "Effect of Changing Gear-Ratio on a Series Railway Motor Equipment," STREET RAILWAY JOURNAL, Oct. 29, 1904, and probably by others. I can not therefore ask any one to consider it a "novel feature," nor had I supposed any one would so consider it. The novel feature of the curve (Fig. 1), however, consisted in placing of the ampere curves upon the network.

Mr. Mailloux further states, regarding the inertia of rotating parts: "With the slide rule either one more setting is required or else an addition has to be made separately before using the rule, as indicated by the sum $(W + W_i)$ in Mr. Simpson's equation." The implication seems to be that this addition must be made before each determination of a time value with the rule. The term $(W + W_i)$ is a

constant for any particular equipment. The addition has to be made only once and it is determined for all time.

I am personally aware of one case where speed-time curves of 200 miles of runs for a proposed Western interurban road were plotted exactly in the manner as shown in my article. The entire job, including all preliminary curves, except the "general speed tractive-effort" curve, already at hand, was completed in about six days.

I have no means of knowing whether faster work could have been done with the chart method, for I plead guilty as being in the class with those who have "never tried the chart method"—on account of having to plot a new "chart of coefficients" for each particular case of weight per motor as well as gear ratio in order to be able to use one "chart of reciprocals." Undoubtedly the chart method would be more accurate, but considering the probable errors of assumption, such accuracy seems unnecessary. Tracy W. Simpson.

LARGE CONTRACT FOR AIR BRAKE EQUIPMENTS

The Allis-Chalmers Company, of Milwaukee, announces that it has just secured contract for supplying all of the air brake equipments required for all electric railways operated or controlled by the New York, New Haven & Hartford Railroad Company. This is said to be the most extensive air brake contract ever placed.

The number of cars in service at the present time aggregates on the different lines a total of about four thousand. Approximately fourteen hundred of the heavier cars are already equipped with air brakes of various types. Over a thousand of these are of the Christensen type, now manufactured by Allis-Chalmers Company.

As a matter of railway history, the first Christensen air brake equipment placed in service in New England was installed, in 1898, on a car of the Hartford Street Railway Company, now a part of the above referred to system. After nine years of continuous service this identical equipment is still in daily use.

IMPROVEMENT IN STORAGE BATTERY CONSTRUCTION

Joseph Bijur, of the General Storage Battery Company, has recently patented a valuable improvement in the method of manufacturing negative plates for storage batteries. The method has been in use by this company for a year or so, but the details have just been made public through the issue of the patent. The invention is designed to prevent loss of capacity in the plates through the solidification of the porous sponge of the lead into a metallic mass, and secure permanent passageways for the diffusion of the electrolyte. It is equally applicable to Planté plates or pasted plates.

Briefly, the invention consists in soaking a plate, which has been made in the usual manner, in a solution of sugar, which penetrates the pores of the plate readily. The strength of the solution used can be from 2 to 30 per cent. The plate is then rinsed to free it from any of the solution which may be on its surface, is then dried, and finally baked at a temperature of from 475 to 575 degs. F., until the sugar is completely carbonized. This may take from 5 to 10 minutes. If the plate has an alloy frame which melts at a lower temperature than the remainder of the plate, these parts can be protected during the heating. The plate is again rinsed to remove any particles of the sugar that are not converted to carbon in the heating process. It is then ready for use. Pasted plates can be treated in largely the same way.

It is claimed that the process makes the plate much stronger and hardy and prevents it from becoming sulphated.

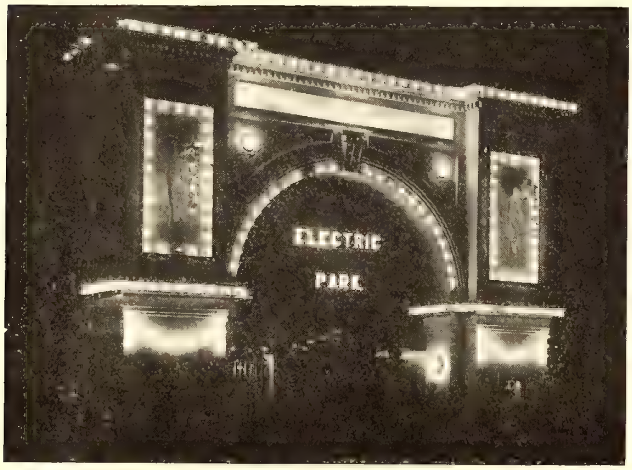
EQUIPMENT DATA OF NEW CARS FOR THE BROOKLYN RAPID TRANSIT COMPANY

The Brooklyn Rapid Transit Company has placed orders for one hundred elevated cars, fifty of which will be built by the Laconia Car Company and fifty by the Jewett Car Company for delivery during October, December and November, 1907. The following data have been furnished in connection with these cars by Wm. G. Gove, superintendent of equipment: Semi-convertible car, seating 54; weight, 69,000 lbs. approximately; length of body, 40 ft. 5 ins.; length over all, 48 ft. 11 ins.; width inside, 7 ft. 6 ins. between posts; width over all, 8 ft. 7 ins.; height inside, 8 ft. 3⅝ ins.; sill to trolley base, 9 ft. 4½ ins.; height, track to trolley base, 12 ft. 6½ ins.; body, wood or metal-wood, with steel in corner and double posts; underframe, pressed steel. The special equipment consists of the following: Axles, trail truck 5¼ ins. wheel seat and motor truck not yet decided upon; body bolsters of pressed steel; steel plate truss bolster for trail truck, but motor truck not yet decided on; brake-shoes of cast iron; center bearings of cast steel; multiple-unit control system; Van Dorn automatic couplers; curtain fixtures, Curtain Supply Company; curtain material, Pantasote; destination signs, flat signs hung on railings; door fastenings, Coburn tracks and sheaves; dust guards, wood; fenders, none; gears and pinirons, steel; gongs, Brooklyn Heights standard; hand brakes, Brooklyn Heights standard; heating system, Consolidated panel electric heaters; arc headlights, "Eureka"; interior finish, cherry natural, white ceiling; journal bearings, trailer 4¼ ins. x 8 ins., motor 5 ins. x 9 ins.; journal boxes, M. C. B.; markers, Dresser; motors, not yet decided; roofs, monitor type; safety tread, Universal; sanders, none; seats, Hale & Kilburn; side bearings, cast steel; springs, elliptic and helical; trolley poles and attachments, 11-ft. 3-in. reinforced steel trolley pole with Nuttall stand; trucks, M. C. B.; ventilators, monitor sash; vestibule, none. In addition one hundred surface passenger cars were ordered in February from the J. G. Brill Company for construction at the Stephenson Works. These are of the semi-convertible type. Their seating capacity is 38; weight, 33,000 lbs.; wheel base, 19 ft. 5¾ ins.; length of body, 28 ft., and over vestibule, 37 ft. 2 ins.; length over all, 38 ft. 3¾ ins.; width inside, 7 ft. ½ ins., and over all, 8 ft. ½ in.; height inside, 8 ft. ⅜ in.; height of track to trolley base, 8 ft. 11¾ ins.; body, wood; underframe, wood. The special equipment consists of axles, driving 4 ins., pony 3½ ins.; bar-steel body bolsters; cast-steel center bearings; curtain fixtures, Acme open car cable; curtain materials, Pantasote; destination signs, Brooklyn Heights illuminated four-side block sign; dust guards, wood; fenders, Empire; gears and pinions, steel; gongs, Brill Dedenda; hand brakes, Brooklyn Heights standard with St. Louis 14-in. handle; heating system, Consolidated Car Heating Company; headlights, Dayton incandescent; interior finish, cherry natural; motors, not decided; roofs, monitor; safety tread, Universal; sanders, Silver & Company's "Reliable"; seats, Heyward Brothers & Wakefield Company rattan covered; side bearings, cast steel; trolley poles and attachments, Brooklyn Heights standard; trucks, Standard Motor Truck Company, maximum traction type; ventilators, monitor sash, and a built-in vestibule with open sides.

PARK MANAGEMENT AND ATTRACTIONS

THE FINANCIAL SIDE OF PARK OPERATION

So much has been written about securing profitable park attractions that it may not be amiss now to turn attention to the means necessary to secure for the operating company every cent taken in at the gate and other points under its control. Railway men are accustomed to the peculations of conductors and take every possible precaution to prevent them, but naturally they are less familiar with the amusement business and therefore more subject to imposition.



ELECTRIC PARK AT NIGHT

The collection of all the money paid to see the different attractions is indeed a very serious problem. As the park season is so short, it is difficult to secure reliable employees. Many of them are of a more or less nomadic character, only staying at their posts while they see a chance to make "big money." The nature of their employment, of course, makes it impracticable to pay them large salaries, yet they are subject to the temptation of handling large amounts of other people's money.

Since it is plain, then, that the finances of a park must be looked after with even more care than a regular business, it may be of value to other amusement managers to explain the collection methods in vogue at Electric Park, Newark, N. J. This park is chosen for illustration because it is an excellent example of a thoroughly successful resort due to the popularity of its attractions and the experienced financial management. It is owned by the Electric Park Amusement Company, of which C. A. Dunlap is president and general manager. The park itself is neither a natural woods nor a "White City," but a neatly laid-out grove, shady in the day and well illuminated at night. The principal attractions are the electric fountain, dance hall, theater, roller coaster, circle swing and merry-go-round—all permanent paying features, together with several smaller shows which are changed every season with little new expenditure for buildings.

The financial end of the business is managed on the principle that honesty cannot be assured unless every temptation is removed. The only way is to make every single department safe in itself with the bookkeeping of such character that if any stealing is to be done it would require the collusion of people in different departments. In the first place, every gate should be protected by a ticket-chopping box. Under no consideration must a gatekeeper be allowed to handle a ticket; if caught, he is discharged at once. Such ticket boxes should be installed in connection with the dance hall, skating rink, theater or any other attraction for which straight tickets are sold. When tickets are issued for reserve seats (as for the theater) they must be torn in any event. It is advisable to change the ticket boxes around during the day, as this action tends to puzzle the choppers and deters them from tampering with the boxes.

In spite of such precautions, there must be some supervision; for instance, the gatekeeper will accept cash to let people who have no tickets enter the grounds unless he knows that some one is watching him. This practice can be stopped if the management should make it a point to send men to the park on different occasions to offer cash to the gatekeeper and see if he takes it. A few discharges for this offense will end such troubles for the season.

When the cashiers of the different attractions and sales stands under the operating company's control arrive in the morning at the office, each receives his proper cash box with a roll of tickets and $5 to $10 in change, as may be necessary. They are then prepared to go on duty. At the close of the day, each cashier prepares a statement on the daily report illustrated. The cashier of the circle swing, for instance, counts his money and notes the amount opposite "Cash Received," after which the cash receipts are placed in the cash box with the corresponding tickets and


THE DANCE HALL IN ELECTRIC PARK, WITH THE ORCHESTRA IN THE CENTER

change. The box is then brought in a canvas bag to the general office. Every bag is lettered according to the department where it is used. The daily report itself is sent to the treasurer, who compares it next day with the report made out by the head cashier. Discrepancies must be accounted for at once, and even if collusion should exist between any of the department cashiers and the one in the office it would not take long to find it out.

The most difficult problem, however, is to keep the liquor bars and the waiters straight, and the only way to solve it

DAILY REPORT

.... *Register No.*..............
Cash Received, $ ....
Checks ....
.... *Superintendent*
.... *Cashier*
.... *Bartender*
REMARKS: ....
....

CASHIER'S DAILY REPORT

is to "work on stock." A head barkeeper or superintendent in whom implicit confidence can be placed should be engaged. At the beginning of the season this man should be given a certain amount of stock, with replenishments as occasion demands, and at the end of the season the stock left must tally with the books.

Each bar should have its own bartender and cashier, the latter getting his little box of change just like the other

Bar No. 1906

Bottles Bar Whiskey	$	Amount Brought Forward Bottles Red Wine	$
" Wilson Whiskey		" Rhine Wine	
" Old Crow Whiskey		" Vermouth	
" Hunter Whiskey		" Creme de Mint	
" Usher Scotch		" Benedictine	
" Tom Gin		" Soda	
" Sloe Gin		" Seltzers	
" Martell Brandy		" Celery Tonic	
" Ginger Brandy		" Bass Ale	
" Apple Jack		" Lyons Ale	
" Blackberry		" Bottle Beer	
" Port Wine		" Lager Beer	
" Sherry Wine		" Champagne	
Manhattan		Cigars	
Martine		Cigars	
Geneva Gin		Cigarettes	

BAR STOCK RECORD

cashiers. Every morning the head barman and his assistants make up the stock to go to each bar. After the day is over, all of the unsold stock is returned to the cellar, in which a separate compartment is reserved for each bar. The next morning the barman will take, say, the stock for bar No. 1, spread it out on a table, and from the stock in front of him figure out on a bar stock record what was sold the day before without knowing how much money the cashier of that particular bar had turned in. After this he refills all bottles. The bar stock record is brought to the treasurer, who on comparing it with the cash report turned in separately from the same bar can easily tell that the bar in question either has a poor bartender or that he is getting less money. The treasurer, after noting the continuance of this sort of trouble for several days, reports to the manager that a certain bar is running behind. The manager then takes the matter up with the head barman, who soon locates the trouble.

Experience appears to indicate that the best way to treat waiters is to pay them on a percentage basis. In Electric Park it is customary to sell $5 in checks for $4.25, thus giving the waiters 15 per cent on all sales. If they have any tickets left they keep them for use next day. The waiters

JAPANESE BALL GAME—A TYPICAL MINOR ATTRACTION

work by the week but seldom draw all their cash before the end of the season. This system is extremely simple, the only labor arising from keeping track of the number of brass checks given to the cashier.

One source of loss which should be avoided relates to delivery of supplies at the park. Most goods are delivered early in the morning, before the arrival of the manager, who usually remains on the grounds until long after midnight. Consequently it is very easy for a dishonest subordinate to agree with the iceman or other teamster to sign a receipt for a larger quantity than he actually receives, the two afterward pocketing the cost of the difference. The same scheme can be worked with other articles, but ice is the easiest, as it is used in large quantities and naturally has diminished considerably by the time the manager arrives, so that detection is difficult. The receiving clerk should be on the ground by 6 or 6:30 in the morning to anticipate all deliveries and count or check all supplies. He should also act as timekeeper to see that the different employees arrive at the proper time.

As the park business is conducted on a cash basis, there is no reason why the books should not always show the exact state of both sides of the ledger. At the end of the season the management should know just what attractions made or lost money, how much was paid on the original investment, how much in improvements, etc. In short, if a park is to earn money, it must be managed along strict business lines.

One other interesting problem in finance that confronts the amusement manager is the attitude he should take toward new attractions whose purchase would require large initial investments. As it is almost impossible to foretell the success of many novelties or how long they will continue popular, the park man prefers a long-term rental or percentage agreement as against outright purchase. Should the attraction be a big success, he is sure to feel disgruntled

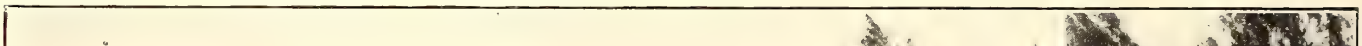
because he is not receiving what he considers a proper share of the proceeds. The only way to avoid dissatisfaction is to embody in the contract with the promoter a clause permitting the purchase under certain conditions of the attraction after one or two seasons have demonstrated its value. By this procedure the park manager avoids big risks and yet has the opportunity to get the best-paying features under his control.

THE PARK SYSTEM OF THE SEATTLE ELECTRIC COMPANY

No other city in the West, and few in the United States, are more fortunately situated in regard to parks and playgrounds than Seattle, the growing and vigorous metropolis of the Pacific Northwest. In all the wide stretch of country bordering the Pacific Ocean there is no section that has a greater or more varied charm in a scenic way than has the Puget Sound country, and Seattle, lying between Lake Washington and Puget Sound, with but a trifle more than 2 miles of land separating the two magnificent bodies of water, is conceded to have the premier position on the map.

CANOEING IN MADISON PARK

ALONG THE SHORE BETWEEN MADISON AND LESCHI PARKS



A SCENE AT THE BOATING PAVILION AND DOCKS IN MADISON PARK, SEATTLE

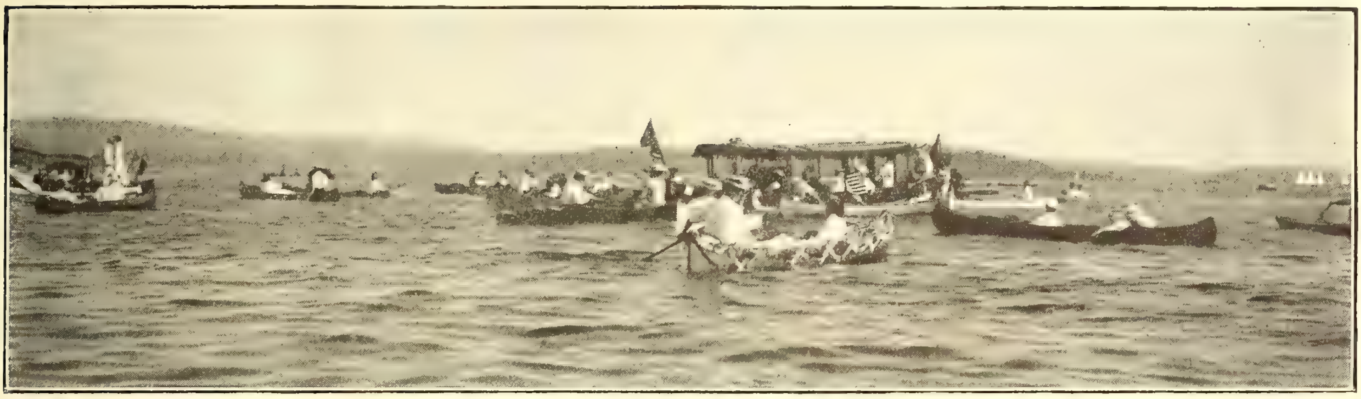
Wise judgment on the part of the Seattle Electric Company and also on the part of the City Council has provided for parks and playgrounds a sufficient area of well-selected land not only to enable the present generation to enjoy this indispensable requirement for life in a large city, but to provide also for the needs of the future; and the purchase of property for this purpose has not by any means been discontinued. The voters of the city of Seattle, on Sept. 12, 1906, authorized a bond issue of $500,000 for this same purpose and for the securing of real property for boulevards and driveways connecting the parks of the city into one harmonious and effective system.

Indeed, it is a matter of congratulation that the foresight of the people of Seattle—and this includes the traction corporation as well as the municipality itself—has been broad enough to permit of the prediction that, in the not far distant future, the city will be known from one end of the country to the other for her wonderfully beautiful and attractive parks and driveways, for in Seattle there are natural advantages in the way of lake, sound, mountain and forest scenery the like of which cannot be found in any other city of the whole West. The variety of the scenic attractions of the city alone is remarkable, and entitles the metropolis of the north Pacific Coast to be termed unique and dis-

tinctive in this regard. The proper safeguarding of these attractions, their wise development by the municipality and the street railway company have already been recognized by tourists and visitors to the city, and the care of these valuable assets in the future will be in keeping with the strong and whole healthy growth of the city itself and the progress made in business, in shipping and commercial pursuits, in the cultivation of the arts and sciences, by the citizens of Seattle.

In any consideration of the parks of Seattle the mind almost instantly takes into view the wonderfully attractive shore of Lake Washington, which forms the eastern boundary of the city limits. The universal desire of tourists coming to Seattle and of pleasure seekers is for a trip to the lake via one of the car lines of the Seattle Electric Company. On the shore of the lake this company owns three parks which are at once among the most popular and attractive in the whole city. These parks are Madison Street, at the eastern terminus of the Madison Street cable line which pierces the center of Seattle; Leschi Park, situated at the eastern terminus of the Yesler Way cable line in the more southerly portion of the city; and Madrona Park, which is at the terminus of the James Street cable-Madrona Park line, a combination cable and electric route.

All of these three parks were secured by the Seattle Electric Company when the consolidation of six different systems of street car lines was effected eight years ago by Stone & Webster, of Boston. All of them are well developed and kept in a high state of attractiveness, and all are heavily patronized by the people of Seattle, especially through the spring and summer months. Even during a great part of the winter these parks are the resort of thousands of people of all walks of life, as the weather for a portion of the winter is ideal for outdoor recreation. There are times in January and February, periods of days and even weeks of dry, bright, warm weather, and the verdure in the parks throughout the year is green and beautiful to look upon, so that they seldom lack attractiveness.



CANOEING ON THE WATERS OPPOSITE MADISON PARK

A WINTER SCENE IN LASCHI PARK SEATTLE

Canoeing is one of the attractions which has made the parks of the Seattle Electric Company and the environments very popular indeed with the people of Seattle and also with tourists and pleasure seekers from abroad. At

the parks on Lake Washington there are several boat houses with quarters for canoeing clubs and for canoeists. The boat houses are plentifully supplied with the latest makes of canoes and of other boats, and these are patronized to the limit during the Saturday afternoon holidays and the Sundays of the long, delightful summer in Seattle.

There is something infinitely charming about the easy buoyancy of a canoe as it glides noiselessly across the waters of the lake—something indefinably distinctive about the comfort and ease with which one may recline among the cushions—something about the long, lazy swing of the paddle, the air and the water and the moonlight nights that make this sport possibly the most popular of all to the pleasure seekers on the lake.

A RUSTIC ROAD IN MADRONA PARK

ON THE SHORE OF LAKE WASHINGTON, NEAR MADRONA PARK

On Sunday afternoon, gathered around the pavilions and the seats surrounding the band stands, may be seen dozens of canoes in which are the youth of the city—young men in white duck trousers and white shirts, with the brown-armed girls in light suits with now and then a touch of bright color to enliven the scene. The picture is a pretty one any Sunday at either Leschi or Madison Park, where the First Regiment Band has regular semi-weekly concert engagements, Wednesday and Sunday evenings and Sunday afternoons.

A JOLLY CROWD AT THE BOAT LANDING IN LESCHI PARK

The largest of the three parks of the Seattle Electric Company is Leschi, at the terminus of the Yesler Way cable line. It is 5.75 acres in extent. It has a frontage on Lake Washington of 558 ft. The park takes its name from Leschi, famous in the days of the Indian wars in the Oregon country as the chief of the Nisqually Indians. During the troublesome period following the Indian uprising of 1854-5, Gov. Isaac I. Stevens was the Governor of the then territory of Washington, and Leschi proved himself a hero by advising the Indians everywhere to lay down their arms. Leschi Park is reached by the Yesler Way cable line with a service varying between three and four minutes and requiring sixteen minutes to make the trip one way from the center of the business district.

On the Madison Street cable line a service varying between two and three minutes on Sundays and holidays is maintained. This park has an area of 3.36 acres, with a water frontage of 650 ft. It is in the greatest favor on Wednesday evenings and Sunday afternoons and evenings during the summer season. The band stand is one of the best in the West, and there are many attractions in the immediate vicinity, including beautiful shade trees, boat houses, chutes, cafes, etc. It is no unusual sight to see from 7000 to 10,000 people gathered on the shore of Lake Washington at Madison Park on a Sunday evening.

Madrona is one of the most beautiful of the Seattle Electric Company's parks, lying midway between Madison and Leschi. It is reached by the Madrona Park line, with cable connection on James Street in the heart of the city. The time required for the trip is about twenty-four minutes. This park is also reached by any one of the number of pleasure steamers plying on the lake, which make regular trips between Madison and Leschi Parks. This is one of the delightful side trips of a "seeing Seattle" journey.

The only attractions which the street railway company provides, other than the natural beauty of the parks, are the band concerts mentioned. The company lets all privileges, such as pavilions for dancing, canoe houses, pier landings for steamer lines, and refreshment booths. All leases carry the clause that no intoxicating liquors must be sold on any of the premises, any infraction causing a forfeiture of the lease. The parks are not enclosed, and are free to the public use. H. F. Grant, manager of the Seattle Electric Company, has given a great deal of attention to the development of this extensive park system, recognizing their high value as traffic stimulators.

The year around the company employs a force of gardeners, with a head gardener, and maintains a greenhouse to grow through the winter months plants for the beautifying of the grounds during the summer. The rentals from the privileges leased just about take care of the expenses of maintenance of the parks and their accessories.

SPRING LAKE PARK, TRENTON, N. J.

The Trenton Street Railway Company, of Trenton, N. J., owns a park which, after years of expense, suddenly blossomed into a self-sustaining enterprise during the season of 1906, and now promises to become one of the finest amusement resorts in the State during the season of 1907. Acquired by the street railway company some fifteen years ago, the yearly expenses were accepted for a long time as a matter of course on account of the additional traffic secured for the railway lines.

Last season the park was taken in hand by Peter E. Wurfflein, an experienced newspaper man, who had had considerable local experience in the amusement line. He threw the gates open to the public free instead of requiring a street railway transfer, or 5 cents, as had been charged in the past. The park was cleaned and the whole tract of between forty and fifty acres put in good condition. After this the pavilion was enlarged and the seating capacity increased to 2000, about double what it was before.

A SUNDAY SCHOOL EXCURSION AT SPRING LAKE PARK, TRENTON, N. J.

In the past the park had been a handicap to the management of the railroad company, because it was an additional service for the already busy officers. With the advent of Mr. Wurfflein they were relieved of the work by a man who could devote a large part of his time to it. One of the first moves was to arrest all disorderly persons and prosecute them to the full extent of the law. This action had a tendency to keep the rough element away. The manage-

ment soon experienced but little difficulty with rowdies, with the natural result that the better class of people came to the park for the first time in years.

Despite the fact that there were twenty-nine stormy days during the past season the attendance averaged 25,000 per week, the total exceeding that of the three previous years combined. A vaudeville show, at greatly increased cost; new row and motor boats, moving pictures, with other amusements and refreshment features were installed. The lake was electrically lighted at night, and perfect order maintained. Both men and women were required to remove their hats in the pavilion, a rule which added much to the pleasure of the patrons.

Sunday concerts also were introduced, Winkler's Seventh Regiment Band being secured for that purpose. For many years past this musical organization, which is noted throughout New Jersey, played exclusively for Cadwalader Park, which is owned by the city. The division of the band's

AT THE BOAT LANDING IN SPRING LAKE PARK, TRENTON, N. J.

services between Cadwalader and Spring Lake Parks aroused quite a storm of protest in the city until it was discovered that Spring Lake, being lighted at night while Cadwalader was not, was a more desirable place to go to in the evening than Cadwalader and the cost was the same.

The introduction of moving pictures and boating on Sunday was a novelty, and the care with which it was conducted may be judged from the fact that Hamilton Township, in which the park is located, is especially strict in its enforcement of the Sunday laws. No music other than the band concerts was permitted on Sunday, and no sports of any kind were indulged in except rowing on the lake.

Four children's days were conducted by Mr. Wurfflein, and on these days the visitors were admitted to all the amusements without charge, in addition to which several hundred dollars' worth of toys were given away. On the first children's day the attendance was 9400. No Sunday schools had picniced at the park in several years, but a specialty was made of them last year, and as many as seven schools attended in a single day, with a total attendance of 7200. All the nearby Sunday schools were followed up and invited to make Spring Lake Park their place for picnicing, and on one of the best days the Passion Play was run free for the benefit of these visitors.

A fireworks exhibition also was organized, and several entertainments given by experts secured especially for the occasion. The attendance ran as high as 13,000, and never less than 5000. This fireworks entertainment was free to all.

All the features were advertised liberally in the newspapers, which also ran many reading notices of the features carried on there. The street railway ran both the South Broad Street and Prospect Street cars to Spring Lake, in addition to many extras from the city hall, carrying the largest crowds that had ever been taken to the park. The park paid all operating expenses without help from the street railway.

Spring Lake Park is the only amusement park in Trenton or vicinity, Cadwalader Park being without amusements. It therefore has no competitor in the local field. It is about 2¾ miles from the city hall, being 1½ miles further than Cadwalader Park, and just over the city line in Hamilton Township adjoining the town of Broad Street Park. Spring Lake Park was called Broad Street Park in the early days of its existence but the town and park of the same name created considerable confusion, hence the change. The fare on the Trenton Street Railway is 5 cents (or six tickets for a quarter) from any part of the city, or from as far as Lawrenceville, on the Princeton line 7 miles from the city hall, or 9¾ miles from Spring Lake. The Trenton Street Railway lines are located two full city blocks from the park entrance, Harrison Avenue (which runs from the tracks to the entrance) being lined with small shops and stands on one side. The Camden & Trenton Railway runs between the park entrance and the Trenton Street Railway.

A movement for the further improvement of this park has just been carried through by the organization of the Trenton Construction Company. The representatives of this company, W. Meredith Dickinson, of Trenton, N. J., and C. H. Oberheide, of New York, have secured the lease and are now preparing to spend about $200,000. As noted on page 324 of the Street Railway Journal of Feb. 23, the new features will include scenic and miniature railways, theater, chutes, etc.

SOME PHASES OF PARK MANAGEMENT

The advent of another open season brings the importance of the street railway park to the front again more forcibly than ever before, for there is a wider appreciation of the value of the park resort as a traffic stimulator than in any previous year. For this reason it might be worth while to consider some of the problems of park management.

There is probably no branch of street railway work which needs to be handled with greater care than this matter of laying out money in pleasure parks. Unless the project is wisely nursed from the day of its appearance on paper to the closing of the gates at the end of the season there is a liberal chance for excessive costs to creep in and turn the venture into a failure financially. It looks like a glittering generality to point out the importance of fitting all park schemes to local conditions, but that is the nub of the whole problem. The tastes and habits of the tributary communities must be sized up at every stage of the game, for the recreations of the factory town often differ diametrically from the amusements of the residential suburb, and the attitude of the people of one section toward out-door life is liable to be the exact antithesis of the feeling in another

community. Knowledge of what the public desires and enjoys is therefore the primary point to ascertain. It is making a leap in the dark to lay out a park resort on the strength of successes in other cities. Any one who travels at all soon learns that cities and towns are as individual as persons, and this is why plenty of local advice should be injected into the scheme to be tried out.

Primarily the effort should be to supply forms of amusement which do not already exist at anything like the same prices in the communities served by the company. Some overlapping will frequently occur, but experience has shown that the place to spend money is on features which add to the sum total of a community's amusement resources, rather than on duplications. It is a hard problem to suit every one's taste, but if there is any single feature of a park layout which is universally approved by the public it is the location of the park close by a sizeable sheet of water. Water adds almost unlimited picturesqueness to any landscape, but besides this, the opportunity to indulge in aquatic sports is a drawing card of tremendous power. Many a park located beside a lake or river has required very little expense for development, and has proved profitable chiefly on account of its natural advantages. In laying out densely wooded parks attention is sometimes omitted in tree trimming, with the result that the place is hot and stifling. The prevailing winds need to be studied with reference to the circulation of air.

Experience has shown the importance of a suitable shelter in climates where showers are frequent, and the erection of a vast log cabin with a grounded tin roof as lightning protection, plenty of comfortable seats and lights inside, with drainage to keep the water away from the floor or bare ground, and space for light refreshment concessions, news paper stands, etc., will do much to tide over the unprofitable hours when the sky is dark and lowering. In fact, the whole matter of park operation is simply one of ceaseless attention to details. The larger the city served, the more money it is safe to put into these things, but there are certain points which are fundamental in importance—cleanliness, both on the grounds, in all waiting rooms, and especially in toilet rooms; orderliness, secured by supervision of the entire grounds and waters by employees with police powers, or by police detailed for the service during the season; safety to the public, insured by hand-rails in slippery paths and on the edges of declivities; a high standard of light and power wiring, and a reasonable measure of watchfulness in water sports and at the car terminals.

The advisability of building an open-air theater in a park is a question that cannot be solved off-hand, but at the present time there is such a wide public demand for vaudeville that there is not much question about what to put on the stage if a theater seems desirable. It is largely a matter of the rival entertainments available in the towns from which the park draws patronage. A park serving a factory town can seldom afford to charge admission, and a moderate sum is all that is assessable even in parks catering to communities of means. It must never be forgotten that it takes a long time to carry enough passengers to and from a park to pay the cost of expensive landscape gardening and elaborate structures. Fortunately the minor conveniences of a well-equipped park—public telephone service, mail collections, a room where sudden cases of illness can be cared for, swings for the children, seats and picnic tables,—are features which cost little to install and maintain. Whatever may be the policy of the company toward amusement concessions, it should always have supreme control with the right to withdraw any objectionable act or feature at will. Much can be learned by actually watching the way the public receives the entertainment. In some parks the various amusements are crowded too closely together for the best results. Plenty of light at night is essential, but the various attractions need to be somewhat separated for their maximum enjoyment. The ideal park appeals to all classes of the community; it offers the charm of solitude to the nature lover and the exhilaration of sports shared in common to the patron out for a jolly time. It is hard to adapt a park to widely varying tastes, but it can be done with careful study. Centralized responsibility for the park service, pithy advertising in cars and papers, and detailed analysis of earnings and expenses are the final requisites which the last few years have indicated unmistakably.

THE EQUIPMENT OF PARK RESORTS

The following series of notes is a continuation of those published in the issue of Feb. 23 upon new attractions and suggestions for the summer park. They are based primarily upon reports received from those who make a business of supplying park attractions.

ELECTRIC ILLUMINATED FOUNTAINS

One of the difficult problems that confronts the park manager in the selection of attractions is to have a number that will retain their drawing power year after year without requiring heavy maintenance or renewal expenditures. This is particularly true of the illuminated spectacular features, as the people expect to see something different every time they visit the grounds. Among night attractions the electric

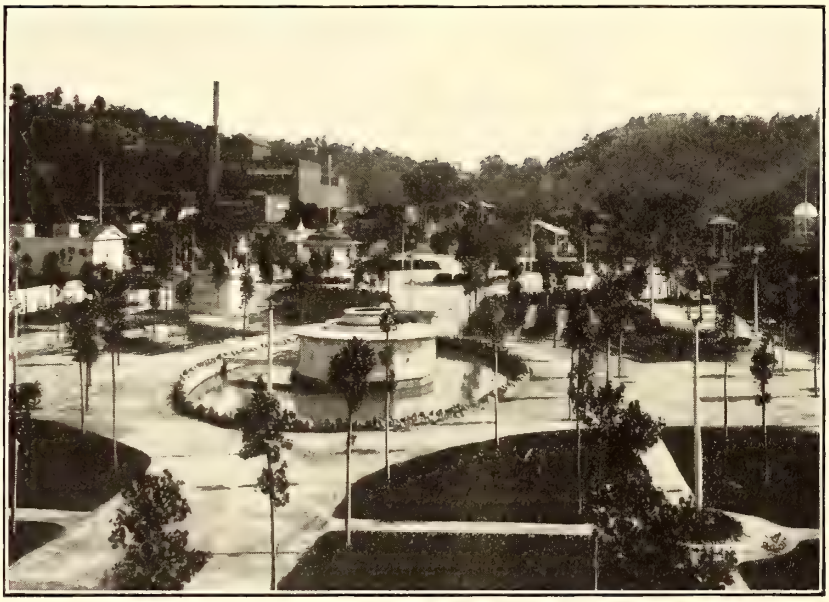
THE ELECTRIC ILLUMINATED FOUNTAIN IN ACTION

illuminated fountain with human groupings is a spectacle that has continued popular ever since its introduction in the early days of electric traction.

Much of the work along these lines was originated by C. A. Dunlap, of Electric Park, Newark, N. J., who has designed and installed many fountains of this character in parks throughout the United States. Mr. Dunlap is himself a successful park manager and his claims for the fountain are substantiated by his own experiences with it at Electric

Park, where over 15,000 people have crowded in on a Sunday evening. A clear proof of its popularity in another park is afforded by one of the accompanying illustrations of an electric fountain and its surroundings taken during the day. It will be noted that a very large number of benches are placed around it, as many in fact as would be there if the attraction were a concert.

Of course, if the fountain could not be varied in its spectacular features without going to considerable expense it would not be worth while for the management to keep it up, but its use in connection with living models in different poses, dancing girls, etc., permits an infinite variety at very low expense. The entire act requires only thirty minutes. The following figures are given to show at what moderate cost an electric fountain can be kept up per week: Dancing girl, $10; four models at $7 each, $28; two children for cupids at $4 each, $8; a woman to superintend the girls and keep costumes in order, $15, making the total cost per week $61, outside of current. The other work in connection with the fountain can be handled by the regular park electrician, stage hands of the theater and other employees without additional expense.



A DAY VIEW OF A KANSAS CITY PARK, SHOWING THE LARGE NUMBER OF BENCHES NEAR THE ELECTRIC FOUNTAIN

KANSAS CITY ELECTRIC ILLUMINATED FOUNTAIN, WITH LIVING MODELS

Mr. Dunlap also makes a portable electric fountain in various styles. These are moderate in cost and add greatly to the artistic appearance of a park, both night and day.

EQUIPPING THE SKATING RINK

While much has been said about the interest manifest in skating at this time, and details have been given in these columns of the plans for operating rinks as worked out by several companies, the question of suitable equipment has not heretofore received that attention which its importance demands. If the park manager is going to cater not only to those who skate, but to an ever increasing number who, while not skaters themselves, enjoy watching others, and more especially if the manager intends to hold competitions, he should give serious thought to accommodating the spectators. Buildings so fashioned that a gallery is available or can be easily constructed, of course, offer an ideal, for then the crowds can be handled so as not to overrun the skating floor. If, however, dependence has to be had on the floor itself for offering a place for spectators, then relatively little of the space should be given over to them and that should be so separated from the skaters that there may be no danger of interference. While these conditions ought to be borne in mind, no general specific can be offered, for it is a question that can only finally be settled by the individual, governed by the considerations in his particular case. This applies also to the question of accommodation for the skaters themselves. Adequate means should be provided for them to adjust their skates without in any way running the risk of interfering with those already on the floor. Some little corner or by-place offers the ideal for this, and removes the skaters from the gaze of the inquisitive public. As to the skates themselves, they have evolved like everything else, and the evolution may justly be said to mean progress in this particular instance. One or two radical innovations there have been, such as the bicycle skate, but for the most part the changes have been rather a refinement in details making for ease of operation. An account was published in the issue of Feb. 23 of some of the skates now on the market. The skating rink is now such a popular pastime that particulars will be given of the latest forms of other manufacturers.

One skate, manufactured by the Chicago Roller Skate Company, of Chicago, Ill., is claimed by the manufacturers to possess qualities peculiarly its own. The foot-plate of this skate is stamped from cold rolled steel, and is strengthened against buckling by two parallel corrugations. Still further to add strength to it, there is a malleable, double-riveted brace which bears upon the rubber cushions. The brace, however, is not rigidly attached to the axle, but play is allowed by slots through which the holding bolt projects. The cushions in this skate are of Para rubber and so placed as to receive direct pressure. In this way their life is materially increased and their service in neutralizing jars considerably increased. The cushions can be easily removed. A hollow steel wheel fitted with ball bearing is used, which is light and durable. The skates are adjusted by a key. The company also offers an aluminum racing wheel.

Another skate in general use is the Richardson, made by the Richardson Ball-Bearing Skate Company, of Chicago. Simplicity has been aimed at and achieved in this skate. The foot-plates are of cold rolled steel, corrugated and re-

inforced to insure great strength. The bearings are case hardened and polished, and all parts are interchangeable. A variety of wheels is offered. Steel, aluminum or wood fiber rollers are furnished with regular rink skates, and boxwood or aluminum on racers.

M. L. Kasmar, of Chicago, also offers ball-bearing steel skates, which are said to have especial advantages for rinks.

The Barney & Berry Company, Inc., of Springfield, Mass., say for their skate that it is practical in construction and exceedingly durable. The bearings are of ¼-in. balls. Retainers prevent the balls rubbing and add to convenience of handling. There is a large demand for the company's product and it is doing a very satisfactory business.

THE ELECTRIC SIGN

The value of the electric sign as an advertising medium is best attested by the prolific use of this device in all its various forms at Coney Island, which at night truly becomes a great white way. To enumerate the uses to which the electric sign is put there would be almost impossible. Suffice it to say that it is used for advertising everything

A TYPE OF TALKING SIGN

from a certain brand of highball to the leaving of the trains of the Brooklyn Rapid Transit Company, for which it is especially applicable. In fact, its use among railway companies for advertising the departure of cars is extending. This is instanced by the order just placed by the Northern Ohio Traction & Light Company for a sign 18 ft. square to show the time of the departure of limited cars for Cleveland and intermediate points. The sign will be placed on top of the building at the corner of Howard and Market Streets, Akron. Of the use of signs for advertising park attractions proper and the variations that are possible with them much has been said before in the STREET RAILWAY JOURNAL. A judicious scheme is to advertise park attractions in the cities along the route of a line by electric signs. A company that makes a specialty of electric signs for display purposes is the Metropolitan Engineering Company, of New York. It offers any variety of signs, and its experience covers some of the largest installations in the country. This company even rents letters for temporary signs. The letters of temporary signs are made of heavy-gaged aluminum and fitted easily in a grooved frame which is supplied for supporting them. The company has a special removable-face letter which permits of ready inspection and repair. The company has also paid especial attention to the accessories for suspending the signs. For outlining doors, etc., the company offers special trough construction.

Another company that has made signs a specialty is the Electric Motor & Equipment Company, of Newark, N. J., which has developed a special talking sign. This sign is an electrically-illuminated bulletin board which automatically flashes out forty words or phrases. They follow each other without intermission of darkness as long as the motor is allowed to run.

The sign is composed of monograms and the flashing changes are made by means of little machines called commutators, one for each monogram, which makes the lamps light up and go out. It contains three wheels, slotted in forty places. These slots hold the letter bars which govern the lighting and extinguishing of the lamps. The base and top of the commutator are slate, held together by cast-iron standards. Through these standards a shaft runs, on which are mounted the three slotted wheels mentioned above. On the under side of the slate top are twenty curved phosphor bronze springs, one for each compartment, also an equal number of brass contact screws which protrude through the slate and act as binding posts. The letter bars, one for each letter, numeral and character, are made of cold rolled steel, of a special size, and so cut that projections or teeth are left on one edge. These teeth are the important points of the mechanism, as they directly control the lighting of the lamps in the monograms. One set of this specially constructed gearing is needed to run each sign.

A STRIKING EFFECT WITH SIGNS AT CONEY ISLAND

LAYING OUT THE PARK ITSELF

As far as the manager is concerned who for the first time is confronted with the problem of laying out a park, there are available a number of firms which make it a specialty to give advice in matters of this kind, and even to draw complete plans and build and equip the resorts. Some of these companies not only do this, but they supply the amusement features developed by them which have proved their worth as moneymakers. One of these companies is Frederick Ingersoll, of Pittsburg, who built such amusement resorts as Pittsburg Luna Park, Cleveland Luna Park, Scranton Luna Park, Washington Luna Park, "Parque Luna," of Mexico. Mr. Ingersoll also pays especial attention to the construction of scenic railways, roller coasters, aerial swings, scenic rivers and carousels.

EQUIPPING THE THEATER

The park manager who runs a theater, no less than the manager of a metropolitan playhouse, is confronted with the question of suitable stage settings. The one subject

likely to engross the park manager's attention, however, is the curtain, that taking precedence even over the scenery. The curtain is something that for some little time is to be before the public, and its make-up generally is accepted as forecasting the program to be presented. But curtains are expensive, and for this very reason the subject of a suitable one is not easy finally to decide. In fact, to cope with the situation thus presented, a special branch of the theatrical business has been developed which is confined to the supplying of curtains, the curtain maker and manufacturers seeking further to increase the sale of their goods by advertisements co-operating to this end. In this way the Lee Lash Company, of New York, is able to offer a variety of curtains to meet any special case, the advertisements on which, confined to not more than five, are so incorporated into the scene portrayed as in no way to detract from the subject of the curtain proper. The company has equipped not a few street railway parks, among them the Brighton Beach Music Hall, at Brighton Beach, N. Y., in which the Brooklyn Rapid Transit Company is interested; the Valley Theater, operated by the Syracuse Rapid Transit Company; the park of the Biddeford & Saco Railway, of Maine, and the park of the Columbia Street Railway Company. Another park supplied by the company is the Electric Park, Newark.

THE ARCADE EQUIPMENT

With the segregation in the penny arcade of the penny vending machines has come changes in the make-up of these devices that have made them approximate a little more closely a thing of beauty than when the general practice was followed of scattering the machines throughout the resort and placing them oftentimes where they were without protection from the elements. That such machines pay well when given ordinary attention is well established, and that they are large money-makers when judiciously handled in the arcade also is well established. Moreover, it can not be argued against them that they are lacking in the essential of ever being new, for they are constantly being modified and adapted to some new service. The extreme has even been reached of delivering pie from these machines. Fixing up and maintaining an arcade with these machines can also be made a feature of park management with which the railway man need concern himself only remotely, for such firms as the Mills Novelty Company, of Chicago, and others undertake the whole burden of establishing arcades and putting them in operation. This company furnishes the machines, the interior decorations, advertising devices and everything else required. The company also installs all the apparatus and furnishes an experienced operator to look after the installation until the local management feels that it is prepared to look after matters itself.

As illustrating the uses to which the slot machine has been put may be mentioned its modification so as to make possible the turning out of name plates. A machine of this kind is made by Roovers Brothers, of Brooklyn, N. Y., and has proved very popular. It is exceedingly simple to operate and the signs turned out are a finished product and may be used for family letter boxes, desks, etc.

F. S. Zimmerman, of New York, is a manufacturer who also has to offer for installation in the arcade and for distribution throughout the park any number of types of slot machines.

ATTRACTIONS FOR THE THEATER

Vaudeville is the proper caper for the summer theater. The season is one of frivolity, and while vaudeville does not necessarily mean a frivolous show, nor is such desired, it offers that variation which prevents one from becoming bored. Perhaps, as a preliminary, some descriptive music, such as made for the fame of a certain coast resort at New York, whose only amusement attraction for years was a music hall, afterward a sensational animal show. Then some popular airs sung by a real artist and so through a program of, say, eight or ten numbers. Among the firms prepared to furnish shows is John C. Jackel & Company, of New York, who put on sensational animal, circus, novelty and vaudeville acts.

J. W. Gorman, of Boston, who has been before the managers of street railway parks ever since the park idea was first evolved, offers this season a special line of attractions especially suited to street railway park conditions. Mr Gorman is one of the circuit managers, and arranges for a show to meet individual requirements, his large number of "stars" making it possible for him to do this.

MOVING PICTURES

With the perfection by the manufacturers of moving picture machines of devices for removing the liability to fire which heretofore existed, an objection to the machines, which in some quarters was greatly exaggerated, has been finally removed. As to the popularity of the pictures as a form of amusement, that is readily attested by the large increase in output of the machines. The pictures never fail to attract, the ingenuity of the film companies in creating new subjects affording a change of program as frequent as may be desired. As for range of subjects, that is limited only by the creative genius of the designers, who are most prolific of ideas. Moreover, the practice of the machine and picture makers in renting pictures alone makes it possible to change the bill as frequently as may be desired. A great advantage of this system is that the co-operation may be had of the picture firms in the selection of subjects, this being something governed largely by the requirements of the public to whom it is proposed to cater. Among the companies whose energies are devoted entirely to this feature of the amusement business is the American Film Exchange, of Pittsburg, Pa., which not only rents and sells films, but furnishes operatives, repairs machines, supplies carbons, tickets and other essentials. Thus is it possible to plan and execute from start to finish with one firm a complete amusement enterprise of the kind.

Geo. K. Spoor & Company, of Chicago, is another firm that makes a specialty of moving pictures. They build their own machines of exclusive pattern and superiority, and furnish the moving picture exhibitions to all the Orpheum Theaters in New Orleans, Kansas City, Omaha, Denver, Salt Lake City, San Francisco, Los Angeles, St. Paul, Minneapolis, together with the vaudeville houses of Kohl & Castle circuit in Chicago, including the Majestic, Olympic and Haymarket Theaters, and in fact all of the leading theaters of the West, North and South, exhibiting moving pictures week in and week out from every known maker of moving picture films in the world. As moving picture exhibitors of very high class, they furnish only their own apparatus and exhibition complete as wanted, with competent and experienced men in charge, giving the show complete to the very minutest detail. There is only a limited number of these special machines in existence and obtainable through the closing of the theaters for the summer season. Spoor & Company say their particular exhibition is one of unusual merit and of a classification that demands the attention of the park managers whose sole aim is to make the people ride and ride again.

The Kinetograph Company, of New York, reports a constantly growing business among parks and theaters. This company supplies the moving picture machine, a weekly change of bill and an operator, or will sell machines outright and supply new films weekly or oftener as desired upon a rental basis. The company says, however, that its machines can be handled by any park employee. The Kinetograph Company is agent for the machines and films made by the Edison Manufacturing Company.

FURNISHINGS

No matter what the enterprise, the question of suitable furnishings enters. In some instances it is only remotely associated with the inducing of patronage. Again, it is a most important factor, and may turn the balance in favor of success. In the park proper it is a question of suitable seats, carefully distributed to afford protection from the sun. Again, it enters where there is a summer theater. Where refreshments are served, and at the soda counter and carousel house it takes the form of suitable drapings and comfortable seats. In one instance on record at Coney Island a portion of a drug store, generally regarded as unavailable for use because it was rather inaccessible, was utilized to good advantage to increase the capacity of the soda fountain by judicious lighting and tasteful furniture, which added a cosy-corner effect. In this case the extreme was even resorted to of miniature steel rod chairs and tables for children. Around a pillar was constructed a seat upholstered in leather. As far as furniture is concerned, there has been an increasing tendency of late toward the use of steel rod furniture. The A. H. Andrews Company, of Chicago, claims that its steel rod furniture is inexpensive, elegant, cleanly and indestructible, and for cigar booths, soda fountains, souvenir stands, etc., has many advantages over wood, more especially that anachronism, the permanent swinging stool.

The E. H. Stafford Manufacturing Company, of Chicago, also makes a specialty of furniture for amusement resorts. This company's products include among other things benches, opera chairs, folding chairs, baseball chairs and office furniture.

THE KICKING MULE

All games or amusement enterprises appealing to men in which the baseball enters or skill in throwing is sought to be tested have proved most profitable. Such games had their beginning in throwing balls at wooden babies, and were thought to have reached their climax when the object of the thrower came to be nothing less than the head of a negro. But that was not the finale. Similar amusements have been perfected recently which appeal alike to men, women and children, and do not call for the exercise of especial care by the operator to arouse among the spectators a competition. The kicking mule, made by the Cincinnati Novelty Company, is one of the latest of the devices perfected in which the baseball plays an important part. Naturally, the mule is Maud. The balls are thrown, and the mule kicks as only a mule can kick. The antics of the mule and the efforts of the ball tossers work the crowd into feverish excitement. The apparatus is inexpensive to install.

BOX BALL

Bowling, which is again in public favor, is made possible for the summer park by the portable boxball alleys, introduced and manufactured by the American Box Ball Company, of Indianapolis, Ind. In the game of boxball, which really is a modification of bowling and resembles what is commonly referred to among bowlers as the duck pin game, can be readily installed in a few hours at slight cost, and is automatic in operation in that no pin boys are required and the balls are returned by gravity. Boxball has the added advantage over bowling of appealing alike to all classes, whereas bowling proper generally is indulged in in public only by the men and here and there a woman member of some club. For this reason the game of boxball has become extremely popular. In boxball, each alley is furnished with five pins instead of ten, and these are so numbered as to make possible a score of 300 in a ten-frame game. Lignum-vitæ balls, 4½ ins. in diameter, are used. Since the introduction of boxball, some three years ago, many street railway parks have been equipped which could not afford a regular bowling alley.

THE RIDING GALLERY

The riding gallery seems always to be popular. In fact, the changes in general design and the elaboration of the equipment have tended to renew the interest of the older people in this amusement device. When there is added to the gallery itself an organ attachment of the latest design, giving a large range of pieces, this is especially true. The statement ever seems to be justified that the carousel is the delight of the children, and ever will remain so. As supplied by the Herschell-Spillman Company, of North Tonawanda, N. Y., the riding gallery may be had in any one of a number of designs which offer a range in completeness and magnitude that will meet all requirements.

Another manufacturer who makes a specialty of riding galleries and similar devices is C. W. Parker, of Abilene, Kan. Mr. Parker has to offer a large assortment of merry-go-rounds, shooting galleries, and all kinds of mechanical and electrical shows. In addition, Mr. Parker has a goodly assortment of circus, flat and private cars. Mr. Parker also is the creator of spectacular amusement shows, and was responsible for the popular attractions, "North America" and "Beautiful Bagdad."

PARK ACCOUNTING

Organization is everything. As pointed out in the article elsewhere in this issue on the methods in vogue at Electric Park, Newark, the amusement and park managers are beset with peculiar conditions against which it is hard to guard. For this very reason particular attention has been paid to the accounting side of amusement enterprises by the large companies, and as a result there has been established at Chicago a firm of accountants, the Froebel-Dehen Company, which makes a specialty of park accounting. This company says that with the aid of its perfect ticket register, a form specially devised for parks, fairs or carnival requirements, any alert bookkeeper can strike his daily balance for every show in the park, including gate admission, within half an hour; this record covers all data for statistical calculation. This system, so the company says, has enabled it to check out and keep correct tab on 18,000,000 tickets in the past two seasons at "White City," Chicago.

THE EMPLOYEES THEMSELVES

There must be some way of distinguishing the park employee from the visitor, and the usual way is to equip the men engaged in managing the different attractions in a distinctive uniform. It is even well to adopt as standard the uniform of the platform men, but slightly to modify it so as to differentiate it from that worn by the car men. In this way the uniforms may be readily converted from one class to the other, which is both desirable and economical. M. C. Lilley & Company, of Columbus, Ohio, make a specialty of uniforms for electric railway employees, theater ushers, guards, bands, etc.

FINANCIAL INTELLIGENCE

WALL STREET, March 20, 1907.

The Money Market

Monetary conditions have improved materially during the past week. The influx of funds from out-of-town institutions attracted here by the high rates prevailing at the close of a week ago, and the heavy liquidation in the securities market resulted in a pronounced relaxation in rates for both call and time accommodations. At the beginning of the week when the disturbances in the securities market was greatest, day to day money loaned as high as 25 per cent, while the premium demanded on fixed time loans commanded the legal rate of 6 per cent and a commission, which brought the total charge to the borrower, in some instances, up to 7½ and 8 per cent. Toward the close of the week, however, several of the large local institutions appeared in the market as liberal offerers of call money, which broke the rates on this class of accommodation to 4 per cent, while the commissions previously exacted on time loans entirely disapeared. At the close of the week the local situation had assumed almost normal conditions, but the immediate future of the market is somewhat uncertain. This is emphasized by the fact that only one bid was received by the city of Philadelphia for its recent bond offerings, while the city of St. Louis failed to receive a single proposition regarding the sale of its $3,000,000 3.65 per cent loan. New York exchange at Chicago advanced to 10 cents premium, showing that the demand for money at that center is less urgent, but at some of the other interior cities the inquiry for funds continues. The offer of the Secretary of the Treasury to redeem with interest to July 1, $25,000,000 4 per cent bonds maturing on the above date has not met with much success up to this time, but it is expected that the depositing of customs collections with the depository banks, which has been authorized by the Treasury department, will sooner or later have a beneficial effect. Since March 15, the local institutions have gained $1,500,000 on their operations with the Sub-Treasury, which compares with a loss of $3,480,000 in the same time a week ago. The low prices prevailing for cotton foreshadows a renewal of the export movement of the staple, but this factor has been partially offset by the sale of American securities by foreigners. Sterling exchange, however, continues at the gold import point, but so far only small amounts have been picked up in the European markets for shipment to this side.

The monetary situation abroad is strained and in some quarters advances in discount rates, both by the Bank of England and by the Imperial Bank of Germany, are looked for. The Bank of England continues to absorb all the gold arriving in London from South Africa, and it is expected that the greater part of the $2,500,000 gold due to arrive at the end of the current week also will be taken by that institution.

The bank statement published on last Saturday was better than expected. Loans decreased $13,380,300 as a result of the heavy liquidation in stocks. Cash decreased $2,997,300, or considerably less than indicated by the preliminary estimates. The reserve required was $3,978,675 less than in the previous week, thus increasing the surplus reserve by $981,375. The surplus now stands at $3,033,100, compared with $5,865,125 in 1906; $5,154,175 in 1905; $27,310,575 in 1904; $3,180,400 in 1903; $3,-471,250 in 1902; $10,002,600 in 1901, and $2,686,425 in 1900.

The Stock Market

The stock market during the past week has been excited and sensational in character, with price fluctuations that have not been equaled since the panicky days of 1901. In some instances certain of the active stocks sold even lower than they did during that period of stress six years ago. There was heavy liquidation, together with active short selling, especially of the standard railroad stocks, but this movement culminated early in the week, and was followed by a very sharp upturn on which the greater part of the decline was recovered. In this movement there was some substantial investment buying in evidence, while active speculative purchases furnished the principal stimulus for the recovery. Following the publication of the bank statement, and over Sunday consideration of the speculative position, and the rumors from Washington having relation to the plans of the administration regarding control of railroads, there was a resumption of the selling movement, and the greater part of the recovery was lost, while the pressure directed against certain of the leading issues developed a feeling of demoralization, accompanied by some very sinister rumors, none of which took on practical form. It was said that some weak spots had been strengthened by banking assistance, and, that, as a result, there was and is, little probability of any failures. The general situation has not changed materially, and while money rates here declined and sterling weakened, the foreign markets continued firm, and all the gold laid down in London was taken by the Bank of England, thereby disposing of the rumor of imports of any substantial amount of the yellow metal by New York brokers. Trade conditions are less satisfactory, owing to the heavy floods and extensive damage in the Ohio Valley, the damage at Pittsburg alone being sufficient explanation of the heavy selling and weakness in United States Steel stocks and some of the trunk line shares. Aside from the various rumors, having apparently a Washington origin, there has been no development that would clearly explain the panicky features of the past two weeks. The technical position of the market has undoubtedly been improved by the heavy liquidation. Notwithstanding that there has been no adverse change in the copper metal situation, the metal stocks have all been weak, and heavy selling of Amalgamated Copper and American Smelting went far to increase the general uncertainty. One good feature of the present situation is that commission houses have not been carrying any large line of stocks on margin, as the speculative public have ignored the stock market for a considerable time, and have given attention almost entirely to mining stocks.

The traction stocks moved in sympathy with the general market, and opinion regarding these issues will continue uncertain, pending further developments in connection with the public utilities bill which will come up for a hearing before the Senate Judiciary committee the latter part of the month.

Philadelphia

Transactions in the local traction shares were considerably larger during the past week, but they were accompanied by a very irregular price movement. In the early dealings, practically all of the active issues reflected the liquidation in other quarters of the securities market, but toward the end of the week the market steadied, and in most instances the early losses were fully recovered. Philadelphia Rapid Transit was an exception to the general rule; opening at 19¼, the price yielded on heavy selling to 16¼, the lowest price recorded for the stock for a long while, and from which it recovered 1¼ points. About 40,000 shares were traded in. Union Traction ran off in sympathy with Philadelphia Rapid Transit, the price declining from 55½ to 53, but at the close there was an advance to 56. Philadelphia Company sustained an early loss from 44⅞ to 43, but later rose to 45, while sales of the preferred took place at 46. Philadelphia Traction, after selling at 90½, advanced to 92. Other transactions included Railways General at 6, United Traction, of Pittsburg, preferred, at 47; American Railways at 49½; Lehigh Valley Transportation preferred at 20¾ to 21; United Companies of New Jersey at 248 to 250; Camden & Trenton at 1⅜, and Union Traction of Indiana at 33.

Baltimore

Interest in the Baltimore traction issues centered almost entirely in United Railway issues, which were active and irregular. The 4 per cent bonds, after a decline from 86½ to 84, advanced to 87, on transactions amounting to $75,000, while the incomes, on dealings of more than $100,000 moved from 52 to 51½ and back to 52¾. The free stock sold at 10½ to 11½, while the certificates representing the pooled stock brought 10½. Atlanta Street Railway 5s sold at 102½ and 102.

Other Traction Securities

The Boston market for traction shares was moderately active and generally lower. About the only issue to display strength was Boston & Worcester common, which, after an early decline to 22¾, advanced sharply to 26. The preferred stock sold at 74. Boston Elevated broke from 147 to 144½, and recovered only a fraction, and Massachusetts Electric common, after selling at 17½, ran off to 16 and recovered a point. The preferred stock lost 1½ points to 64. Boston & Suburban common sold at 14, and the preferred at 57 to 55, the transactions at the latter figure being ex. the dividend. West End common changed hands at from 94 to 92½, and the preferred at 107 to 106. The Chicago market was practically neglected. A few transactions in Metropolitan West Side Elevated were reported at 67 to 65. West Chicago sold at 20 for a small lot.

Aurora, Elgin & Chicago was in demand on the Cleveland Stock Exchange at times within the past week, and some of the stock changed hands. It held around 34 for several days and closed at 34½, with 35 asked. Cleveland & Southwestern was bid at 11, with the preferred stock in demand at 55, and 61 asked. Forest City still holds its own well at 95 bid, notwithstanding the stories on the street regarding the probable settlement of the traction fight. There has been little activity in Cleveland Electric for several days, and it will probably not be in demand until something more definite is known from the consultation room of Messrs. Andrews and Du Pont. Holders of stock are asking 63½, while 60 was bid.

Security Quotations

The following table shows the present bid quotations for the leading traction stocks, and the active bonds, as compared with last week:

	Mch. 13	Mch. 20
American Railways	50	49
Boston Elevated	147	145
Brooklyn Rapid Transit	55	54
Chicago City	150	150
Chicago Union Traction (common)	4¼	4¾
Chicago Union Traction (preferred)	13	13
Cleveland Electric	65	—
Consolidated Traction of New Jersey	72	71
Detroit United	72	69
Interborough-Metropolitan	24⅞	24
Interborough-Metropolitan (preferred)	60	58½
International Traction (common)	54	54
International Traction (preferred), 4s	79	79
Manhattan Railway	137¼	135
Massachusetts Elec. Cos. (common)	17	16½
Massachusetts Electric Cos. (preferred)	65	63
Metropolitan Elevated, Chicago (common)	23	23
Metropolitan Elevated, Chicago (preferred)	65	64
Metropolitan Street	—	—
North American	73¾	73⅞
North Jersey Street Railway	40	40
Philadelphia Company (common)	44	43
Philadelphia Rapid Transit	17	16¾
Philadelphia Traction	*91½	92
Public Service Corporation certificates	66	65
Public Service Corporation 5 per cent notes	95	94
South Side Elevated (Chicago)	78	80
Third Avenue	103	106
Twin City, Minneapolis (common)	93	94½
Union Traction (Philadelphia)	55½	54

* Ex-dividend.

Metals

According to the "Iron Age" the flood in the Pittsburg district has led to a serious loss in production, both on the part of blast furnaces and of steel works and rolling mills. The impression, however, that all of the plants were affected is not quite correct. There is very little doing in basic pig. At times an urgent demand for spot foundry iron crops up for which premiums are obtained. Satisfactory reports come from the finished iron and steel trades, particularly so far as the lighter lines are concerned.

Copper metal holds strong at unchanged prices. They are: Lake, 25⅜ and 25¾; electrolytic, 25⅛ and 25⅜; castings, 24⅝ and 24⅞.

OFFICERS NOMINATED FOR NEW ENGLAND CLUB

The nominating committee appointed by President Winsor, of the New England Street Railway Club, to present a list of officers to be voted for at the annual meeting, Thursday, March 28, has made its report, and the recommendations are given below. The annual business meeting will be held at 3 o'clock in the afternoon of March 28, at Hotel Somerset, Boston, and balloting for officers will begin at 3.30 o'clock. As stated in the Street Railway Journal last week, the annual banquet will be held in the evening at Hotel Somerset.

Nominations for officers, 1907: President, Henry C. Page, Springfield, Mass.; vice-presidents, M. C. Brush, Newtonville, Mass.; Horatio Bigelow, Norwich, Conn.; J. Brodie Smith, Manchester, N. H.; F. H. Foote, St. Albans, Vt.; D. F. Sherman, Providence, R. I.; E. A. Newman, Portland, Me.; secretary, John J. Lane, Boston; treasurer, N. L. Wood, Boston; executive committee, Paul Winsor, Boston, Mass.; W. D. Wright, Providence, R. I.; C. H. Hile, Boston, Mass.; John F. McCabe, Worcester, Mass.; E. A. Sturgis, Boston, Mass.; Charles C. Pierce, Boston, Mass.; George C. Ewing, Boston, Mass.; finance committee, Henry C. Page, Springfield, Mass.; John W. Corning, Boston, Mass.; E. P. Shaw, Jr., South Framingham, Mass.

THE SAN FRANCISCO COMPANY'S FINANCES

Some interesting statements are made by the United Railroads of San Francisco in connection with its request to list on the New York Stock Exchange additional sinking fund gold bonds. The $1,000,000 4 per cent bonds are secured by first general deed of trust, dated June 7, 1902, given by the United Railroads of San Francisco to the Union Trust Company of San Francisco, as trustee, and make the total amount listed to date $21,000,000, all of which have been sold and passed beyond the control of the company. The $4,409,000 4 per cent sinking fund gold bonds of the denomination of $1,000 each, also sought to be issued, make the total amount of 4 per cent sinking fund gold bonds to be ultimately listed $25,409,000. The said bonds for which the present application to list is made are for $1,000 each, maturing April 1, 1927, bearing interest from April 1, 1902, payable semi-annually on April 1 and Oct. 1, either in San Francisco or New York, at the option of the holder. They are in coupon bearer form, but can be registered as to principal at the office of the company in San Francisco.

The company has actually expended in work of reconstruction, betterment and improvement, to the date of this application, upwards of the sum of $3,870,563.83, and has entered into contracts to be performed within the ensuing six months for additional construction, betterments and improvements, upon the lines above indicated to the amount of upwards of $?,717,351.29. The company has received from the trustee, duly certified, pursuant to resolution of its board of directors and under the provisions of the deed of trust hereinbefore set forth, out of said reserve of $5,409,000 bonds, the sum of $1,000,000 of bonds of $1,000 each, numbered consecutively 20,001 to 21,000 inclusive, which bonds have been sold and delivered to actual purchasers, and the proceeds thereof applied to the payment so far of the expenditures as made by it as above. A sinking fund equal to 2 per cent of the entire gross earnings of the company, but not less than $100,000 per year, is provided for in the deed of trust, and began to run Jan. 1, 1905. All surplus income above 5 per cent on the common stock of the United Railroads of San Francisco otherwise applicable to the payment of dividends thereon must also be applied as a sinking fund or for improvements.

Statement of sinking funds:

	Park & Cc. R. R. Co.	Mkt. St. Cab. Ry. Co.
Balance uninvested Nov. 30, 1906	$3,530	$22,933
Investments (total) to Nov. 30, 1906	89,872	686,848
Total to credit sinking funds	$93,402	$709,781

	The Omnibus Cable Co.	United Railroads
Uninvested Nov. 1, 1906	$102,011	$11,052
Balance uninvested Nov. 30, 1906	102,011	11,052
Investments (total) to Nov. 30, 1906	508,900	276,895
Total to credit sinking funds	$610,911	$287,947

ANNUAL REPORT OF THE INTERNATIONAL TRACTION COMPANY

The annual report of the International Traction Company, of Buffalo, for the year ended Dec. 31, 1906, has been issued. The income account compares as follows:

	1906	1905
Gross receipts	$4,972,688	$4,484,643
Operating expenses	2,884,985	2,483,663
Net earnings	$2,087,703	$2,000,980
Other income	69,110	68,562
Total income	$2,156,813	$2,069,542
Interest, rent and taxes	1,691,959	1,652,376
Surplus	$464,854	$417,166

Surplus is equal to 2.64 per cent earned on the $10,000,000 common stock after allowing for the 4 per cent dividend on the $5,000,000 preferred stock.

The condensed general balance sheet of the International Traction Company as of Dec. 31, 1906, compares with that of April 30, 1906, as follows:

Assets.

Stocks and bonds of other companies	$29,949,763
Organization expenses	15,488
Bills receivable	3,131,129
Accrued interest on bills receivable	112,368
Car trust No. 1	224,835
Car trust No. 2	914,301
Accounts receivable	324,234
Fifty-year 4 per cent collateral trust bonds on hand	300,000
Funds in bank to pay coupon interest	361,860
Funds with treasurer	4,791
Total	$35,338,768

Liabilities.

Capital stock	$15,000,000
Funded debt	18,255,000
Car trust certificates No. 1	112,000
Car trust certificates No. 2	570,000
Bills payable	425,000
Accrued interest on funded debt	362,227
Accrued interest on car trust certificates	1,069
Surplus	613,473
Total	$35,338,768

President Pierce says in his annual report that inasmuch as the company cannot increase its bonded indebtedness, it will be necessary, in order to carry out its undertakings, not only to expend the profits of 1907, but also to borrow $1,000,000 from the banks. This means that the payment of dividends must be further delayed. During the year ended Dec. 31, 1906, the surplus amounted to $464,854, which was sufficient to allow of the 4 per cent cumulative dividend on the $5,000,000 outstanding preferred stock and to leave an amount equal to 2.64 per cent on the $10,000,000 common stock. During the previous year the preferred dividend was carried and a balance equal to 2.10 per cent on the common stock.

The undertakings mentioned by President Pierce consist of building within the next eighteen months a new double-track line over the company's own right of way between Buffalo and Niagara Falls, connecting at Tonawanda with its Lockport division. The company also contemplates building additional tracks in various streets of Buffalo in order to relieve the present congestion of street car traffic and to afford proper transportation facilities. Franchises for the construction of some of these tracks have been secured, and the other franchise necessary will probably be secured in time to permit of all of the work being done before the close of the present year.

During the last year the company completed its new car shop and a new sub-station on the east side of Buffalo; constructed 12 miles of track in Buffalo, and added 150 new cars to its equipment, at a cost of nearly $1,000,000.

AN IMPORTANT DECISION IN NEW YORK REGARDING THE BUILDING OF PARALLEL STEAM AND ELECTRIC LINES

In granting a certificate of public convenience and necessity to the Rochester-Corning-Elmira Traction Company, the Appellate Division, sitting in Rochester last week, handed down a lengthy decision, a considerable portion of which was devoted to the expediency of permitting electric roads to be constructed parallel to established steam roads. The opinion, by Justice McLennan, with all other justices of the Appellate Division concurring, states that the fact that electric lines parallel steam railroads does not constitute a valid objection to the former, although it may reduce the earning capacity of the latter. This, the opinion cites, has been the decision of the courts in many similar cases, and electric roads have been built through the State not only parallel to, but within sight of the roads operated by steam.

The real dissension of the Appellate Division from the opinion of the State Railroad Commission, which denied the company the right to build, was on the question as to whether or not people residing in the territory through which it is proposed to operate the new road are already reasonably well supplied with transportation facilities by means of the steam roads and existing trolley connections. The Board was of the opinion that such was the case, especially as the steam roads have expressed the intention of changing their motive power to electricity and improving their service. On this point the decision of the court says:

The question was not whether the through transportation facilities between termini or even between the larger cities were inadequate, but whether the people living along the line of such steam railroad and between its stations required additional facilities. Indeed, between points a long distance apart the trolley roads do not compete with the steam roads. The passengers and freight which the former carry are as a rule carried to the station of the latter. In all essential respects, the two serve separate purposes, each equally necessary to the convenience of the public.

This policy has been adopted by the Board of Railroad Commissioners so uniformly that it may be regarded as the settled policy of the State, to wit: to permit steam railroads to be paralleled by trolley roads, however ample the facilities furnished for travel by such steam roads between terminal points or between principal stations, and so notwithstanding such trolley road may reduce the earnings of the steam roads. The primary purpose of a trolley road is to convey people directly from their homes to the nearby villages or cities or vice versa.

The opinion says that facilities for through service between Rochester, Corning and Elmira are now reasonably adequate, but the evidence demonstrates that the facilities for local traffic are wholly inadequate upon the entire route (except between Corning and Elmira), that trains are run infrequently; that the stations are comparatively long distances apart and that a considerable portion of the territory is not accommodated by existing railroads, which will be no more closely paralleled by the proposed railroad than such railroads usually have been by such construction in other parts of the State.

The fact that the Erie Railroad Company proposes to electrify its road does not materially alter the proposition. That does not mean that it is to be converted into a street surface railroad, but rather that the motive power for the transportation of passengers will be changed from steam to electricity. Regular trains, passenger and freight, will be run then as now, must be run on schedule time, and will only stop to take on or let off passengers at the regular stations. The passenger trains may run more frequently, but, with all the changes suggested, the people along the route will not have such facilities as is understood will be afforded by a street surface railroad. The evidence shows that the population to whom the line of the proposed road would be reasonably accessible averages between 400 and 500 per mile, not including the population of either Rochester or Elmira, and the evidence very conclusively shows that such population has at the present time very inadequate transportation facilities along the greater part of such route. That fact becomes apparent upon examination of the time-tables of the existing roads.

It does not necessarily follow that the present facilities for through traffic between the termini are not reasonably adequate, but it can hardly be contended that the local demand has been reasonably met. And it is established beyond doubt that with additional accommodations the demand would be largely increased. In addition, it is true that considerable portions of the territory through which it is proposed to operate the road in question have practically no railroad facilities. We think the evidence fails to show that such conditions will be materially changed

even after all the improvements which are under way or are contemplated by the opposing companies have been made. When all is completed, practically none of the facilities offered by a street surface railroad, if properly operated, would be afforded to the inhabitants of the territory in question.

From Albany to Buffalo street surface railroad companies have been authorized to construct their roads within sight of the railroad of the New York Central for practically the entire distance, and so, although upon such road passenger trains are run in each direction hourly or oftener, it was not considered an objection that such new road would reduce the revenue of the old, or that it had ample facilities to accommodate a much larger traffic. We fail to see how a distinction can properly be made as between such cases and the one at bar.

Upon the whole evidence and after giving full consideration to the many suggestions of able counsel, we conclude that the order applied for, directing the Board of Railroad Commissioners to issue a certificate of public convenience and a necessity, should be granted, but without costs.

ARRANGEMENTS FOR EXHIBITS AT IOWA CONVENTIONS

A special notice has been issued to manufacturers' representatives with reference to the convention of the Iowa Electrical Association and Iowa Street and Interurban Railway Association, to be held at Clinton, Ia., April 18, 19 and 20, 1907, as previously noted in the Street Railway Journal. As is customary at all conventions, it will be necessary for delegates to "double up," *i. e.*, more than one man in a room, and in the case of very large rooms, possibly three or four. The rates at the hotel will be: Outside rooms with bath, $3.50 each person per day; outside rooms without bath, $3.00 each person per day; court rooms without bath, $2.50 each person per day. All rooms are on the American plan. In case the Lafayette Inn will not accommodate all delegates and manufacturers' representatives, reservations have been made at the Revere House and the Grand Hotel, at the same rates, no baths, as at the Lafayette Inn. Space for exhibits, also current for light and a limited amount of power will be provided in the basement of the Lafayette Inn, free of charge. The only expense to exhibitors will be that of providing materials and labor for erecting and dismantling booths and the moving of their goods. The exhibition space, which consists of thirteen 10 x 8 divisions, three 7 x 10, one 7 x 9, two 4 x 6, and one 8 x 8, is clean, well lighted and suitable for the purpose. Current furnished will be single-phase, 60-cycle, 110 and 220-volt alternating, and 600-volt direct current. Arrangements have been made with the Western Passenger Association for a rate of one and one-third single trip fare on the certificate plan, from any part of the State of Iowa and from Chicago, St. Louis and Minneapolis, based on a single-trip rate of 3 cents per mile. The committee asks to be informed by the manufacturers of their intentions by April 15.

THE FLOODS IN THE CENTRAL WEST

From all over the Central West come reports of damage to street railway property by the floods. Pennsylvania and Ohio roads especially seem to have suffered, and more particularly the territory adjacent to Pittsburg and Cincinnati. The latter city on Thursday evening, March 14, was visited by a very heavy storm, and for 30 minutes not a street car in the city was able to move, and some of the lines were badly crippled afterward. The East End line was clogged with stones and rubbish washed from cross streets in some places 3 or 4 ft. deep, and it was some hours before this could be removed. The lower end of the Sedamsville line was covered in places with water to such a depth that the cars could not move. Landslides blocked the Warsaw and Elberon lines in places, and a number of cars were derailed as a result. A number of other lines were seriously crippled. The Walnut Hills tracks, reaching a fine residence portion of the city, escaped.

The street and interurban cars about East Liverpool were compelled to cease operations or run in a very limited way, as a result of a rapid raise in the Ohio River, while the electric light plant shut down. Wheeling, W. Va., was cut off from the outside world also, both the steam and interurban roads being covered with water.

Between New Philadelphia and Uhrichsville the tracks of the Northern Ohio Traction & Light Company were under water to the depth of 3 ft. Wednesday and Thursday, and all traffic was cut off. At Zanesville the water also greatly hindered trolley operations, and the Scioto Valley Traction Company has had difficulty in keeping its cars in operation. Many other places have suffered greatly from the flood, which results from heavy rains falling while the ground was covered with several inches of snow.

Buckeye Lake, on the Newark division of the Indiana, Columbus & Eastern Traction Company, overflowed and did much damage to property near it. The flood gates had been opened, but they did not relieve the situation rapidly enough.

As previously stated, the lines in the Pittsburg district were hard hit. The Johnstown Passenger Railway Company had certain lines out of operation for some little time, and the power house was flooded. Johnstown experienced the greatest flood since the catastrophe of 1889. The tracks of the Altoona & Logan Valley Railway were covered with several inches of water at Buena Vista. The lines along the Susquehanna River were not greatly inconvenienced, the ice passing off without causing serious damage.

CAMBRIDGE SUBWAY STATIONS AND RAPID TRANSIT

In connection with the development of the Cambridge subway plans by the Boston Elevated Railway Company, the question of the number of stations to be located between Park Street, Boston, and Harvard Square, is at present one of much local public interest and discussion. Opinion in some cases favored the establishment of but one station between these points, while in other instances the demand is for four or five stations. The company favors the single station plan, pointing out that the greater portion of the public—perhaps 80 per cent—will come nearer getting rapid transit by the location of a single intermediate station at Central Square, Cambridge, than by the establishment of four stations for the benefit of people desiring frequent stopping places. Both Harvard and Central Square are local points for heavy passenger traffic, and many car lines traverse one or both of these localities. Transfers from local surface cars to through subway trains making express runs between Central Square and Boston, and between Central and Harvard Squares, can be made with the same readiness which experience has shown feasible at all the elevated stations in Boston proper.

With infrequent stops it is expected that the trains in the Cambridge subway will be able to make 40 m. p. h. on straight track, and with a stop at Central Square only it is estimated that the run from Harvard Square to Park Street can be made in 8 minutes or less. The establishment of three more stations would increase the running time 5 minutes, or 62.5 per cent, because with frequent slow-downs, stops and starts, the maximum speed can be maintained only for a fractional part of the distance to be covered.

It is to be hoped that in this instance the single station plan will prevail, for there is no question in the light of Boston experience that the location of stations relatively far apart in the middle territory between the business districts and the rapid transit terminal stations was a wiser policy than would have been the establishment of a multiplicity of stations for intermediate traffic. It is fair to assume the surface and subway lines in Cambridge will supplement each other in the same general way now in effect in Boston. It is impossible to build a railroad in any populous region without some heartburnings on the part of that portion of the public which does not get stations in its immediate neighborhood. This applies even to pole stops, as was recently shown on another division of the Boston Elevated system. In the latter case, at the request of certain inhabitants along the route, some of the old pole stops were cut out in the endeavor to give faster service. Other inhabitants strenuously objected to the reduction in stops, and so the original service was resumed. The privilege of boarding or leaving a trolley car at practically any street corner is thoroughly ingrained into the public temperament, despite the antipodal attitude of mind observable in steam railroad patrons. Nothing is more certain than that the only salvation of some lines in the way of giving faster service is by reduction of certain stops, but it looks like a very difficult task to bring this home to the public's intelligence.

CONTRACTS AWARDED BY SCHOEPF SYNDICATE

Contracts awarded by the Schoepf syndicate provide for the construction of concrete steel bridges and the grading of 45 miles of road between Lima and Bellefontaine and 31 miles between Leipsic and Toledo, and reconstruction work on 9 miles of road between Middletown and Hamilton. The Indiana, Columbus & Eastern awarded the contract for the work between Lima and Bellefontaine; the Cincinnati Northern Traction Company, that between Hamilton and Middletown, and the Stratford Construction Company, of New York, the line between Leipsic and Toledo. J. C. Carland, of Toledo, a steam railroad contractor, secured the contracts. The construction of the two pieces of road will complete a line from Cincinnati to Toledo, the Schoepf interests already reaching Bellefontaine from the south. The Lima & Toledo Traction Company is a part of the same system, and will complete the line into Toledo. The reconstruction of the Middletown-Hamilton section will take the road off the public highway and make possible much better speed. From Lima to Fort Wayne the company will have connection, and the electrifying the steam road from Lima to Defiance will give a start toward Michigan territory in another direction. Contracts for rails will be let shortly.

NEW YORK COMMISSION TO DISCONTINUE REPORTS FOR GREATER NEW YORK

The State Board of Railroad Commissioners of New York has decided to discontinue, at least temporarily, the issuing of the quarterly reports showing statistics as to transportation in Greater New York. These reports have been issued every three months for several years and have been remarkably complete in their detail. They have given for each quarter the cash fares, the transfers and the total cash fares and transfers received by each street railroad operating company; the greatest number of passengers carried in one day, the car mileage, and the number of transfer points.

OHIO MEN NOT FORCING FREIGHT INTERCHANGE

Electric railway managers at Cleveland resent the statement purporting to come from the steam railroad interests that the trolley managers are making a concerted effort to force the steam roads into an interchange of business through the Interstate Commerce Commission. The report originated through the story from Chicago to the effect that the Chicago & Milwaukee Electric Railway Company had filed a petition with the Commission to force the Illinois Central and the Yazoo & Mississippi roads to enter a rate agreement with them. Although the Interstate Commerce Commission has declared the electrics to be common carriers, the electric railway managers say there has been no concerted action to force an agreement. Some of the roads now have individual agreements with the steam lines and on such freight as can be handled on a through basis is taken. This, however, is a matter between the roads making the agreement and has nothing to do with the others. Few of the roads in Ohio make any attempt to handle anything more than light freight and packages.

LEGISLATION IN SOUTH DAKOTA

The only enactment of the late legislative session in South Dakota which bears upon street railway work was an amendment to the State corporation laws, allowing the extensions of charters for such utilities for a period of thirty years in any city of 10,000 or more population, when such extension of charter life is authorized by a vote of three-fifths of the voters of the city. The normal charter life under the laws of the State is twenty years, and this is not considered a long enough time for the floating of securities for street railways. The real intent of the law was to allow the construction of a street railway system in Sioux Falls, which has been attempting to secure such an improvement for a number of years. A company now promises a system in case the required vote is assured at the coming city election.

A measure which passed the Senate but failed in the House was to give electric railways right of way on the highways of the State. Ninety per cent of the members of the House were farmers, who instead of looking upon the electric railway as a benefit to themselves, took the position that there are now, with automobiles and other means of propulsion, enough bogies on the highways. The main purpose of this bill was to secure a right of way for a line from Presho, on the Chicago, Milwaukee & St. Paul system, running west from Chamberlain and Fort Pierre, at the starting point of the Chicago & Northwestern line west from the Missouri River.

TEXAS TRACTION COMPANY PERFECTING ITS FINANCES

The Texas Traction Company has made a mortgage to the Old Colony Trust Company, as trustee, to secure an issue of $3,000,000 of thirty-year 5 per cent $1,000 gold bonds, due Jan. 1, 1937, subject to call at 110, to provide for the construction and equipment of the line now being built between Sherman and Dallas, Tex., 63 miles. Of the bonds, $2,000,000 are issuable forthwith, the balance being reserved for improvements and extensions, as required under severe restrictions contained in the mortgage. The company was incorporated in Texas in 1906, with $2,000,000 authorized common and $2,000,000 6 per cent cumulative preferred stock (the right to cumulative dividends to be computed from the time the road is placed in operation); outstanding $1,000,000 of each, par $100 each. Interest is payable in Jan. and July 1 at the office of the trustee. Sinking fund of 5 per cent of gross earnings for the previous calendar year is payable July 1 yearly, beginning 1912, to be used in purchase of bonds at not over 110 or to draw bonds (by lot) at that price. Bonds drawn by sinking fund will remain uncanceled in the treasury and draw interest for sinking fund purposes, but will not be considered as outstanding. The location of the road is for the most part outside of streets and highways on private land, the company having a perpetual right of way thereon, either in fee simple or by necessary easements, for a double-track road. Over streets and highways the company has fifty-year franchises except in Dallas, where entrance is made over the tracks of the Dallas Consolidated Electric Street Railway. The power house will be located at McKinney, about midway between Dallas and Sherman, J. F. Strickland, president; James P. Griffin, secretary; Osce Goodwin, treasurer. The details of the contract for the construction of the line were given in the issue of the STREET RAILWAY JOURNAL for Dec. 22, 1906.

THE COUNCIL AND THE STREET RAILWAY AT GRAND RAPIDS

C. M. Clark, president of the Grand Rapids Railway Company, when in Grand Rapids recently, met members of the Common Council for the purpose of talking over the extensions which the Aldermen have insisted upon being made by the company. Mr. Clark put the case plainly, and intimated that if the company complied with the requests of the Aldermen, it would in turn expect from the city an extension of the franchise. In part, Mr. Clark said: "If the Grand Rapids Railway Company were making money we would not hesitate a minute to spend it. In the seven years in which I have been interested here, we have spent all the profits and twice as much again in improvements.

"Another serious question is the life of the extensions and the conditions of the grants. If I was not connected with the Grand Rapids Railway Company now, and you would ask me to invest money in Grand Rapids under the present charter I would not do it. The charter makes it bad for raising money. As an independent business proposition I would not build one of the proposed extensions.

"In seven years we have spent $1,620,000 in improvements for the Grand Rapids Railway Company. It has been profitable to every citizen of Grand Rapids. In that time the city itself only spent $2,145,000 in improvements. We think that the money we have spent here has been one of the most potent influences in the development of the city. Our system has been almost entirely rebuilt. What we took was a junk pile, and we have developed it into one of the best systems in the country for a city of this size.

"When we bought the road in 1899 the taxes were $5,118, and last year we paid over $42,000. Have any of your taxes increased that much? At the rate which this taxing of corporations is growing the corporations will soon pay all the taxes. Then the country will be ruled by people who don't pay taxes."

Mayor Ellis favors putting the matter of franchise extension before the people to be voted upon.

LEGISLATION IN PENNSYLVANIA

The flood of new bills of every description will stop March 27, under a resolution adopted this week by the House of Representatives, which provides that after the date above mentioned unanimous consent must be secured in order to introduce a new legislative measure. Mr. Creasy wanted to amend the report of the committee on rules by providing that a new bill may be introduced after that date by a vote of a constitutional majority, but his colleagues didn't think the same way.

Trolley legislation is still to the fore. A new bill introduced this week in the House gives trolley companies the right of eminent domain, but with powers more sweeping than that now enjoyed by any other class of corporations in Pennsylvania. It was presented by Representative Moyer, of Lebanon, who last week had the Homsher Eminent Domain bill referred back to committee for amendments.

The street railway bills presented by Senator McNichol have been laid over. The companion bills in the House are having rather rough sailing, the most vigorous opposition coming from Mr. Scott, Fusionist, of Philadelphia, who is backing the contention of the Philadelphia Trades League.

It is generally believed that the trolley freight bill and the trolley eminent domain bill will reach the Governor before adjournment, although both may be somewhat amended, particularly the latter. The members from the rural districts feel that the more trolley facilities enjoyed by the farmer and the country storekeeper the greater will be their degree of prosperity and comfort.

PORTLAND RAILWAY POWER FACILITIES

With the completion of the large hydro-electric power station at Cazadero, on the Clackamas River, the Portland Railway, Light & Power Company will have 40,000 hp ready for immediate use, while 90,500 may be obtained in the near future. The Cazadero plant was started about four years ago, though it was planned at least two years earlier. When completed it will represent an expenditure of $1,000,000, and in point of equipment is probably the most modern on the Coast. It is larger than the Oregon City plant, Station B, the present capacity of which is 12,000 hp, though from the ultimate hydraulic capacity of the Willamette River it is hoped to develop from 30,000 to 40,000 hp if required. At the steam plant in North Portland, Station E, 11,000 hp can be developed, and 2500 hp is available at Station F. This gives a total capacity of 40,000 hp gaging the Cazadero station at 15,000. With the plant projected 2 miles above Cazadero, 25,000 hp additional will be available. The entire dam is cribbing, filled with rocks. The flume, which carries the water from the dam to the reservoir, is built on crushed rock, and follows the contour of the hills along the Clackamas a distance of 2622 ft., where it empties into a ditch which leads to the basin. The ditch is 35 ft. wide and 22 ft. deep, with a length of 2898 ft. The lake or reservoir covers 50 acres when filled to an average depth of 20 ft.

LEGISLATION IN IOWA

The 2-cent fare bill has passed both branches of the General Assembly of Iowa, has been signed by the Governor and will become operative July 4, 1907. The bill provides that all railroad companies which have annual gross earnings of $4,000 per mile or over shall not charge in excess of 2 cents per mile for passenger fares; those with gross earnings of over $3,000 and under $4,000 per mile shall not charge in excess of 2½ cents per mile, and those with gross earnings under $3,000 per mile shall not charge in excess of 3 cents per mile. The bill also contains the provision that railroad companies may charge a maximum fee of 10 cents for any distance not in excess of 5 miles. The latter provision will give the street and interurban railroads of the State the right to charge 10 cents for any distance traveled up to 5 miles, unless otherwise provided by their franchises.

The bill requiring street and interurban railway companies to equip their cars with vestibules has passed one house, and a seems probable that it will pass the other. Other bills affecting interurban interests are now up for consideration before the different committees.

NEW YORK UTILITIES BILL HEARING

The Senate judiciary committee and the Assembly railroad committee, in joint session, will give a hearing on the Governor's Public Utilities bill on March 27. Great interest is being expressed here as to the interests which will appear in opposition to the measure. Representatives of the various transit reform organizations of New York City will be present to advocate the bill, because of the local commission which it creates. Senator Page and Assemblyman Merritt, the bill's introducer, will argue for it if necessary, but the significant part of the hearing will be the opposition manifested and the line taken by its opponents.

THE PUGET SOUND-CHELAN-SPOKANE SYSTEM

Preliminary work has been begun at various points on the extensive railway system to be included in the lines of the Puget Sound-Chelan-Spokane Railway Company. This company is capitalized for $12,000,000 and is issuing bonds to that amount; the Snohomish Valley Railway Company is capitalized for $2,500,000 and has issued bonds to an equal amount; the Puyallup Valley Northern Rapid Transit Company is capitalized at $3,000,000 and has issued bonds to the amount of $2,500,000, making a combined capitalization for the Puget Sound-Chelan-Spokane system of $17,500,000, having a combined authorized bond issue of $17,000,000.

The contract for the construction and equipment of the Puyallup Valley Northern Rapid Transit Company has been let to the Continental Engineering-Constructing Company, of New York. This company has suitable franchises in Tacoma, Puyallup, Auburn and Kent, and has its northern terminal at or near Renton, where it makes junction with the Snohomish Valley Railway Company and the Puget Sound-Chelan-Spokane Railway Company under very liberal traffic agreements.

The Snohomish Valley Railway Company has its southern terminal at Renton at the above-described junction with the Puget Sound-Chelan-Spokane Railway and the Puyallup Valley Northern Rapid Transit Company, also operating under the same liberal traffic arrangement. The northern terminus of the Snohomish Valley Railway Company is Snohomish, the line passing through the fertile valleys of May Creek, Issaquah and the entire Snoqualmie and Snohomish Valleys to Snohomish, at which point is connects with the Puget Sound-Chelan-Spokane Railway under liberal traffic agreements. The contract for the complete construction and equipment of the Snohomish Valley Railway has also been let to the Continental Engineering-Construction Company, of New York.

The Puget Sound-Chelan-Spokane Railway has its southern terminus at Renton, as previously described, thence runs in a northerly direction, serving the city of Seattle direct, passing through the Alaska-Yukon Exposition grounds, thence in a northerly direction through an entirely undeveloped, but resourceful, strip of country about half-way between the coast and the Northern Pacific coast line to Snohomish; thence in a northerly direction, avoiding the construction and maintenance of five drawbridges and approximately 3 miles of trestle across the Snohomish River, which is subject to floods. Everett will be served by a connecting line, probably as an extension of their present city system, which line will be less than 2 miles in length from the junction. From Marysville the line follows the coast, passing through Tulalip, Port Susan and Stanwood, thence continuing north through the towns of Fir and Mount Vernon, at which point it curves to the eastward, remaining on the south side of the Skagit River to the Cascades, thence up the south bank of the Cascade to the Cascade Pass near Horseshoe Basin, thence down the north side of the Stehekin River and the north shore of Lake Chelan to the town of Chelan, thence to Bridgeport on the Columbia River, the crossing of which has not been definitely decided, thence following up the Columbia River by the most feasible route to Spokane or to a practical connecting point with some of the electric roads running out of Spokane in that direction, which connection, however, has not been arranged, but will be undertaken in the near future.

While no official announcement has been made as to arrangements for power, it is reported that plants are to be installed at points on the Columbia, Skagit and Snohomish Rivers.

FOREST HILLS TERMINAL DEVELOPEMENTS

A tentative sketch showing how the land belonging to Harvard College, about half a mile south of Forest Hills Square, could be utilized as an elevated terminal station was recently submitted by the Boston Elevated Railway Company to the Massachusetts Railroad Commission. The plan as worked out merely answers the board's inquiry as to how this lot could be utilized, and is not a proposition of the Boston Elevated at this stage. The essential features are a loop about 250 ft. wide and 350 ft. long, with separate loading and unloading platforms at the right, where the elevated trains would stop to deliver and receive surface car passengers. Surface cars from the south would reach the terminal over inclined tracks, enabling transfers to be made at a single level. The sketch intimates that the area within the loop formed by the elevated tracks could be used for storage tracks sufficient to accommodate 150 elevated cars, with a car house for 320 elevated cars. There is also a provision for a second loop inside the elevated loop, to allow for platforms on the inner sides of the two stopping places designated at the overhead level. This is understood to indicate the proposed method of handling interurban cars from Providence in case such a road is built. As yet no law exists under which the elevated extension to Forest Hills can be carried south of Forest Hills Square, but a bill has been introduced into the Legislature to authorize the Boston Elevated to take the necessary tract for the terminal—about 14 acres—and to extend its lines to its site.

BOOKS RECEIVED

"Management of Accumulators." By Sir David Salomons. Ninth edition. New York: D. Van Nostrand Company. 178 pages. Price, $2.50.

"Continuous-Current Armatures." By C. Kinzbrunner. New York: D. Van Nostrand Company. 80 pages. Price, $1.50.

"Alternating-Current Windings." By C. Kinzbrunner. New York: D .Van Nostrand Company. 80 pages. Price, $1.50.

"How to Build a Direct-Current One-Kilowatt Dynamo or a One-Horse-Power Motor." By A. E. Watson. Lynn, Mass.: Bubier Publishing Company. 100 pages. Illustrated. Price, $1.00.

"Steam Turbines, Practice and Theory." By Lester G. French. Brattleboro, Vt. The Technical Press. 418 pages. Price, $3.00.

"The Steam Engine Indicator and Indicator Diagrams." By W. Worby Beaumont. New York: D. Van Nostrand Company. London: The Electrician Printing & Publishing Company. 255 pages. Illustrated. Price, $2.50.

"Railroad Curve Tables." By R. S. Henderson. New York: The Engineering News Publishing Company. 69 pages, with tables. Price, $1.00.

"The Six-Chord Spiral." By J. R. Stephens. New York: The Engineering News Publishing Company. 68 pages. Illustrated. Price, cloth, $1.25; boards, $1.00.

"Water Softening and Treatment, Condensing Plant, Feed Pumps and Heaters for Steam Users and Manufacturers." By William H. Booth. New York: D. Van Nostrand Company. 308 pages. Illustrated. Price, $2.50.

"Boiler Waters, Scale, Corrosion, Foaming." By William Wallace Christie. New York: D. Van Nostrand Company. 235 pages. Illustrated. Price, $3.00.

"Practical Alternating Currents and Power Transmission." By Newton Harrison. New York: W. L. Hedenberg Publishing Company. 375 pages. Illustrated. Price, $2.50.

NEW PUBLICATIONS

"Air Brake Catechism." By Robert H. Blackall. Twenty-first edition. New York: Norman W. Henley Publishing Company. 374 pages. Illustrated. Price, $2.00.

No description of this book is necessary, as its successful record through twenty-one editions testifies. It contains nearly 2000 questions with their answers, giving a detailed description of all the old standard and improved equipment, and also all the necessary information to enable a railroad man to pass a thoroughly satisfactory examination on the subject of air brakes. In the 1907 edition the book has been revised and enlarged, and answers even better than before the needs of air brake instructors and students.

"Quasi-Public Corporation Accounting and Management. By John F. J. Mulhall. Boston: Corporation Publishing Company. 198 pages. Price, $5.00.

This volume illustrates forms used and gives classifications of accounts as well as a great deal of general information in regard to accounting for water works, gas plants, steam heating, electric light, electric railway and telephone installations. Other topics treated are customers' registers, the purchasing department, sales department, engineering department, depreciation, sinking fund and miscellaneous account forms.

"Elements of Gas Engine Design." By Sandford A. Moss. New York: D. Van Nostrand Company. 197 pages. Price, 50 cents.

This book gives in condensed form the fundamental principles with which a designer of gas engines should be familiar. It discusses gas generation, cylinder design and action governing, etc., and has been compiled from a set of notes used by the author in lectures upon the subject at Cornell University and from articles in various technical papers.

"Practical Lettering with Original System for Spacing." By Thomas F. Meinhardt. New York: Norman W. Henley Publishing Company. 15 pages, paper. Price, 60 cents.

This pamphlet has been published for draftsmen, engravers, sign painters and all who have to design and execute lettering, and is intended especially to correct common errors in spacing. The objections to the common plan of leaving the same space between all straight stems are pointed out and the correct principles are given. The book is illustrated by two plates as well as spacing guides.

"City Roads and Pavements Suited to Cities of Moderate Size." Third edition. By W. P. Judson. New York: Engineering News Publishing Company. London: Archibald Constable Company. 197 pages. Illustrated. Price, $2.00.

"Economics of Road Construction." By H. P. Gillette. Second edition. New York: Engineering News Publishing Company. 49 pages. Illustrated. Price, $1.00.

These are excellent discussions of the subject treated. Mr. Judson's work discusses the characteristics and methods of laying stone block, concrete, wood, brick, asphalt, bitulithic pavements and broken stone roads, while Mr. Gillette's smaller book is devoted more to macadam and earth roads. A valuable feature of each is detailed figures of costs.

"Railroad Location, Surveys and Estimates." By F. Lavis. New York: Myron C. Clark Publishing Company. 270 pages. Illustrated. Price, $3.00.

The author takes up the subject from the reconnaissance and gives a description of the work and the methods followed by him which should be of great value. It is refreshing to see at least one chapter devoted to electric railway location, in which the writer points out several features in which practice differs from that in steam railroad work, notably as in grades. He also offers hints as to methods af projecting locations in towns on property across which it was considered inadvisable to run preliminary lines, by carrying the line on either side of the proposed location and connecting them at intervals through cross-streets.

"The Walschaert Locomotive Valve Gear." By W. W. Wood. New York: Norman W. Henley Publishing Company. 193 pages. Illustrated. Price, $1.50.

The increasing use of the lighter and more accurate Walschaert type of valve gear instead of the Stephenson link in steam locomotives, makes this book a timely one. Although invented sixty years ago the Walschaert valve gear has been applied to American locomotives only within recent years, but is now being very generally used. The book first takes up the principal of the gear in an elementary way. It then treats of its design and erection from the standpoint of the scientific engineer and master mechanic. The third part discusses its actual work and advantages. Finally, there is a section of instructions as to its use and treatment in the form of a catechism.

MEETING OF THE CENTRAL ELECTRIC RAILWAY ASSOCIATION

The program has been announced of the convention of the Central Electric Railway Association, to be held at the Algonquin Hotel, Dayton, Thursday, March 28. For the convenience of members in Indiana a special car will leave the Traction Terminal Building, Indianapolis, at 6 a. m., and a cordial invitation is extended to those desiring to make the trip. The executive committee of the association will meet on the evening before the convention. The business meeting will be called at 10:30 a. m., after which the following papers will be read: "Track Bonding," by Thos. B. McMath, civil engineer, Traction-Terminal Company, Indianapolis, Ind; "Car Wheels for Interurban and City Service," by C. Skinner, master mechanic, Scioto Valley Traction Company, Columbus, Ohio. At the afternoon session these papers will be read: "Trolley Wheels," by M. M. Baxter, electrical engineer, Western Ohio Railway Company, Lima, Ohio; "Car Inspection," by Lees M. Jacques, master mechanic, Ft. Wayne & Wabash Valley Traction Company, Ft. Wayne, Ind. There will be a special report by a committee on express company contracts with interurban railways.

THE LOUISVILLE STRIKE SETTLED

The strike of the employees of the Louisville Railway Company was declared off Friday, March 15. The settlement of the controversy was brought about by an agreement signed by President Minary for the board of directors of the company, Thursday, March 14, and later by the special committee for the union. Both sides made concessions. The men got an hour, a 10-hour day, 30 minutes for lunch, to be taken from their own time. All the old employees, except those guilty of disorder or of having destroyed property are to be retained by the company and given the same standing they had before the strike. The men are left free to join the union or not, as they choose, but any employee found coercing another to join or not to join, shall be dismissed by the company. The company expresses a willingness to meet a committee of its men on all grievances, real or fancied, at any time. The details of matters in the agreement are to be arranged by the directors and a committee of its own men. This gives the street railway an "open shop." The men withdrew a number of their demands, including the right to demand the discharge of employees not members of the union; the right to demand the reinstatement of discharged employees upon the exclusive investigation by the union; the arbitration committee with outside parties as members, and some other minor details.

ALLIS-CHALMERS STEAM TURBO-ALTERNATORS RECENTLY PUT IN SERVICE

The Allis-Chalmers Company has been particularly fortunate in successfully placing its steam turbines and generators in service in various parts of the country. Practically without exception these units have been erected, put into operation and accepted in record-breaking time without accident or mishap of any kind. One of the first of the large Allis-Chalmers turbo-alternators to be installed was the 5500-kw unit at the Kent Avenue station of the Brooklyn Rapid Transit Company. Steam was turned on March 22, 1906, to dry out the generator. On March 27, owing to a breakdown in one of the other plants of the Rapid Transit Company, a sudden call was made for power. The new unit was hastily put in operation, and within 20 minutes after the preparations had been completed, it was delivering 4000 kw. Since then this turbine has been operating continuously, generating on an average 6000 kw and up to a maximum of 8300 kw, taking heavy loads on the morning and evening peaks.

At the Brooklyn Edison Company's Gold Street station, the erection of a 5500-kw Allis-Chalmers turbo-alternator was begun in April and completed in very short order, the machine being operated for the first time on June 16. From then on this unit is said to have satisfactorily carried all the load to which it has been subjected.

A 1500-kw Allis-Chalmers turbo-generator unit at the power house of the Memphis Consolidated Gas & Electric Company, Memphis, Tenn., was shipped on Sept. 8, and ready for steam and condenser pipe connections on Sept. 16. On Nov. 15 the steam connections were blown out and the machine placed in operation. After running for fifteen days the turbine was accepted. The temperature rise of the generator has always been far below the contract guarantee, and both it and the turbine are capable of carrying much heavier overloads than those specified in the contract.

A 500-kw Allis-Chalmers unit for installation in the power house of the Western United Gas & Electric Company, of Aurora, Ill., was delivered complete on Oct. 8, and was put on the circuit Oct. 17. Since that time this turbine and alternator have undergone rigid acceptance tests, both at overload and three-quarter load, with the result of having bettered the guaranteed steam consumption by 8¼ per cent for the overload and 9.6 per cent for the three-quarter load test.

The power station of the City of Jacksonville, Fla., has a 500-kw Allis-Chalmers turbo-generator unit fully erected and operating, and a second unit of the same capacity on the way to Jacksonville, both working satisfactorily.

A number of Allis-Chalmers turbo-generator units shipped within the past month or two have recently been started or are now awaiting steam connection. A 1000-kw unit at the power house of the Kokomo, Marion & Western Traction Company, at Kokomo, Ind., has just been erected. Out of three 1500-kw units for the Milwaukee Electric Railway & Light Company, one now being erected will probably be started up in the course of the next two or three weeks. The second turbine has been received on the ground but its erection not yet begun.

Other turbines are being installed at the plants of the Meriden Electric & Light Company, Meriden, Conn.; of the Canton Light, Heat & Power Company, Canton, Ohio; Indianapolis, New Castle & Toledo Railway, New Castle, Ind., and Kings County Electric Light Company, Gold Street station, Brooklyn, and at other points.

STREET RAILWAY PATENTS

[This department is conducted by Rosenbaum & Stockbridge, patent attorneys, 140 Nassau Street, New York.]

UNITED STATES PATENTS ISSUED MARCH 5, 1907

845,736. Combined Air Brake Setting Device and Alarm; Robert E. Adreon, St. Louis, Mo. App. filed Nov. 30, 1906. A brake valve and a whistle valve combined in a single housing and means for maintaining the air pressure of the train-line on both of said valves to force the same against their respective seats.

845,874. Coupling Apparatus for Fluid Pressure Brake Mechanisms; George E. Kelly and George F. Royer, Wilkesbarre, Pa. App. filed May 1, 1906. An automatic coupling device consisting of two similar sections, each comprising a head having therein a passage adapted to form part of the brake-fluid conduit, a valve adapted to open said passage to the atmosphere, and a pivotally-mounted device adapted to engage the operating device of the aforesaid valve of the other coupler-section.

845,882. Fare Register; Otto N. Moore, Indianapolis, Ind. App. filed May 24, 1905. Details of a register designed to make separate registration and record of cash and ticket fares of varying amounts.

845,900. Trolley Wheel and Harp; Edward S. Roland, Cleveland, Ohio. App. filed Oct. 19, 1905. The trolley wheel is provided with separate and removable tread portions and the bearings of the wheel are also bushed with replacable boxes.

845,967. Amusement Device; Isidor S. Moscovitz, New York, N. Y. App. filed July 6, 1906. Consists in the arrangement of a super-naturally sized head of a wild animal, the jaws of which are made to open and close, and upon the lower jaw of which a railway track is arranged, the rails being continued rearward and formed to a loop. The movement of a car from its starting point begins automatically at the moment the lower jaw is closed.

845,977. Truck; Edgar Peckham, Kingston, N. Y. App. filed July 29, 1904. One of the objects of this invention is to provide a pedestal construction which shall be adapted to inclose heavy spiral springs and yet possess strength and stiffness to a marked degree.

845,991. Alarm Signal; Robert J. Zorge, Chicago, Ill. App. filed Feb. 28, 1906. A device adapted to be placed adjacent to the track rails of a railway by which torpedoes are automatically fed into a position to be exploded when a train passes in case a switch is open.

846,029. Movable Point Crossing; William M. Henderson, High Spire, Pa. App. filed June 23, 1906. Provides hard-metal switch points of unique construction, said switch points being provided with suitable pick-up devices for guttered wheels, which devices are integral with the hard-metal points.

846,062. Switch Stand; Fred W. Snow, Hillburn, N. Y. App. filed Nov. 10, 1906. A rotatable shaft having projections thereon which engage a spring-pressed bar when the shaft is turned. The switch is thus held in either its open or closed position.

846,122. Rail-Bond; George A. Mead, Mansfield, Ohio. App. filed Nov. 23, 1904. The bond is made up of a plurality of superposed ribbons of copper, which are sheathed in a copper envelope at their ends.

846,147. Automatic Switch; Gerhand Schmitz, Byesville, Ohio. App. filed Sept. 19, 1906. An automatic flying switch for mine cars.

846,185. Electrical Indicating Device; Charles Crandall, Newport, R. I. App. filed June 2, 1906. A block signal system in which sections of the rails are insulated from one another and the joints are placed in staggered relation so that the truck of a small car, such as a hand-car, will not operate the signals.

846,190. Railroad Crossing; Edward T. Dumas, Chicago, Ill. App. filed Dec. 17, 1906. The track rails of the intersecting tracks have short rail sections adapted to slide forward or rearward to make a continuous track over either road, the rear ends of the rail sections forming a splice joint with the track rails.

846,205. Trolley Harp; Charles Hibbard and Warren Hibbard, Sandy Hill, N. Y. App. filed Feb. 28, 1906. A stub-shaft carrying the trolley wheel has triangular bearings in the harp, a cam disc forming one side of the bearing and means for rotating the cam disc so that the stub-shaft may be released and removed through slots extending to the edge of the harp.

846,207. Railway; Stephen E. Jackman, New York, N. Y. App. filed June 18, 1906. Relates to switchback or inclined gravity pleasure railways.

846,210. Brake Mechanism for Inclined Railways; Stephen E. Jackman, New York, N. Y. App. filed June 28, 1906. Gripping brake-shoes mounted in the track engage the sides of a shoe on the bottom of the car.

846,311. Car Replacer; William A. Hutson, Orlando, Fla. App. filed July 5, 1906. Comprises two frogs, each having a lengthwise recess for receiving the head of a rail and each provided with a laterally-extended wing diverging at an angle, each wing having a raised rim and one of the wings provided with a lengthwise convexity and the other with a lengthwise concavity.

846,365. Automatic Trolley Retriever; Robert J. Walker, Anderson, Ind. App. filed Jan. 13, 1906. The retrieving drum is mounted on a worm-shaft, so that in case of excessive unwinding movement it will move laterally to impinge against a trip and cause the retrieving spring to act.

846,378. Wire Retrieving Attachment for Trolley Wheels; W. C. Althen, Columbus, Ohio. App. filed April 2, 1906. The harp has a pair of arms which are pivoted to move upward so as to overlie the trolley conductor. These are displaced by a contact with the hangers in passing.

846,425. Railroad Crossing; John E. Reese, Louisville, Ky. App. filed Sept. 12, 1906. Intersecting track rails, each embodying a movable section divided to comprise end-to-end separable members, and means for shifting one member lengthwise and the other both lengthwise and laterally away from the track rails.

PERSONAL MENTION

MR. S. R. DUNBAR has returned to the Indiana Union Traction Company, at Anderson, to take up the duties of purchasing agent. Mr. Dunbar formerly was connected with the company in the capacity of purchasing agent and later as passenger agent.

MR. E. L. GREENE, formerly foreman of the general repair and new equipment shops of the New York City Railway Company, at 146th Street and Lenox Avenue, has accepted a position with the engineering department of the Westinghouse Electric & Manufacturing Company.

MR. W. E. HARRINGTON, president of the Pottsville Union Traction Company, of Pottsville, Pa., has been relieved of much routine work by the appointment of Mr. J. T. Mooney, chief of the construction department, to the position of assistant manager of transportation, and Mr. H. O. Ellis as chief of construction.

MR. ALLEN JONES has been appointed superintendent of transportation of the municipal street railway system at Monroe, La., vice Mr. B. L. Jakeway. Mr. Jones has been connected with the water, light and traction department for several years.

MR. EITURO SAKUMA, manager of the Tokio Street Railway, is on a tour of inspection in this country. He has visited New York, Chicago, Philadelphia and St. Louis, and last week was in Cleveland. The Tokio Street Railway has nearly 200 miles of trackage, and this will be increased by 300 miles. Mr. Sakuma expects to study the street railway situation in Cleveland for a week. He will then return to Japan.

MR. M. NAMBA, professor of electrical engineering at the University of Kyoto, Japan, is making a short visit in this country, during which he will inspect a number of the more interesting installations and manufacturing establishments. Prof. Namba is also electrical engineer of the municipality of Kyoto, which will shortly increase the capacity of its electrical generating plant from 2000 hp to 7000 hp, and extend its street railway system.

MR. CHARLES JONES, chief engineer of the Aurora, Elgin & Chicago Railway, presented a paper at the meeting of the Armour Institute Branch of the American Institute Electrical Engineers on March 8. The address was one of exceptional interest, and was on the subject, "Some Experiences in Electric Railway Building." Mr. Jones gave a detailed account of the work of the construction engineer to the ninety members and visitors present.

MR. JOHN A. BEELER, vice-president and general manager of the Denver City Tramway Company, contributed an interesting article in a recent issue of "Public Service" on the "Five-Cent Fare." A comparison is made between the advantages of the uniform fare as employed in America and the zone system of fares common in Europe, the wages and taxes paid by the different companies and other points. The article is reprinted in the "Western Tramway Employees' Journal," of Denver.

MR. F. D. HOFFMAN has been elected treasurer of the Chicago City Railway Company to succeed Mr. J. P. Burke, who has been elected assistant treasurer. Mr. Hoffman gained his first street railway experience in Milwaukee in the employ of the Milwaukee Electric Railway & Light Company, whose service he entered in 1898. Later he became secretary to Mr. Thomas E. Mitten, the president of the Chicago City Company, when Mr. Mitten was superintendent of the Milwaukee Company, and accompanied Mr. Mitten to Buffalo at the time of the Pan-American Exposition. In 1905 he became secretary to President Pierce, of the International Railway Company, of Buffalo, and in February, 1906, was made assistant secretary and treasurer of the Chicago City Railway.

MR. ORAL A. STEVENS has resigned as division superintendent of the Boston & Northern Street Railway Company, and Mr. W. E. Maloney has been elected as his successor, who for the past five years has held the office of superintendent of the Manchester Street Railway Company. Mr. Maloney began his career at 18 years of age in the offices of the Worcester Consolidated Company. For twelve years he remained with that company, working up until he had reached an important position in its management. From Worcester, Mr. Maloney was called to the superintendency of the Manchester Street Railway Company, which position he has filled with ability for the last five years.

MR. CHARLES H. ARMATAGE has been appointed traffic manager of the United Traction Company, of Albany, N. Y., and its subsidiary lines. This is a new position, and Mr. Armatage will have charge of the passenger and freight business, and his jurisdiction will extend over the United Traction, the Hudson Valley and Forest Park lines. Mr. Armatage has been connected with the United Traction Company for about six months as superintendent of the express department. He is a former railroad man, and was at one time a conductor on the West Shore Railroad. He was also on the Lebanon Springs Railroad. He was also connected with the Traction Company a few years ago but left, and then again entered the service of the company about six months ago.

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Of this issue of the Street Railway Journal 8000 copies are printed. Total circulation for 1907 to date 106,150 copies, an average of 8165 copies per week.

Auxiliary Wiring on Pole Lines

On many electric roads little or no attention is paid to the maintenance of auxiliary wiring on pole lines until a breakdown occurs which ties up telephone, signal or lighting equipment and sends an emergency crew up and down the track at a feverish pace in the effort to get things going again. As a road develops, particularly in long-distance interurban service, there is a tendency for small wires for special purposes to multiply, and if care is not taken to install these auxiliary circuits according to the best standards of insulation and mechanical support, trouble is invited.

Crosses between telephone and signal wires, breakages of important leads for lighting or private communication, or in the event of a heavy storm or high wind, the tangling together of high and low-tension circuits are all most annoying from the operating standpoint. Sometimes it is these smaller troubles which cause the most exasperating delays to traffic. It is a simple matter to remedy bad conditions of this kind when they are discovered, and it needs but a little courageous inspection to locate weak spots. One of the truest mechanical axioms is that a sound job looks right; its proportions are acceptable to the eye. When telephone cables, signal circuits, lighting loads, pilot wires, feeders, trolley suspension and high-tension conductors are concentrated on a single pole, with the auxiliary lines running every which way according to no definite right angle or parallel scheme, the conditions are favorable for a tie-up that will cost the road more in lost earnings than would have been needed to properly maintain the auxiliary circuits for months.

The Public Utilities Bill

The general movement all over the country in favor of a closer supervision of public service corporations has found its outcome in national affairs in the enlarged powers of the Interstate Commerce Commission, and is represented in New York State by the public service or public utilities bill now before the Legislature. The abstracts which we have previously published of this very sweeping measure indicate that its sponsors contemplate a very radical change in the present methods of supervising and controlling the energies of the different public service corporations within the State. So far as the transportation interests of the State are concerned, it will be remembered that in the past the companies have been largely under the supervision of the State Board of Railroad Commissioners, a body which has existed for some twenty-five years. In New York City, however, there was the somewhat anomalous condition that while the surface and elevated railway companies reported directly to the Railroad Commission, the subway was built under the direction of an entirely independent board, the Rapid Transit Commission, and that to this latter body has been consigned the work of planning new rapid transit lines.

Under the proposed bill both of these existing boards will be legislated out of office and an entirely new body will exercise all of the privileges of both, as well as many not previously entrusted to either. It will have power, in some cases with the approval of the local authorities and in some cases without, to fix the fares and rates to be charged by the railway companies, to dispose of new franchises, to conduct investigations, to prescribe what the board considers

adequate service, to require changes in methods, and so on. Similar powers are given over the gas, electric and other public service corporations. For convenience in administering these functions two separate and independent commissions are to be appointed—one for New York City, the other for the rest of the State.

It will easily be seen that powers so extensive as those contemplated can be productive of a tremendous amount of good or evil to the communities served, depending upon the character and wisdom of the administrators. If a despotism was omniscient and impeccable it would be the best sort of government, and the same is true in regard to the powers of a commission. Street railway companies in the past have been the chief sufferers from a divided responsibility in matters of this kind, as it has often prevented them from introducing in their service improvements which were required by the needs of the community. The power to grant franchises and permit other necessary extensions in American municipalities is usually limited in so many ways that such concessions are difficult to obtain even when their necessity is generally recognized. This has been shown in Chicago, where the desirability of a working and business agreement under which the companies could make improvements has been apparent for a long time, but no body or individual in the municipal government has been able or willing to take the responsibility of settling the trouble. It has also been exemplified in connection with the East Side Bronx transportation situation, where, as shown in recent issues of this paper, there is a crying need for additional facilities. We have always believed that the chief danger to the transportation companies of to-day is their vulnerability to irresponsible attack by sensational newspapers or demagogues and in being held responsible for conditions which they would be glad to alleviate if they could. Any investigation of the New York City conditions by an impartial tribunal with power to apply remedial measures cannot but be beneficial to the transportation enterprises, because the need for transportation is so great that such examination must result in the grant of better facilities.

A despotism, however, has its dangers as well as its advantages. If the new commissioners administer their office in an intelligent, broad-minded way they can be of great service to the community. If, however, arbitrary power is accompanied by a tyrannical use of it, the interests of the city and State will suffer. For this reason we fear that the remarkable clause which seemingly aims to put the commission above the law by making its rulings binding until they are reversed by court procedure offers under possible conditions chances for a serious miscarriage of justice. Of course it would be unconstitutional to give binding force to the unreasonable regulations of any commission, but it is equally important to the entire community that quick redress should be granted for every wrong done. As the personnel of a commission of this kind must change from time to time we hope that this aspect of the situation will be considered by the Governor.

We are in a sense on the threshold of a new order of corporate administration. Whether rightly or wrongly, the sentiment seems to be that the public should take a closer interest and direction in the affairs of public service corporations. As a broad proposition we believe that the railway companies will benefit by such supervision if intelligently administered. The principal troubles in the past have come from being misjudged, and if the new era results in a better general knowledge of the policy and methods of the railway companies it cannot but be beneficial in setting them right in the eyes of the public.

Converting Apparatus

The discussion at the Institute meeting last Friday took up matters which are of direct interest to street railway men. The main subject under consideration was the relative desirability of the various converting methods, and, in addition, the practicability of winding large generators for pressures as great as 20,000 volts. The former subject was initiated by a paper from Mr. Lincoln favoring the synchronous converter, the latter by a discussion of the practical features of the problem from Mr. Behrend. The two topics are in a measure interconnected, since motor generators can be wound for the transmission voltage if not too high, and synchronous converters must work through a bank of transformers. In many cases, therefore, motor generators have an advantage in simplicity of plant and especially in the avoidance of switchboard complications. Year by year the relative cost of switchboards has increased until it has become a very serious amount, making switchboard economy almost as necessary a matter to consider as generator efficiency or first cost. The synchronous converter has become so thoroughly entrenched in American practice that it is pretty near to lèse majesté to criticise it, yet in view of the facts now available one must admit that its rule cannot much longer go unchallenged even if there is no open revolt.

To begin with, it must be admitted that railway work is the best hold of the synchronous converter. In such service practically all the energy generated is transformed to d. c. at present, and there is no need of precise voltage regulation upon the working circuits. Moreover, the service is fairly continuous and machines do not have to be frequently stopped and started. Mr. Lincoln's paper is not limited, however, to railway working, so that these favoring facts are lessened in importance. He lays great stress on two phases of the matter which are fairly open to debate, to wit: reliability and efficiency. On the former count he gives the synchronous converter a good record, estimating that if in a given period of service a synchronous converter would be out of service ten hours, an induction motor generator would be out fourteen hours and a synchronous motor generator about seventeen hours. This is important if true. Something must be assumed in such a case as to the existence or non-existence of transformer outfits with the latter machines. If these had no transformers but were wound for 6000 to 10,000 volts, as may well be the case, we should be inclined to think that the induction motor generator would make a better showing than the synchronous converter, and the synchronous motor generator one nearly or quite as good. A motor either synchronous or induction is a wonderfully reliable machine and a simple d. c. generator is so much less liable to trouble than a synchronous converter as to more than make up for the presence of the

added machine when one takes account also of the transformer bank and the added switchboard complications. Even admitting the use of transformers in all three cases, Mr. Lincoln's estimate seems unduly favorable to the synchronous converter even at 25 cycles.

In point of efficiency Mr. Lincoln's estimates run as follows for all-day efficiency at a load factor of about 75 per cent. Synchronous converter, 93 per cent; synchronous motor generator, 85 per cent; induction motor generator, 84 per cent, assuming units of about 500 kw. To get the first-named figure including the transformers would require the machine itself to have about 96 per cent efficiency at 75 per cent output. We know several railway men who would be glad to get machines on this sort of guaranty, but we fear they will have to wait a while. Taking out the transformers from the figure quoted the net efficiency would be about 90 per cent, which is quite as high as the facts would warrant. On the other hand, in 500 kw units 80 per cent is low for a motor generator properly designed for its work, and comparing the machines on the basis of high-voltage motors we think the difference here cited would be practically cut in two. On the same supposition the first costs of the equipments, including switchboards, would be nearly or quite on a parity. Parshall and Hobart in their recent book show in fact a balance in favor of the motor-generators when wound for high voltage. The extreme difficulty of getting accurate voltage regulation in a synchronous converter on account of the nearly complete interdependence of the a. c. and d. c. voltages is a practically fatal objection to this apparatus on lighting systems whatever its cost, so that this phase of the case may be dismissed. On railway systems, however, the case is different, since with suitable care in designing and operating the transmission system a fairly satisfactory regulation can be attained. The question then reduces itself to a comparison of efficiency, cost and general convenience, which is more favorable to the synchronous converter.

Mr. Behrend, whose opinion is entitled to much respect, holds that in modern turbo-generators of large capacity, say 10,000 kw and above, the armature can be successfully wound for as much as 20,000 volts, and has backed up his theory by building a 150-kw three-phase generator for 25,000 volts and working it successfully. It is notable that even in this small machine the loss of efficiency over one for 2300 volts is only about 3 per cent, no more than would be lost in raising transformers. In large units the loss in efficiency would be much less, and the problem of insulation much simpler. In most cases it would be feasible then to use high-voltage generators and motor generators if desirable. It seems to us, however, that, admitting the gain in simplicity in using motor generators, the loss of 4 or 5 per cent in actual efficiency is not compensated by the gain in regulation, especially since on long lines it is desirable to use not 20,000 volts but 40,000 to 60,000 or more, which would necessitate transformation in any case. It is of course doubtful whether d. c. will remain a necessity on systems having transmissions of this class, but assuming that it may, it seems to us that unless in enormously long transmissions the synchronous converter has rather the advantage. It has more to fear from the cascade converter and from the permutator than from ordinary motor generators. The permutator has an efficiency materially greater than any other equivalent device and is particularly good at light loads. If it can be built in large sizes it certainly must take an important place. The synchronous converter seems to us likely to be used less rather than more as time goes on, but for railway service it is excellently well suited. There may arise cases in underground distribution where the motor generator may be valuable for regulative purposes, and other special uses certainly exist in which it has advantages over the synchronous converter, yet for the rough-and-tumble conditions of electric railroading the latter machine is too effective to put aside without many another hearing.

Cars for Branch Line Service

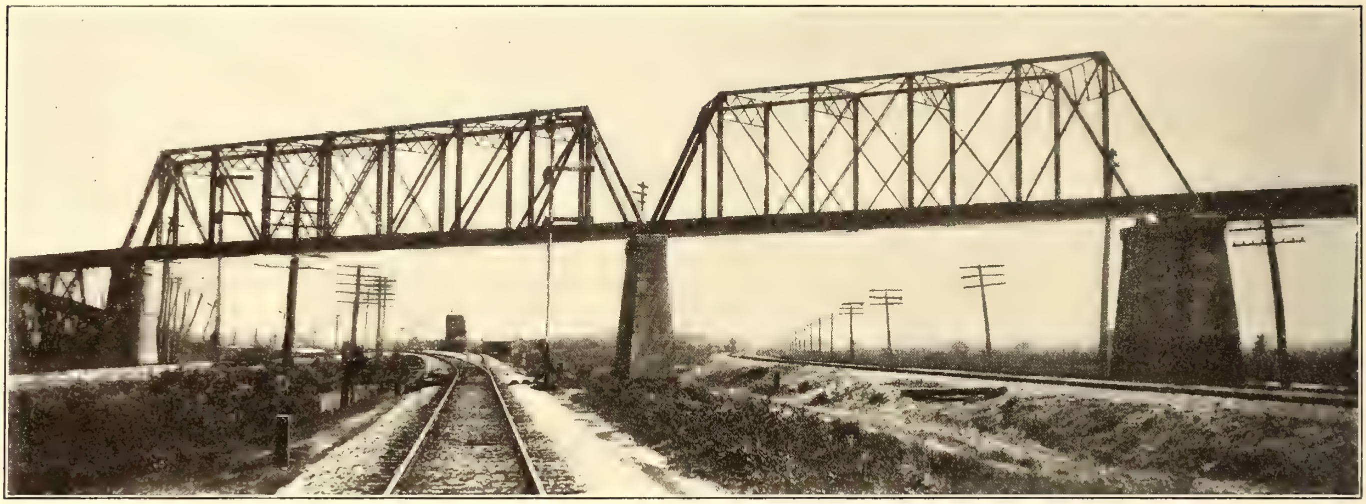
The type of car best suited to branch line service is a difficult problem to solve on many interurban roads. Of course, a great deal depends upon the character of the communities in which the branch lines operate, and upon the relative volume of the main line and branch traffic. On steam railways the well-nigh universal practice of relegating the older and partially worn-out equipment to the branch lines causes little comment from the public, but in electric service the standards are considerably higher. If competitive traffic is to be captured, the rolling stock must be reasonably comfortable and capable of running at maximum speeds of 30 or 35 m. p. h. if the branches are more than a mile or two long. The contrast between main line and branch service must not be too great if the public's opinions are to be held favorable.

There is no doubt that the reduced weight and lessened power requirements of single-truck cars, coupled with their lower first cost, incline many managers toward their use on lines where the traffic is light. But the rising standards of comfort demanded by the latest service favor the double-truck car for branch line work, though it may rightfully be designed from 10 ft. to 25 ft. shorter than the connecting rolling stock of the main line, and in most cases equipped with two motors instead of four. Multiple-unit control is a desirable specification for branch line cars, on account of the ease with which it enables heavy traffic peaks, excursions, etc., to be handled.

It is a question if it is not wiser to specify a certain class of double-truck car for branch service, buying these new and working them steadily during their life, than to operate superannuated main line cars on the branches. A multiplicity of car types on an interurban road makes the work of the shops more difficult, on account of the enormous number of spare parts which have to be kept in stock, but there is little disadvantage in operating three or four types on a road embracing say from 50 miles of track upward. Local conditions may modify the type best suited for a given road, but in general the same scheme of seating arrangement, smoking and baggage compartments can be followed with profit on both main line and branch rolling stock. The motors can usually be the same on both equipments, double or quadruple as the case may be. Uniformity in rolling stock is hard to attain in these days of changing car designs, but it is worth striving for in a broad way.

SOME CONSTRUCTION AND OPERATING FEATURES OF THE ALTON, GRANITE & ST. LOUIS RAILWAY

The Alton, Granite & St. Louis Railway, no doubt, has a greater number of overhead railway crossings and a greater total length of viaducts than any other Western interurban system of equal mileage. This road operates between East St. Louis, Alton and Edwardsville, Ill. It was built by the Alton, Granite & St. Louis Traction Company in 1904, with J. G. White & Company, of New York, as construction engineers. In the spring of 1906 it was acquired by the East St. Louis & Suburban Company and it is now under the management of the East St. Louis & Suburban Railway system, of which L. C. Haynes is vice-president and general manager and G. C. Pierce is general superintendent. It is operated as a division of this company with R. W. Bailey, former electrical superintendent at East St. Louis, as superintendent of the division. Mr. Bailey has his office at Alton.



VIEW SHOWING ANGULARITY OF CROSSING TRACKS ON MITCHELL VIADUCT

MITCHELL VIADUCT WITH CURVES ON BOTH APPROACHES

THE VIADUCTS

The tracks of the system form a "Y," the junction of the branches to Alton and to Edwardsville being at Mitchell. Between East St. Louis and Alton the tracks of ten different steam roads are crossed. Fortunately, however, some of the systems parallel one another and this lessened the number of separate crossings required. On the whole system, which includes 34 miles, there are seven separate railroad crossings, six of which are viaducts, having an aggregate length of 4440 ft. One has a maximum height of 60 ft. There is only one grade crossing with steam roads, and this is protected by an interlocking system.

The longest of the viaducts over steam roads is that one near the terminal in East St. Louis. Immediately over the nine tracks which it crosses are two riveted steel spans, one 112 ft. 6 ins. long and the other, an incline top chord Pratt truss, 237 ft. 4½ ins. long. These spans rest on concrete piers at a height of about 25 ft. above the steam road tracks. The steel approaches are made at a 4 per cent grade and are 930 ft. long. The north approach is straight, but the one on the south, which is a temporary one, contains a reverse curve of 200 ft. radius. This approach will be changed shortly to run straight from the viaduct to the tracks of the East St. Louis city system and the curves will be eliminated. On the steel portion of the approaches to this viaduct, as well as the others, the trolley wires are carried on a steel framework. A short distance south of Madison are two viaducts, the southernmost of which crosses the tracks of the Troy & Eastern Railroad at a point where the steam road itself is on a high embankment. The dirt embankment of the electric line is carried up to the level of the steam road tracks and the additional elevation of the electric road tracks is obtained by means of pile trestle approaches.

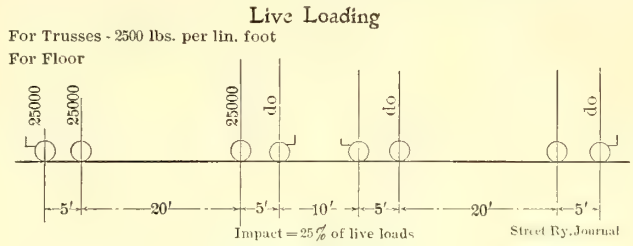
The other viaduct in Madison, which has a total length of 1009 ft. and is 30 ft. high, consists of a central portion of three steel spans 195 ft. 6 ins., 237 ft. 9 ins. and 126 ft. long, respectively, and approaches which are each built on a 4 per cent grade and are 450 ft. long.

Immediately north of the junction at Mitchell, the Wabash, Big Four and the Chicago & Alton Railroads are crossed diagonally by a steel viaduct, both approaches of which contain curves. The total length of the steel portion is 1050 ft. It consists of two central spans 166 ft. long and approaches built on a 3 per cent grade. One approach contains a curve of 200 ft. radius and the other a 222-ft radius curve. The maximum height of this structure is 30 ft. The tracks of the Chicago & Alton Railroad are crossed by a viaduct about one mile east of the Alton terminus. This structure consists of a single bridge span resting on concrete piers, a steel girder approach on one side and an approach formed of a dirt embankment on the other.

The only viaduct on the Edwardsville branch is that one over the Chicago, Peoria & St. Louis Railroad at Edwardsville. The structure, however, was occasioned by the deep valley or ravine, which is crossed by the electric line, rather than by the presence of the steam road. The steam road tracks under the structure are on an embankment 31 ft. higher than the tops of the foundations of the steel structure, but the banks of the ravine are of such a height that the viaduct, although built with level approaches, crosses the steam road at a height of 23 ft. The steel structure, which is 1100 ft. long, consists of a middle bridge span 150 ft. in length and two approaches made up of fifteen 30-ft. and ten 50-ft. girder spans. The spans are supported on steel towers resting on concrete piers. The maximum height is 60 ft., while the average height is about 40 ft.

All of the longer viaducts were built by the American Bridge Company. The trusses are designed for a loading

cent. With one or two exceptions all the curves outside of cities are of sufficient radius to permit the full-speed operation of cars around them. The right of way varies in width from 40 ft. to 60 ft. On the main line the track has been built on one side of the center of the right of way with a view of ultimately putting down a second track. Further provision has been made for two tracks by supporting the trolleys on span wires and placing the poles at a distance apart sufficient to accommodate the other track. Fills are

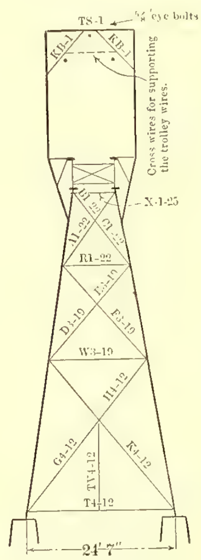


LOADING DIAGRAM, EDWARDSVILLE SINGLE-TRACK VIADUCT

14 ft. wide at the top for single-track and 30 ft. for double track construction, while for single and double tracks cuts are respectively 26 ft. and 38 ft. wide.

The main line is ballasted throughout with 8 ins. to 10 ins. of broken rock under the ties. A portion of the Edwardsville branch is ballasted with chatz. This material is finely crushed lime rock of a flint nature, and is the tailings from the zinc and lead mines in the mining district lying about 100 miles south of St. Louis. Rails 70 and 75 lbs. in weight and in 30-ft. and 33-ft. lengths are used. Some continuous rail joints are in service, but on the greater portion of the road standard angle-bars are employed. The joints are suspended and are laid broken. Turnouts, or sidings, are about 200 ft. long in the clear. They are all of the through type and are located at intervals of two or three


EAST ST. LOUIS VIADUCT, SHOWING REVERSE CURVE ON SOUTH APPROACH



Bents 4 to 12
EDWARDSVILLE VIADUCT

of 2500 lbs. per lineal foot, while the floors are designed for a train of two 50-ton cars. In addition to the viaducts mentioned, the only other important overhead construction work is the bridge over the Wood River near Alton. This consists of a single span 120 ft. long and was built by the Kenwood Bridge Company.

THE TRACK AND ROADWAY

With the exception of those on the approaches to the viaducts there are no grades on the line steeper than 1 per

miles. Elliot semaphore switch stands with oil lamps are used.

OVERHEAD CONSTRUCTION

Span wire trolley construction is used on the main line and bracket construction on the Edwardsville branch. The poles, which are placed 100 ft. apart, are extra heavy and are of Michigan white cedar. Double trolleys of 000 grooved wire are placed 18 ft. above the rail. Lightning arresters are located one-third of a mile apart, and in addition to having the usual earth ground are grounded to the rail.

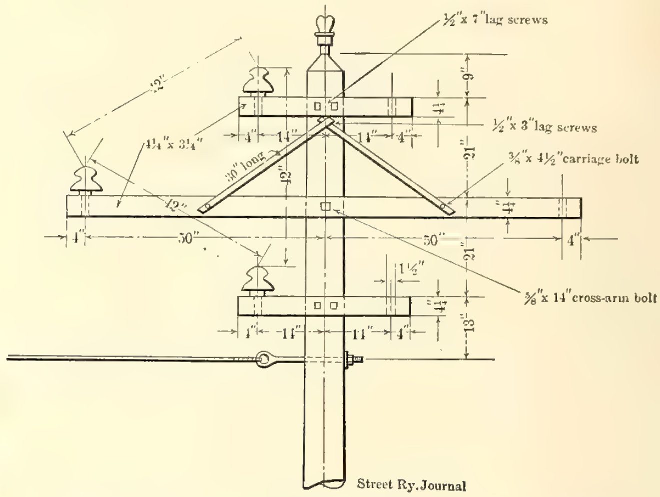
Direct-current feeders are carried the full length of the line and consist mainly of 300,000 and 1,000,000-circ.-mil bare

NORTH APPROACH OF THE EAST ST. LOUIS VIADUCT

aluminum cables. Taps to the trolleys are made at intervals of 1000 ft.

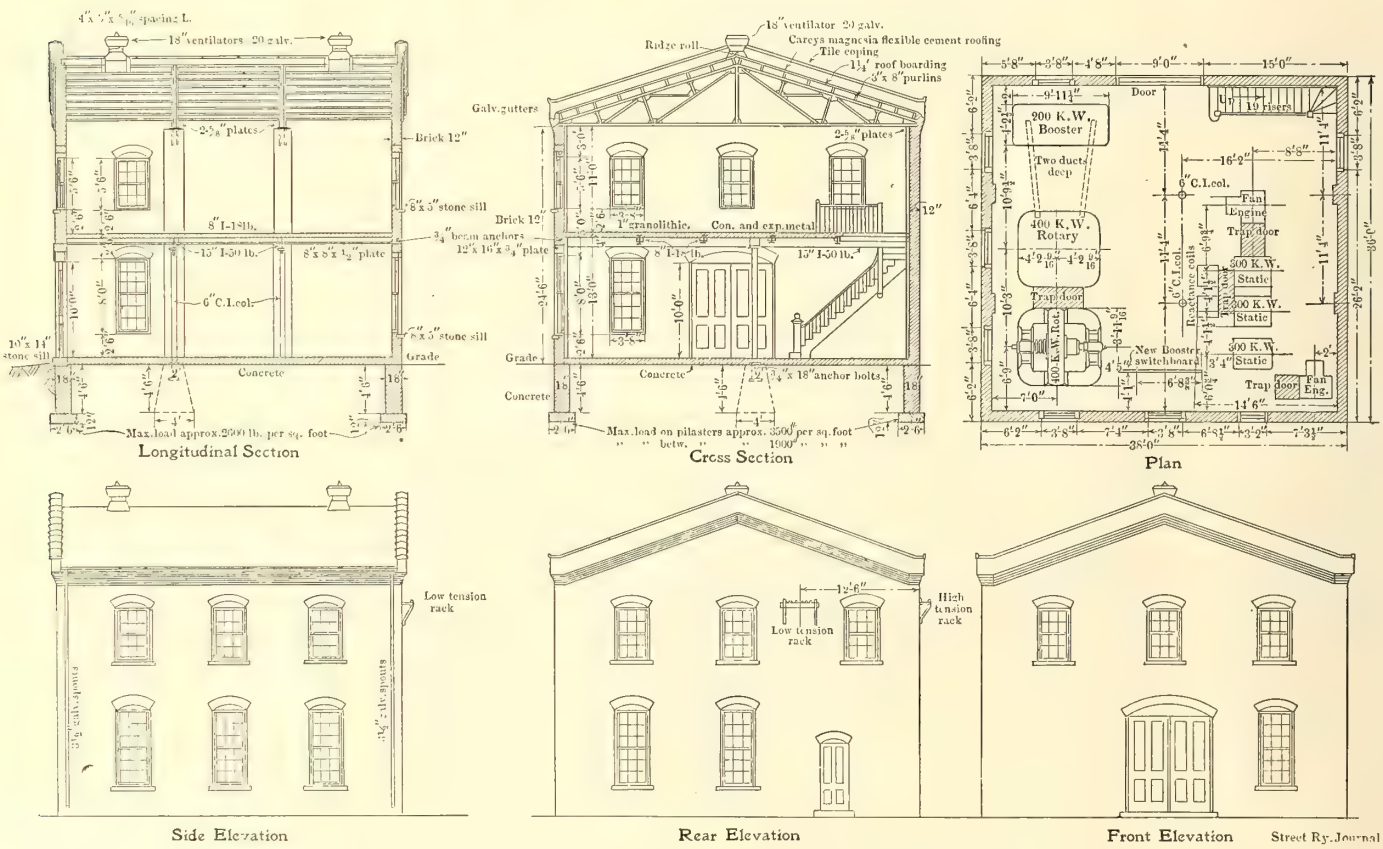
HIGH-TENSION FEEDERS AND SUB-STATIONS

Current to operate the line is obtained from the power station of the East St. Louis & Suburban Company in East St. Louis. From this station current is transmitted at 13,200 volts to two sub-stations, one located at Granite City and the other a few miles south of Alton. The one high-tension line supplying these sub-stations consists of three No. 4 copper conductors supported on lock No. 18 glass insulators. The manner in which the high-tension wires



STANDARD POLE AND INSULATION LAYOUT FOR HIGH-TENSION WIRES

are carried on the poles is somewhat unusual. Three cross-arms, two of which are 3 ft. long and the third 9 ft. long, are employed. The arms are 25¼ ins. apart and one wire is placed on the end of each cross-arm. This arrangement throws the three wires into a 42-in. triangle. The cross-arms are arranged for two circuits, but at present only one is installed. As a protection against lightning a No. 9 iron wire, which is grounded every 1000 ft., is carried on a ridge pin. At present this wire is run continuous, but it is



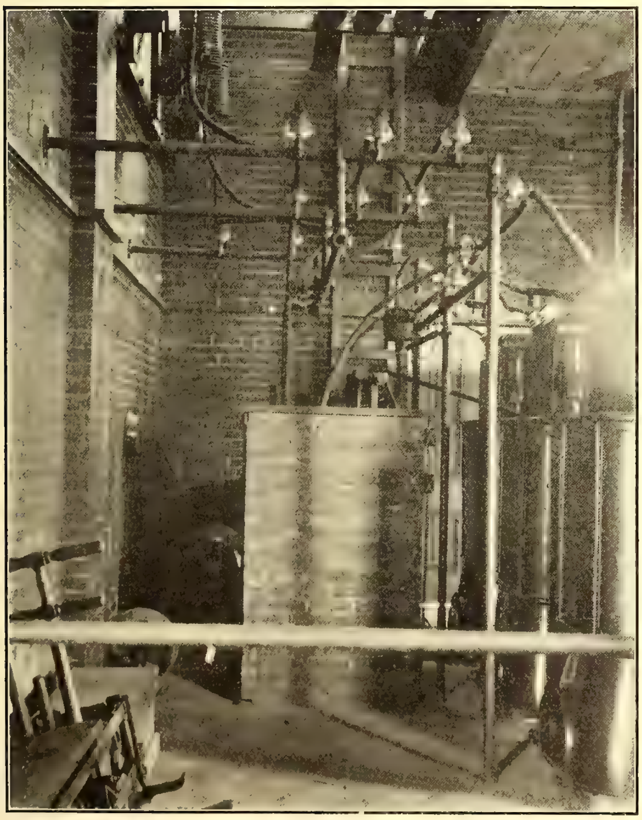
PLAN AND ELEVATIONS OF THE TWO-STORY SUB-STATION OF THE ALTON, GRANITE & ST. LOUIS TRACTION COMPANY

the intention to cut it in sections to prevent the generation of induced currents.

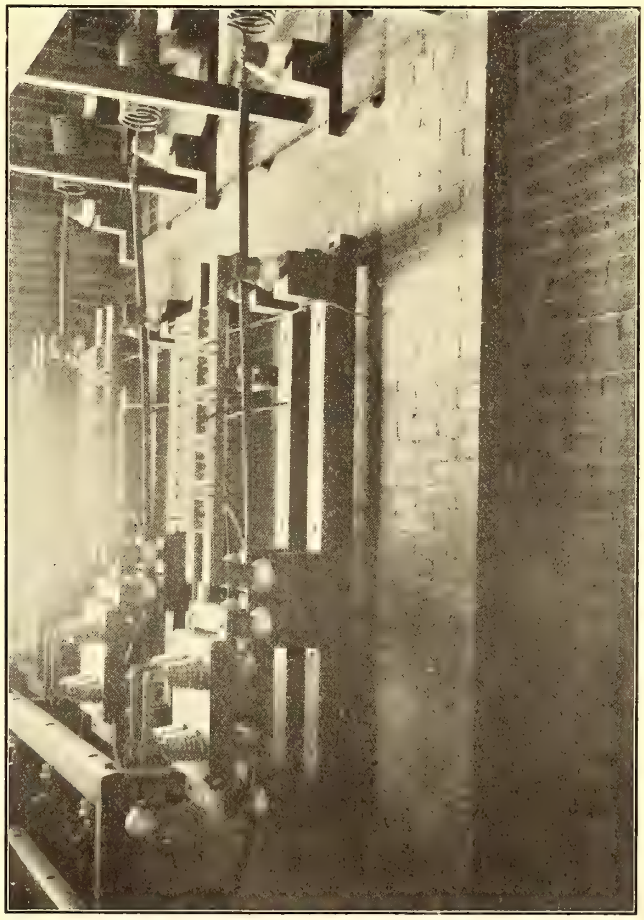
The two sub-station buildings are practically identical in construction with the exception of the fact that the one near Alton is only one story high while that one at Granite City has a second story. Both buildings have concrete foundations, pressed brick walls, concrete floors and steel roof trusses. In both stations the high-tension apparatus is grouped on one side of the building; the rotary converters are on the opposite side, and the switchboard is located near the rear wall so as to face the open spaces between the machines and the transformers. The high-tension apparatus, as well as the rotary converters, are of General Electric manufacture.

A somewhat unusual method was employed in bringing the high-tension wires into the building. Six or 8 ft. distant from the walls of the building, heavily insulated wires are substituted for the ones leading up to this point. The insulated wires are then carried into the building through porcelain tubes of practically the same diameter as the insulation on the wires. The relative location of all the high-tension apparatus in the stations is such as to permit the connecting leads between the lightning arresters, switches and tranformers to be exceedingly short, as is shown in an accompanying reproduction from a photograph. The transformers are air-cooled, two motor-driven fans being employed to supply the forced draft. The rotary converters are started from the a. c. side by means of double-throw switches through which current at 185 volts is supplied.

INTERIOR OF GRANITE CITY SUB-STATION, SHOWING TRANSFORMERS AND END OF THE SWITCHBOARD



HIGH-TENSION WIRING IN THE GRANITE CITY SUB-STATION



LIGHTNING ARRESTERS ON THE SECOND FLOOR OF THE GRANITE CITY SUB-STATION

The Granite City sub-station contains, in addition to two 400-kw rotary converters, a 200-amp. booster, which raises the voltage to 800 and is connected to a separate feeder, from which no taps are made until Mitchell junction is

reached. The other sub-station is equipped with two 300-kw rotary converters.

CARS

Eight interurban cars, all of the same type, are employed in the operation of the line. These cars are 52 ft. 9 ins. in length and 8 ft. 10 ins. in width over all. They are equipped with the GE-73 motors and GE multiple-unit systems of control. All are mounted on Peckham 40-A trucks, having

INTERURBAN STATION AT THE JUNCTION AT MITCHELL

38-in. steel-tire wheels. The gearing of the motors is such that a speed of 50 miles is frequently attained.

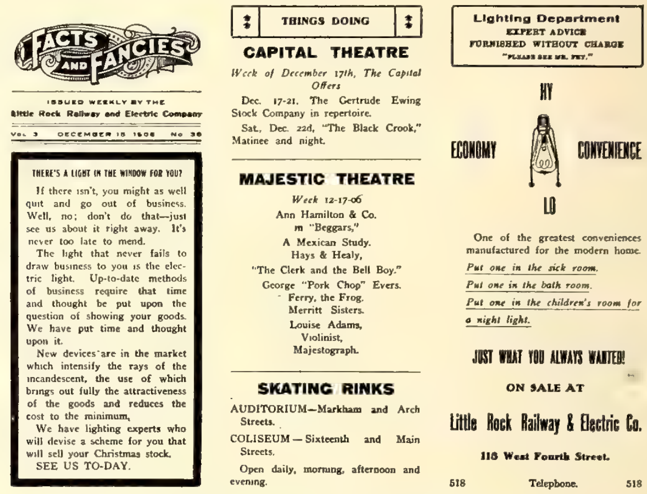
A car house at Alton is equipped with facilities for making light repairs, but all of the heavy work—such as turning wheels, changing gears and winding armatures—is done in the shops of the operating company in East St. Louis. A one-hour schedule is maintained over the whole line throughout the day. The cars are all in what is usually termed regular service; that is, they make all schedule stops.

STANDARD PASSENGER CAR

No occasion has yet arisen for the inauguration of limited service. The regular cars, however, are operated at a speed approximately that of cars in limited service on many lines.

FACTS AND FANCIES AT LITTLE ROCK

All of the cars of the Little Rock Railway & Electric Company are provided with small cast-iron pockets on the side posts which are kept filled with the company's weekly publication, "Facts and Fancies." In the issues which are gotten up in the form of a folder, measuring about 2½ ins. x 6 ins., considerable space is devoted to the announcements of the theaters, of the skating rink, and of other places of amusement, while a portion is used by the lighting department of the company in such a manner as to further its interests. All announcements in regard to schedules or changes in the railway service are given to the public through this medium.



FACTS AND FANCIES

ISSUED WEEKLY BY THE Little Rock Railway and Electric Company

VOL. 3 DECEMBER 15 1906 No. 38

THERE'S A LIGHT IN THE WINDOW FOR YOU?

If there isn't, you might as well quit and go out of business. Well, no; don't do that—just see us about it right away. It's never too late to mend.

The light that never fails to draw business to you is the electric light. Up-to-date methods of business require that time and thought be put upon the question of showing your goods. We have put time and thought upon it.

New devices are in the market which intensify the rays of the incandescent, the use of which brings out fully the attractiveness of the goods and reduces the cost to the minimum.

We have lighting experts who will devise a scheme for you that will sell your Christmas stock.

SEE US TO-DAY.

THINGS DOING

CAPITAL THEATRE

Week of December 17th, The Capital Offers

Dec. 17-21. The Gertrude Ewing Stock Company in repertoire.

Sat., Dec. 22d, "The Black Crook," Matinee and night.

MAJESTIC THEATRE

Week 12-17-06

Ann Hamilton & Co.
in "Beggars,"
A Mexican Study.
Hays & Healy,
"The Clerk and the Bell Boy."
George "Pork Chop" Evers.
Ferry, the Frog.
Merritt Sisters.
Louise Adams,
Violinist,
Majestograph.

SKATING RINKS

AUDITORIUM—Markham and Arch Streets.

COLISEUM—Sixteenth and Main Streets.

Open daily, morning, afternoon and evening.

Lighting Department
EXPERT ADVICE
FURNISHED WITHOUT CHARGE
"PLEASE SEE MR. FEY."

HY
ECONOMY CONVENIENCE
LO

One of the greatest conveniences manufactured for the modern home.

Put one in the sick room.

Put one in the bath room.

Put one in the children's room for a night light.

JUST WHAT YOU ALWAYS WANTED!

ON SALE AT

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118 West Fourth Street.

518 Telephone. 518

OUTSIDE PAGES OF THE LITTLE ROCK RAILWAY & ELECTRIC COMPANY'S WEEKLY FOLDER

ELECTRO-MAGNETIC BRAKING ON SEVERE GRADES

Some interesting work in electro-magnetic track braking has been carried out on an electric railway in Germany between Elberfeld and Cronenberg, on certain portions of which the grades are over 10 per cent. The first type of brake used required a set of racks placed between the rails with which a gear wheel on the car body would mesh. When the car attained too high a speed this gear wheel would release a counter-weight which in turn actuated a band brake. The latter required such heavy maintenance expenses that it was removed after four years' service.

The company is now using an electro-magnetic track brake with the standard shoes of the Allgemeine Elektricitäts Gesellschaft. Instead of braking on the running rails, however, the two shoes are applied on a pair of flat rails laid in the center of the track about 2 ins. above the pavement. The center rails were preferred because they had already been installed in connection with the rack system, they permitted any desirable area on the magnetic shoes, and as the rails are not continuous can be placed in circuit in advance to apply automatically when a severe grade is reached. Hence, the motormen are instructed to switch on the brakes at the head of a grade.

When the electromagnets of the brakes are excited with a current of about 30 amps., each brake exerts a pull amounting to 1.9 tons, thus increasing the weight of the car available for adhesion by some 3.8 tons. The car itself weighs empty some 10 tons, and when all the seats and standing places are occupied the weight is 12.3 tons.

MAINTENANCE METHODS AND DETAILED COSTS OF CAR HOUSE FIRE PROTECTION IN CLEVELAND

One of the first electric railway companies to give especial attention to the protection of car houses and repair shops by the installation of automatic sprinkler systems was the Cleveland Electric Railway Company. An account of the sprinkler equipments installed in this company's car houses was published in the STREET RAILWAY JOURNAL for May 19, 1906, but some particulars of the method of maintaining these sprinkler systems, based upon experience extending over a year or more, should prove of interest. So far, there have been no fires of any moment to test their efficiency in practical use, but such is the care with which these protection systems are maintained that, without doubt, they would do the work perfectly when under trial.

Not only has the Cleveland Electric Railway Company installed a complete system of roof and aisle sprinklers, but in some of the largest houses division fire walls were built, some of them lengthwise of the houses and some crosswise, with automatic fire doors to allow the cars to have free passage through the buildings. In addition to this, the standpipes and hose lines, chemical extinguishers and yard hose reels that had been in use before were retained and may be used to extinguish fires that have not gained enough headway to open the sprinkler heads.

It might be supposed that, once the sprinkler system is installed, it will take care of itself, but this is not true. As in all other matters of equipment, the feature of maintenance and care asserts itself. All of this apparatus is carefully inspected and tested regularly, that the management may be certain it is in perfect working order at all times. Just as in all other departments of the company's business a system of reports has been adopted which show the actual condition of the system, the water pressure and everything else pertaining to it. The ways and means of taking care of the system were devised by T. Scullin, the capable master mechanic of the road. In the first place he put upon the foremen at the various car houses the responsibility of keeping their systems in proper order and everything in good shape. Then a general inspector was employed to keep a lookout on all the stations. He goes over the plants and checks up the reports of the foremen at least every two days. This man is an expert and of course is able to discover any trouble in making his inspection. A blank (Fig. 1) is used to record the water and air pressures each day in each installation. This blank is signed by the foreman who takes the readings and by the special inspector. It is then sent to Mr. Scullin. As the pressure always stands close around a certain figure at each of the stations, it is thus possible to see whether the systems are properly maintained and kept in shape for instant work. Since the special inspector may drop in at any time, he is a check on the foreman, who must take his readings correctly. The readings are generally taken between 9 and 10 o'clock in the forenoon.

FORM 150 3M-11-17-05

THE CLEVELAND ELECTRIC RY. CO.

Inspector's Report on SPRINKLING SYSTEM at ______________ Station.

Week Ending ______________ 190__

DATE	PRESSURES IN POUNDS AT VALVES																			
	No. 1		No. 2		No. 3		No. 4		No. 5		No. 6		No. 7		No. 8		No. 9		No. 10	
	Air	Water	Air	Water	Air	Water	Air	Water	Air	Water	Air	Water	Air	Water	Air	Water	Air	Water	Air	Water

REMARKS ______________

Correct ______________ FOREMAN. Signed ______________ INSPECTOR.

FIG. 1.—BLANK USED TO RECORD VALVE PRESSURES

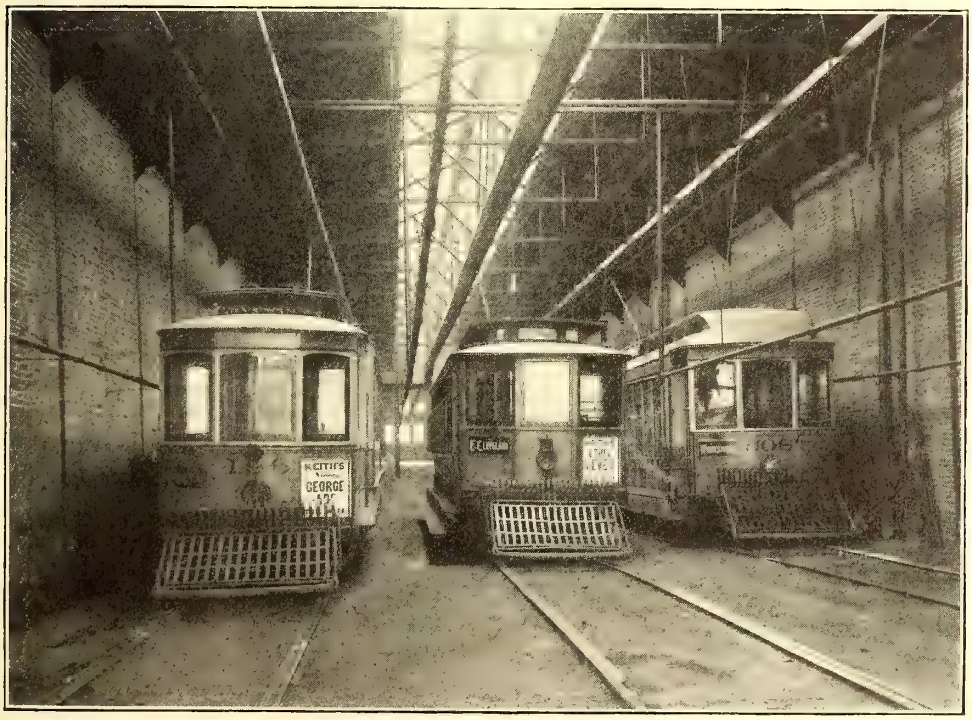


FIG. 2.—INTERIOR OF WINDERMERE CAR HOUSE, SHOWING SIDE LINES AND TROLLEY TROUGHS

All systems must, of course, have two sources of water supply, that is, either two large tanks or a tank with reliable city connection. During the winter careful attention is required to prevent the water in these tanks from freezing. In stations where steam is used for other purposes, a coil is placed in the bottom of the tanks and steam is passed through it from three to five hours a day, depending upon the severity of the weather. The water is usually kept at about 65 degs. F. Five of the houses are provided with steam, but in the others gas hot water heaters are used. These gas heaters are similar to those used in heating houses

where gas is used as a fuel. They usually consist of an enclosed coil of copper or other pipe around which a blaze from a gas burner circulates freely. The blaze coming into close contact with the water heats the water very rapidly.

To ascertain the temperature of the water in the tanks, a ½-in. pipe extending 12 ft. through the water in the tank is carried down the side of the main water pipe to the inside of the tank riser house, where an ordinary hot

FIG. 3.—ENCLOSURE FOR VALVE WITH DOOR OPEN AND LAMPS INSIDE FOR HEATING. OUTSIDE ARE THE RISERS TO ROOF AND SIDE LINE SPRINKLER PIPES

water thermometer is attached to it. By drawing off a small amount of water, the thermometer will register the correct temperature. The readings have been compared often with the actual tank readings to ascertain their correctness. This plan has been found the most satisfactory of several that have been tried and requires less effort in getting the readings. No system of reports has been formulated to record these temperature readings, but they could be incorporated with the pressure readings, if found necessary.

Both the dry and wet pipe systems of sprinklers are used but the former is found in all the car houses on account of absence of heat and danger of freezing. In the shops the wet pipe system may be employed without danger. As is known, in the dry pipe system the pipes are filled with air kept at a sufficient pressure to counterbalance the water pressure at a double-seated valve which is always located close to the floor or at some other easily accessible point. When there is sufficient heat to open a valve, the air discharges and the water, having nothing to retard it, rushes in, This trips the main valve, allowing the water to flow into the pipes. At the same time an electric alarm sounds.

In houses where there is no heat and where the supply pipes come up from the ground these large valves and other apparatus containing water are enclosed and heated by passing current through five ordinary lamps such as are used for lighting cars. Car lamps that have been pretty well burned out and useless for lighting are utilized for this purpose. In addition oil lamps are kept in certain of the enclosures, and if the temperature gets low they are lighted. Steam heat or electric heaters are used elsewhere.

Each of these enclosures is furnished with a thermometer. so that the temperature may be ascertained at any time, and careful attention is paid to this point. During the summer and on warm days in winter these dry pipes are tested by letting the water into them, afterward thoroughly draining it off. Leaks and poor sprinkler heads are also found in this way when the temperature will permit. In some of the houses the enclosures for keeping the pipes and valves warm contain two valves and some only one. Where the sections of piping to be supplied could be conveniently arranged so that their valves could be placed in pairs, this was done, as the expense is reduced somewhat by this method. In the Rocky River car house it was found impossible to bring up the pipes in enclosures near the wall, as in the other cases. The valves were therefore placed in pits beneath the floor. These pits were built of concrete and are heated in the same way as the enclosures.

The valves for closing the roof sprinklers in the paint

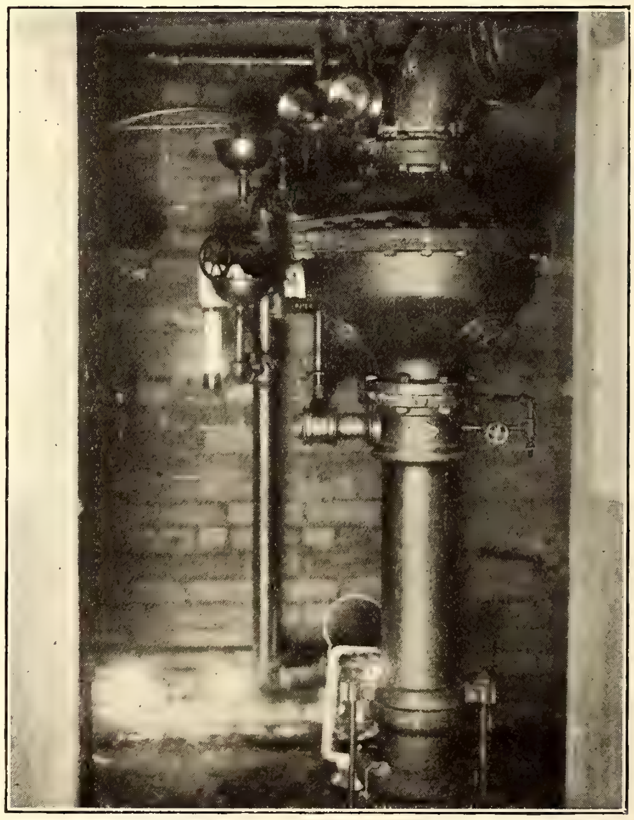


FIG. 4.—DRY PIPE VALVE IN ENCLOSURE BUILT ON OUTSIDE OF CAR HOUSE, SHOWING ELECTRIC AND OIL LAMPS FOR HEATING

shop and other sections of the Lake View plant, where the wet-pipe system is used, are 18 ft. or 20 ft. above the floor. The old plan of reaching them was by means of a ladder. Master Mechanic Scullin has arranged a sprocket wheel, in place of the usual valve wheel, with the chain dropping within easy reach of a man on the floor. This is not only more convenient, but requires less time to open or close the valve, and it can be done as effectually as in the old way. All car houses are also equipped with electric indicators.

For keeping up the air pressure in the pipes, standard compressors, such as are used on the cars, are employed. This is done because a stock of parts is always kept on hand. Usually the systems require pumping up about every three days. The city water pressures vary in different localities, so the air pressure is regulated to suit the water.

When it was decided to equip the houses it was found that the city had not provided pipes sufficiently large to supply enough water to many of them, and it was necessary for the company to put these in. As a charge is made for all connections, the expense thus incurred was charged back to the city, but at the same time the work took time and involved considerable trouble.

In all the houses the pipes are divided into sections and each is supplied with water from a separate pipe. As it is obvious that outside control is necessary in event of fire there are valves on the outside of the buildings, numbered the same as the sections, where the water may be turned off. There are also valves inside, where the water may be turned off, either from the roof lines or the transom lines or both.

The aisle sprinkler pipes are hung on adjustable hands $1\frac{1}{2}$ ins. x $\frac{3}{8}$ ins. In some cases single hangers are used, in other cases a double hanger is employed. In still other cases double lines were formed by placing the heads on inverted T's. This latter arrangement is followed only where the tracks were so far apart that one line of aisle sprinklers would not protect the cars on both tracks.

As a precaution against possible electrolysis, an insulating joint is used in the water pipe near the point where it enters the car house. As will be seen from Fig. 2, it consists of a hard maple washer boiled in parafine, held between the flanges of the water pipe by insulating bolts. These bolts are covered with rubber hose, and are provided with fiber and machine washers on the outside.

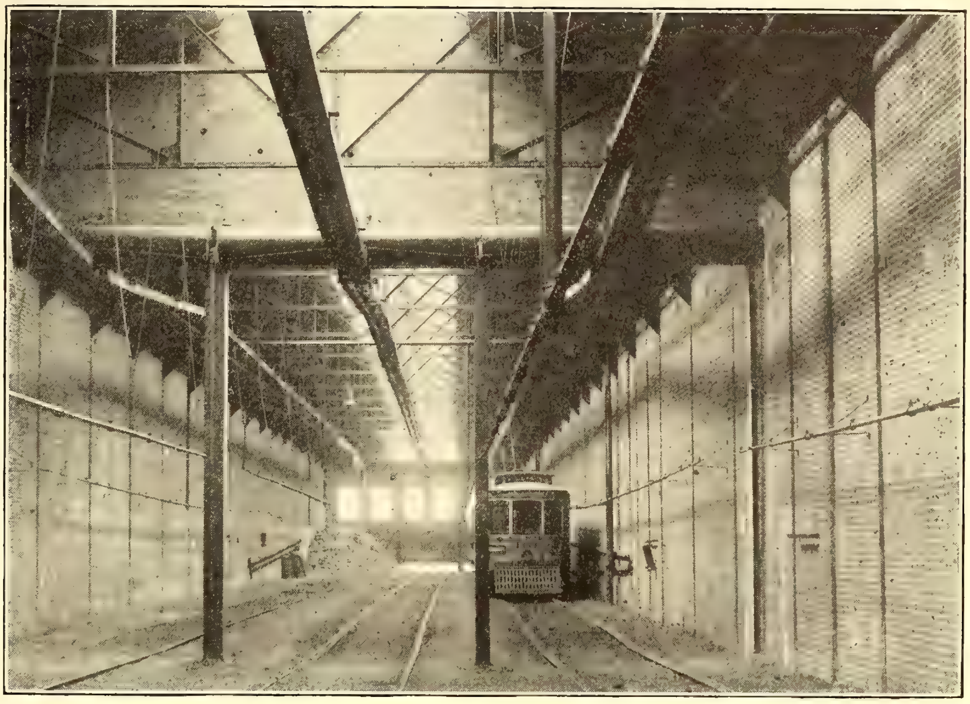


FIG. 5.—INTERIOR OF WINDERMERE CAR HOUSE, SHOWING ROLLER FIRE DOORS ROLLED UP

COST

The Grinnell system, furnished by the General Fire Extinguisher Company, is used throughout. The work was done on contract at a total expenditure of $128,428.56. Of this $121,823.09 was for the sprinkler systems alone and the remainder, $6,605.47, went for miscellaneous equipment and all articles that were required in addition to the work that was done by the contractors. The fire walls and automatic

FIG. 6.—EXTERIOR OF WINDERMERE CAR HOUSE, SHOWING PRESSURE TANK

fire doors entailed an expense of $13,908.08, making a total expense of $142,337.64.

On a basis of area the cost of equipping the houses with sprinklers was between 23 and 24 cents a square foot. This is exclusive of the cost of fire walls and miscellaneous expenses. But the work was done some time ago and since then the prices of materials, especially pipe, have advanced very materially. In all probability the cost at the present time would be very much larger than is given in the figures herewith. The reduction in insurance rates secured through the protection was such as to pay for the installation in six years.

DETAILS OF THE CONSTRUCTION AT EACH HOUSE

The Windermere car house, originally divided lengthwise by a solid brick wall, was furnished with a fire wall across the building, dividing it into four sections. Automatic closing fire doors with fusible links are used at each opening. This house has the dry pipe system and is protected by pipe lines carrying 1596 sprinkler heads. On the west side of the house are several tracks where cars are sometimes stored. To overcome this exposure all the windows on that side were bricked up. The enclosures for the dry valves are built on the outside of the side walls but open on the inside.

At Lake View 2029 heads are used, but for the most part the sprinkler system is installed in the shops, the cars being stored in an open yard. In the mill room and machine shop the sprinkler lines are located overhead, but in the erecting room, paint shop and motor department both the overhead and drop lines are used to take care of the cars that are constantly kept in these departments while repairs are being made. The wet pipe system is used here, because the buildings are always warm and there is no danger of the water freezing.

The Superior Avenue house has 637 heads, 444 on the lower and 193 on the upper lines. A row of open sprinklers has been arranged across the rear end of this house on the outside to form a water curtain for the protection of cars inside should fire occur in the yard, where many cars are stored. A fire wall was built lengthwise through the center of this building, dividing it into two parts. This was done at the suggestion of the railway company, as the insurance companies do not insist upon division walls in sprinkled car houses. The location of the lines is the same as in other houses and are cared for and maintained in the manner already described.

At the West Madison Avenue house 651 heads in all are used. This building has doors at the ends, which serve as a protection from air currents in case of fire. This is an important adjunct, but cannot be used in all houses, because of the arrangement of the tracks.

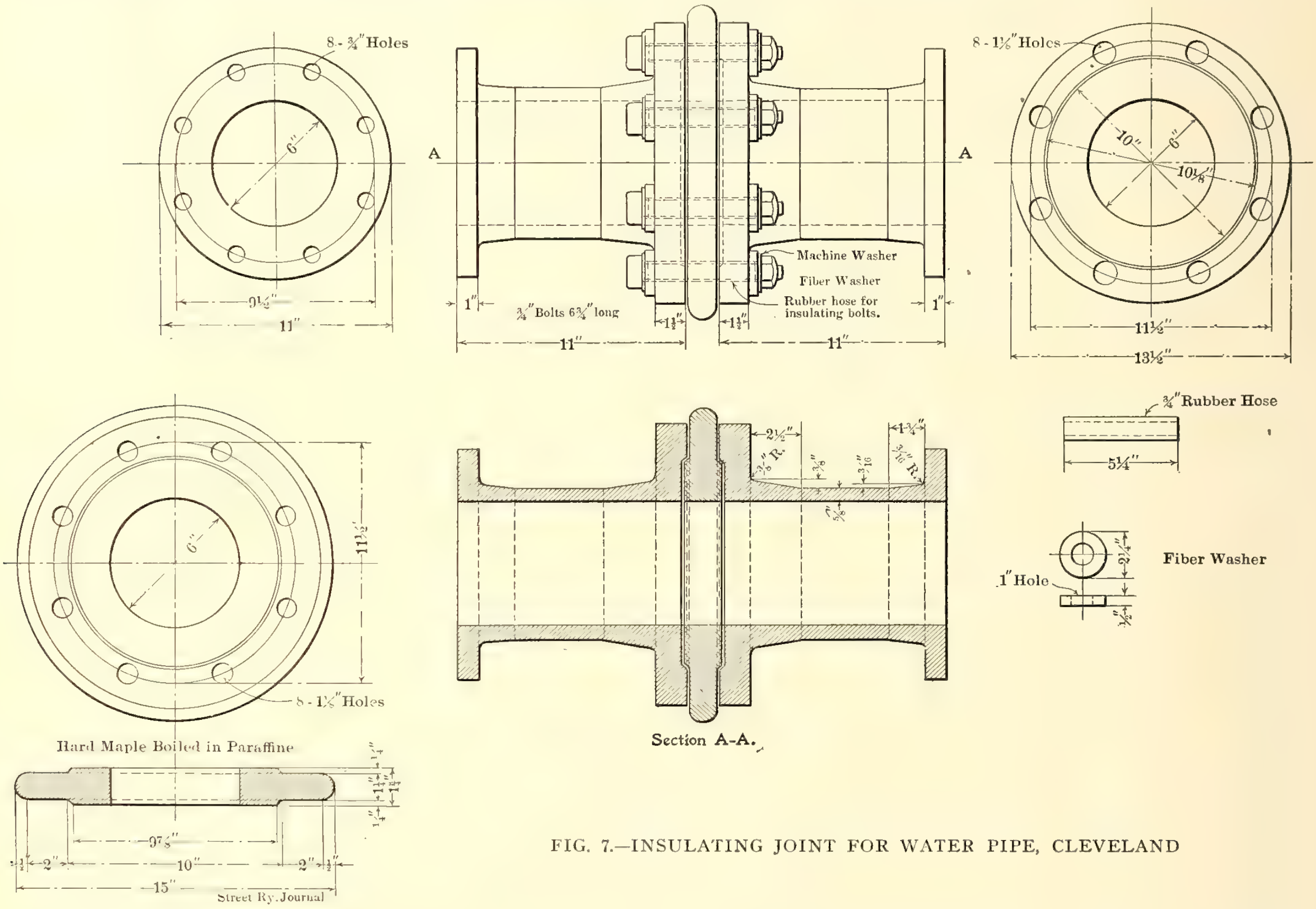


FIG. 7.—INSULATING JOINT FOR WATER PIPE, CLEVELAND

At Willson Avenue the car house was divided into three sections by walls which the company had built. This building is provided with 1130 sprinkler heads.

The windows were taken out of one side of the Lorain Avenue house and the side bricked up solid, where cars are stored. This house is provided with 1815 heads, arranged in the same way as in the other buildings.

At Miles Avenue, where many sprinkler tests took place, the large brick house is divided into two sections by a fire wall built across it, with automatic fire doors, as in the Windermere houses. The number of heads used in this building is 1567.

The South Brooklyn house has 785 heads.

At Rocky River the large brick car house is equipped with 1755 heads, while the Cedar Avenue house has 1668.

The St. Clair Avenue house is built of wood. It is

equipped the same as the others and has a water curtain at the rear, like the Superior Avenue building.

On Payne Avenue the company has a brick building which was equipped with 890 heads.

The cost of these improvements in detail is as follows:

	Sprinklers	Fire Walls
Cedar	$11,289.75	
West Madison	9,278.25	
Lake View	12,157.39	
Lorain	13,187.00	
Miles	12,366.50	$5,380.00
Payne	5,530.00	
Rocky River	11,483.70	
St. Clair	6,332.50	
South Brooklyn	7,741.00	
Superior	10,092.00	5,932.29
Willson	10,665.75	
Windermere	11,599.25	2,495.79

The miscellaneous expenditures were not gotten out in detail, but as they are only a small portion of the entire amount, it can be seen in about what proportion they might reasonably be distributed among the car houses.

At the Windermere house a hose house is maintained some distance from the main building, where a long hose is kept for the purpose of putting out fires in the cars on the outside of the building. The same plan is used at the Lake View, where cars are stored in large numbers in the yard. At Holmden Avenue, where there is no building, four hose reels are kept for this purpose. The hydrants are sealed by the city, after being used, in order that employees and others may not use them for any other than fire protection purposes.

Chief Engineer E. J. Cook had charge of the installation of the entire system for the company, and devised several plans for greater convenience and economy in the installation and maintenance of the system that had been provided for.

WESTERN SOCIETY OF ENGINEERS DISCUSSES STORAGE BATTERIES

"The Application of the Storage Battery for Lighting Power and Railway Service" was the subject of a paper presented by J. M. S. Waring, of the Electric Storage Battery Company, at the regular meeting of the Electrical Section of the Western Society of Engineers held in the Monadnock Block, Chicago, March 15. Mr. Waring separated battery installations into two classes, those for railway and power service and those for lighting service. Installations for railway and power service were further subdivided into power house and sub-station batteries and line batteries. Mr. Waring went at some length into the question of regulating batteries, and outlined by means of charts the different methods. The use of differential boosters, constant-current boosters and the carbon regulators was taken up. The differential booster, he said, had the advantage that when the load increased beyond that for which the series fields were designed it was necessary to shunt the fields and thereby impair the regulation. With the carbon regulator, however, increased loads could be cared for by simply substituting a larger solenoid.

Mr. Waring said that when a battery was installed to keep the generators working at an efficient loading the losses due to conversion were almost negligible as compared with the increased economy of the plant. Later in the discussion he stated that batteries sometimes worked at an efficiency as high as 90 per cent. Line batteries, he said, frequently saved more than their cost in feed wire. In industrial railway work, where the locomotive is required to work continuously for several hours without opportunity for charging the batteries, he said the size and capacity of the battery installation often made the installation of batteries prohibitive. Where the service required of the locomotive was such as to permit charging at frequent intervals, however, batteries could often be used to a great advantage. He cited one instance where the locomotive was required to make a two-minute run and was then allowed to stand two minutes. In this case only a comparatively small battery installation would be required, as charging could be effected at the end of each run.

With regard to the life of battery plates the discussion brought out the statement that in the most severe railway service the positive plate would last about four years, while the negative plate had a greater life. In less severe work plates would last seven years or longer.

Reference was made to the batteries on the gasoline-electric car of the St. Joseph Valley Traction Company, operating out of Lagrange, Ind. This car, which was described in the Street Railway Journal, April 8, 1905, was burned a few months ago in a car house fire. The batteries, however, operated successfully for more than two years. As an evidence of this the company placed an order for a larger installation for a second car. The car made two trips per day over the line, and during the time it was in operation the batteries entailed no expense and the repairs on the car were trivial. The power consumption with the car hauling a 25-ton trailer was about 45 watts per ton-mile.

CONVERTING OPEN TO CLOSED CARS AT HOT SPRINGS, ARK.

During the past season several open cars have been converted to closed cars in a rather novel manner by Edward Harden, superintendent of the Hot Springs Street Railroad, Hot Springs, Ark. An accompanying reproduction from a photograph shows one of the converted cars. They were formerly provided with running boards and openings between the posts extending to the floor, and in fact were of

OPEN CAR CHANGED TO A CLOSED CAR

the customary open car type with the exception that they contained center aisles and central openings in the bulkheads. In converting them a belt rail and sash rail were mortised into the posts, and over these were placed sheets of No. 14 gage steel. These sheets are 30 ins. wide and extend the full distance between the side sill and the sash rail and one-half the length of the body of the car. They were secured in position by bolting them to the posts with stove bolts spaced 1½ ins. apart. Sashes were fitted between the posts in such a manner that they can be removed in summer.

THE REINFORCED CONCRETE VIADUCT OF THE RICHMOND & CHESAPEAKE BAY RAILWAY AT RICHMOND

An account was published on page 986 of the STREET RAILWAY JOURNAL for June 23, 1906, of the plans of the Richmond & Chesapeake Bay Railway Company. This is a single-phase line of which Frank J. Gould, of New York, is president, and which is building a single-phase road 15 miles in length from Richmond to the Chesapeake Bay. It is to be supplied with a 6600-volt catenary trolley and the cars will be equipped with four G E A-603 single-phase motors on the multiple-unit system. All grades are less than 1 per cent., and long, easy curves are used in every instance, except on the viaduct entering Richmond. The company expects to do a mixed freight and passenger business.

The road enters Richmond almost directly from the north, over an elevated structure 2800 ft. long and ranging in height from 18 ft. at either end to 70 ft. where it crosses a small stream known as Bacon Quarter Branch. A riveted girder viaduct was first considered, but was rejected on account of the present high first cost and cost of maintenance, as well as the difficulty of double-tracking such a structure, should this become necessary. A wooden trestle with steel girders spanning the streets only was then planned and carried so far as to have lumber ordered and partially delivered. The great danger of such a structure being destroyed by fire, as well as the necessarily temporary character of wood construction caused the officers of the company to turn to reinforced concrete as a modern, strong, permanent and handsome construction. The design accepted was submitted by the New York branch of the Trussed Concrete Steel Company, of which B. J. Greenhood is chief engineer. This company was to furnish all steel for construction under the Kahn system of reinforcing concrete, and John T. Wilson, of Richmond, Va., was the successful contractor to do the construction work.

The viaduct was designed to carry a train of cars each 54 ft. long over all and weighing 150,000 lbs. on four-wheeled trucks placed 33 ft. center to center. The wheels on each truck were 7 ft. on centers, and thus the nearest wheels of the adjoining cars were 14 ft. center to center.

The design consists essentially of a system of girders of rectangular cross-section supported by towers. Each tower is made with two vertical bents, each having two columns 6 ft. 9 in. apart on centers at top and battered 1 to 6. They are of square cross-section and reinforced with from four to nine steel bars, the steel being placed for transverse strains only and the concrete to take the compression. The longitudinal struts and transverse braces are all horizontal.

The girders follow the grade and are rectangular in cross-section, except at the span across Marshall Street, where the desired depth could not be used on account of the city limiting the company to a clear headway of 14 ft. These girders could not be made deep enough to take care of the bending movement, and as the railway company did not care to get any higher than was absolutely necessary, it became a problem of the designing engineer how best to span this street. It was found that with girders 6 ins. deep, the depth allowed here, that the beam would not contain enough concrete to take the compression stresses. A T-shaped beam was finally decided on.

The spans vary in length from 23 ft. 6 ins. to 67 ft. 5 ins. center to center bents, the longer spans being used at the crossings of the Seaboard Air Line Railway and streets which had to be crossed with a clear span. Expansion in the structure is taken care of by expansion joints placed at intervals of about 200 ft., consisting of a grooved steel plate on top of the bent, on which a planed steel plate on the bottom of the girder slides, while a sliding toggle near top of girder prevents any tendency to turn the girder. On account of unavoidable circumstances, it was necessary to put two seven-degree curves in the viaduct, both in the same direction. The grade is upward from the north end of the viaduct to about 200 ft. from the terminal, at which point it becomes level. The grade on the tangent is plus 1.10 per cent., and on curves plus 0.7763 per cent., there being a total difference in elevation of 25 ft. between the two ends of the structure.

The concrete, of a 1:2:4 mixture, was figured for a compressive stress of 500 lbs. per sq. in. and shear of 50 lbs., while the steel used was given a tensile stress of 16,000 lbs.; compression, 60,000 lbs. and shear of 10,000 lbs. per sq. in. of cross-section. The modulus of elasticity of concrete to steel was taken as 1 : 12 and the percentage of steel to be less than 1.45 per cent.

Work on the viaduct was begun in the latter part of May,

CLAY STREET SPAN COMPLETED WITHOUT TRACK. SPAN 67 FT. 5 INS. CENTER TO CENTER

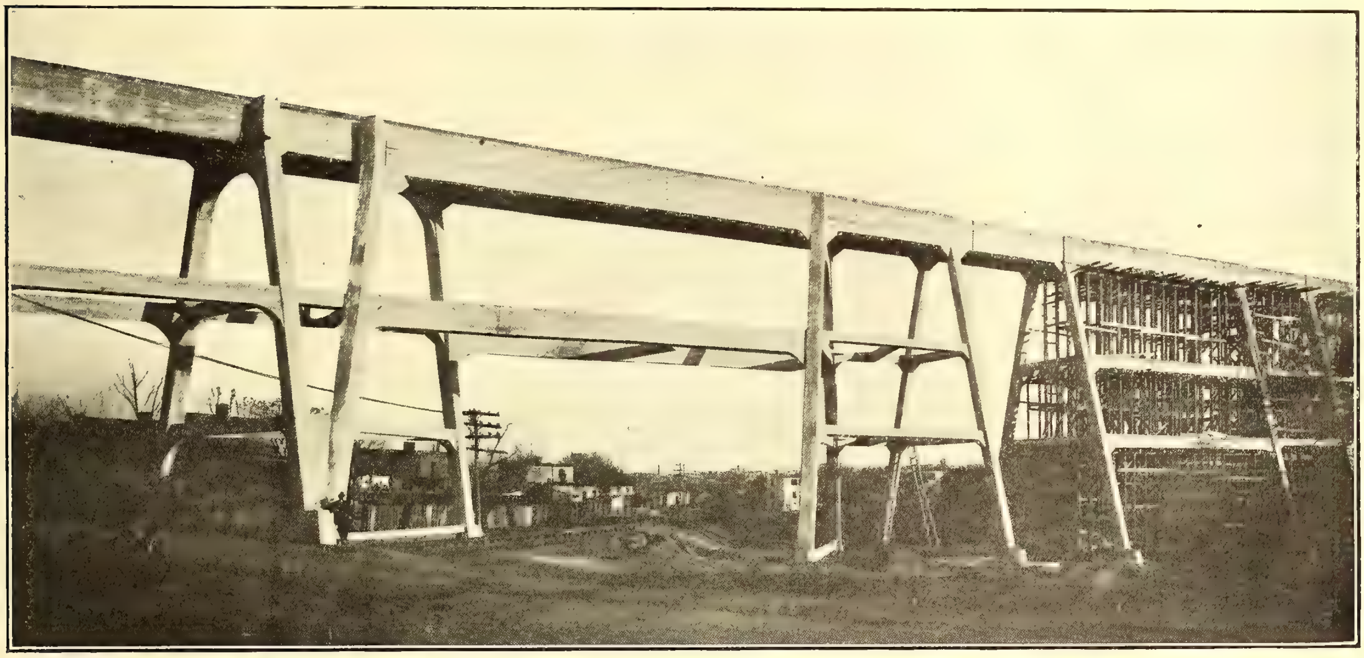
1906, and was quite slow until the contractor got a system of operations fully established. Work was started at two points, the northern end and about the middle, and both forces worked southward. The footings for the columns were first put in, having four ¾-in. rods projecting 4 ft., around which the column was built, and also a pocket left for the bottom of the column. The foundations were either hard clay or compact gravel, and were calculated for a pressure not to exceed 6000 lbs. per sq. ft. As the structure was designed so that it could be readily double-tracked when necessary, the footings were made twice as large as they would have been if designed simply for a single track, and a 4-ft. stump of a column was left on which the future double-track column will rest. When traffic justifies double tracking the viaduct, it will be easy to construct an additional girder with proper supports, on one side of the viaduct, shift the track so that it will be supported by the new girder and one of the original girders and carry the traffic on this track during the construction of the additional girder and new track on the other side. Cored holes are provided to take care of fastening new work to the old when double tracking is begun. The footings were carried down a uniform depth of 4 ft., unless extra depth was required to get suitable foundations.

The contractor supplied suitable equipment for two concrete gangs, consisting of two No. 2½ Smith concrete mixers, two hoisting engines, elevators, buckets, etc. But it was found that while one force was erecting forms the other was putting in concrete, and, therefore, one mixer was taken away to other work. After the erection of the forms the columns, up to the bottom of girders, and contiguous struts were poured at one continuous operation, so as to make them monolithic. Next the girders and floor were put in in the same manner. At first the attempt was made to pour columns from the top, but owing to the difficulty of properly ramming and working the concrete through the reinforcing Kahn bars, this method was abandoned. The column forms were then built in a U-shape and the fourth side built up in sections as the concrete was poured.

Dumping buckets holding 3 cu. ft. and built for this express purpose were used in dumping into column forms. These buckets were lifted by means of a traveling single boom derrick, seated on top of the viaduct, and a hoisting engine. The struts were poured from wheelbarrows from the top of the structure through a 10-in. hinged pipe of galvanized iron. Concrete for the girders and floor was hoisted on wheelbarrows by double cage towers to the top of the viaduct and wheeled to position on runways on the forms.

The forms were made of 2-in. lumber, dressed on one side, and as much of the lumber as possible was cleaned and used again after forms were pulled down. The forms on the sides of the girders were removed at the end of a week, but those on the columns and the supporting falsework of the girders were left in place thirty days longer if the lumber was not needed.

The smaller girder forms were supported by falsework, consisting of 4-in. x 4-in. pieces placed 3 ft. on centers along the viaduct and resting on planking placed on the ground, which had been leveled to firm bearing. Under the heavier girder forms, at street crossings, the falsework was made of 6-in. x 6-in. timbers and the struts were supported by 4-in. x 4-in. pieces, placed at distances to suit the weight carried Owing to the great height of the structure throughout a considerable part of its length, a prodigious amount of lumber was used in the forms and shoring. Approximately 456,000 ft. B.M. was used in the entire job, or about 16,500 ft. B.M. to each 100 cu. ft. of concrete. Of course, at street crossings, and especially at Clay Street, where a double-track street car line was crossed, and at the Seaboard Air Line Railway crossing, special provision had to be made to carry the great weight of girders. It is notable that in spite of the great weight of these girders, being considerably in excess of 50 tons each, the forms were erected and concrete put in place without delaying a train or street car. The cement used in the entire work was Atlas Portland. The stone was granite, crushed so that all would pass through a one-inch ring, and was thoroughly screened. The sand originally was obtained by dredging in the Appomatox River at Petersburg, and was of good quality. In the early stages of the work, comparative tests were made of mortar made from Petersburg sand and from screenings



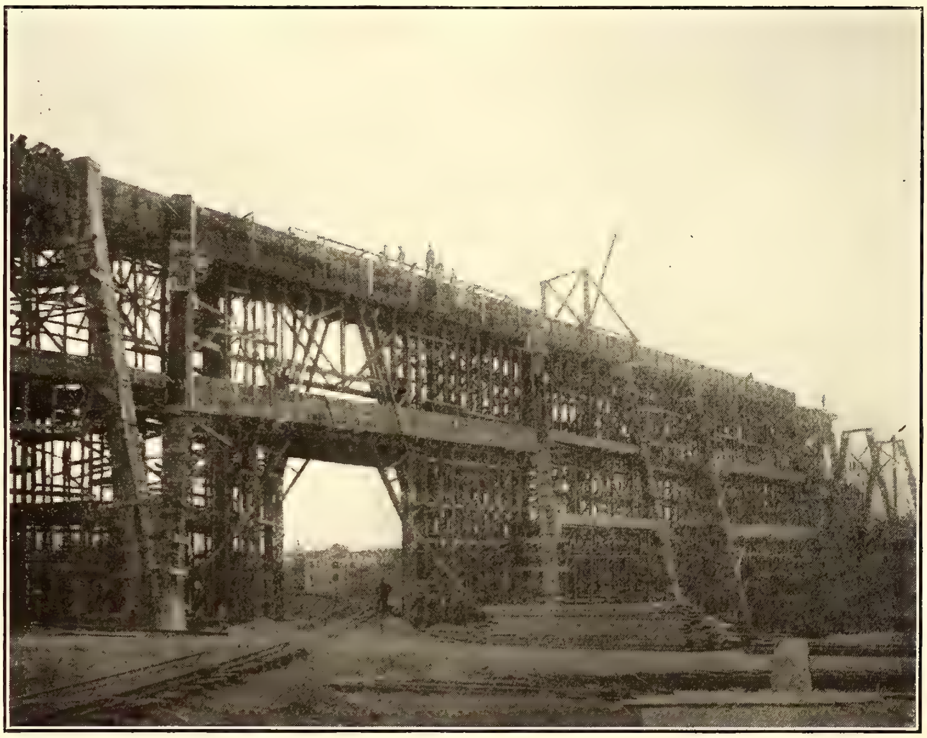
CROSSING OF SEABOARD AIR LINE RAILWAY AND OAK STREET AFTER THE FORMING WAS REMOVED

from the granite crushers at a neighboring quarry, and as the granite dust showed a superior tensile strength of from 20 to 50 per cent. over the sand, it was adopted and used in at least 80 per cent of the work.

The concrete in the footings was made of a mixture of one part cement, three of sand and six of stone, except that in wet pits near Bacon Quarter Branch, more cement was added. In all of the rest of the work a 1 : 2 : 4 mixture was used. This was made quite wet and the concrete was thoroughly worked into the reinforcement with spades and rammers. No concrete was allowed to go in that had stood as long as fifteen minutes.

After the forms were removed, porous places in the cement were plastered up with 1 : 2 mortar and a finish of sand and cement applied with a brush was required.

The track rests upon 6-in. x 12-in. heart pine stringers, placed over the girders on each side. The cross-ties are 8 ins. x 8 ins. x 9 ft., spaced 12 in. on centers, and are oak.



CROSSING OF THE SEABOARD AIR LINE RAILWAY AND OAK STREET, SHOWING FALSE WORK

Every 5 ft. a ¾-in. bolt, imbedded 9 in. in concrete, goes up through the stringer and tie, while half-way between is a bolt through the stringer only. The holes in the stringers were 2 in. in diameter and afterwards were filled up with 1 : 3 mortar. This was to facilitate the placing of the stringers and also to prevent any tendency of the bolts to rust off where they come out of the girder. On the outside of curves a 12-in. x 12-in. stringer was used, thus giving the proper elevation of the rail, which was full at the beginning and end of curves and dropped off ⅛ in. to each foot.

The guard rail is of 8-in. x 10-in. pine, dropped 2 ins. between the ties. A walk-way is provided on the west side of the viaduct by using a 12½-ft. tie every 5 ft. and a neat hand rail of angle posts and pipe is added for safety. The supports for the trolley wire will rest on 8-in. x 14-in. x 16-ft. oak ties, placed every 60 ft. on tangents and 30 ft. on curves.

J. H. McLure, chief engineer of the railroad, who furnished these notes, has given much personal attention to the detail of both design and construction of the viaduct.

CORRESPONDENCE

NOTES ON SPEED-TIME CURVES

NEW YORK, March 25, 1907.

Editors STREET RAILWAY JOURNAL:

I have read with interest Mr. Tracy W. Simpson's communication criticising and commenting upon my "Notes on Speed-Time Curves" published in the STREET RAILWAY JOURNAL of March 2, 1907.

A few more "notes" from me seem to be "in order," under the circumstances.

The most interesting and significant statement in Mr. Simpson's communication is the admission, in the last paragraph, that he "*never tried the chart method.*" I was fully prepared for this information. Indeed it would have been very hard for me to believe that he could have tried the method. I felt sure that if he had had even a limited practical experience with it, the tenor and tone of his original "notes" would have been quite different. I might "rest my case" at this point, but I am incited to go further by the rather confident manner in which Mr. Simpson proceeds to criticise a method admittedly untried by him, and the ease with which he shows it to be inferior to his own. His confidence and frankness are commendable. I regret that I cannot agree with him on many points; indeed, I must disagree more or less emphatically with him on certain points.

After reading Mr. Simpson's "notes" and his presentation of the "theory" of speed-time curve plotting, one can understand that his views regarding the burdening effect of "certain refinements in the theory and in the method of application" are natural enough to him; but, unfortunately, that does not make them true or make them acceptable, except, perhaps, to those who know nothing at all of the subject. The theory may be extremely simple; but that is no excuse for garbling or suppressing it altogether. There is a true and a fictitious simplicity; and we all know that nothing is so insidious, so misleading, so mischievous as the simplicity which is fictitious. A straight line may be the shortest distance between two points, geometrically, but it may also be the worst possible "route," practically, between these two points. The old adage that "fools rush in where angels fear to tread" was first invented decades ago, and it has been used ever since, with special reference to the poor unfortunates who allow themselves to mistake the "appearance" for the "reality" of simplicity. There happens to be, by the way, a very good specimen of this kind of simplicity in Mr. Simpson's own presentation of the theory. He describes V as an "arbitrary" interval of speed during which A is practically constant (see STREET RAILWAY JOURNAL, p. 245). He further says: "V is best chosen at about 5 m p. h. for the low speeds and 2 or 1 m. p. h. as the maximum speed is approached." Not a word is said about any reason why V should not be taken at any constant value or why it

should vary with any conditions. After giving this simple "theory" he proceeds to discard it himself in the very next paragraph by taking V = 29.5 m. p. h. He makes no apologies or explanations for this discrepancy between his "theory" and his "practice." Those who happen to know the whole theory of the subject know, of course, that Mr. Simpson's practice of taking V = 29.5 m. p. h. is entirely warranted for that portion of the speed-time curve, and that portion only. They also know why They also know why and how much the value V must be reduced in all other portions of speed-time curve. They also know that even the lowest value (1 m. p. h.) given in Mr. Simpson's simple "theory" is still much too large for certain portions, in many cases. Any reader whose knowledge of the theory of this subject has been obtained wholly from Mr. Simpson's "notes" must be highly gifted if he can answer these questions intelligently. Moreover, if he can, with merely the instructions therein given, prepare interpolation charts such as shown in Figs. 2, 3, etc., or plot speed-time curves such as shown in Fig. 8 of Mr. Simpson's notes, without making serious errors, he must be something of a genius. The errors of 3 per cent or 5 per cent which Mr. Simpson so much dreads from uncertainties as to train-resistance values might perhaps be made to appear relatively small, in some cases.

It is already apparent that the extremely simple theory of Mr. Simpson is ridiculously incomplete. We shall see presently that it is, also, not quite as simple as it seems at first glance. In reality, this alleged theory amounts to a partial explanation of an incomplete formula, with a set of values for the quantity V which, so far as the theory given is concerned, are fixed empirically, although it is well known that these values do have a scientific, rational, mathematical explanation and determination. Mr. Simpson may possibly be able to present the complete theory without the notation or the methods of the calculus, but, certainly, he has not done it yet. His V and his t are "*increments*" with the "symbol" left off. They would both be recognized and understood much better if he retained the symbol of a "difference," infinitesimal or finite, and if he had written dV or ΔV, and dt or Δt. Any engineer who does not know at least that part of the "alphabet" of the calculus is, in my opinion, out of his sphere entirely in the art of plotting and using speed-time curves intelligently. The calculus method shows easily and clearly where and why and to what extent errors are introduced by making the velocity increments, ΔV (i. e. V according to Mr. Simpson's notation) finite instead of infinitesimally small. Mr. Simpson is not very explicit here, as we have found. Since he can presumably make such matters very clear without any "burden" of calculus, there is an excellent opportunity for him to distinguish himself right here.

Mr. Simpson is right in his contention that I neglected to give him due credit for using one more factor (besides 91.3), namely, the number of tons of train-weight per motor, in transforming the scale of ordinates of his "general speed-tractive-effort curves." The truth is that I did not attach so much importance to this innovation as he, apparently, does, and I did not wish to lengthen unduly my previous communication by a discussion of it.

I am very glad, however, to be reminded of my seeming neglect of this factor, because I see now that it does really make more difference than I had thought at first. It is much more objectionable and makes his method less practical than I had supposed. His alleged short-cut around the chart method is, in reality, a more devious and lengthy route than I had believed.

Mr. Simpson's categoric statement to the effect that, with the chart method, a new chart of coefficients must be plotted for each specific case, or "for each particular case of *weight per motor*, as well as gear-ratio," is of course due to and reveals his want of familiarity and experience with the chart method. It also reveals a certain lack of sagacity. The reference to "proportional dividers" in my previous communication should have served as a hint of possibilities which are damaging to his cocksure statement. Even if Mr. Simpson's statement were entirely true, however, his method would still be, both theoretically and practically, inferior to the chart method. We can see easily and clearly that the alleged great advantages of the "general curves" are not worth the price which has to be paid for them, precisely because the factor (tons per motor) of which Mr. Simpson is so proud enters into the scale of ordinates. The introduction of this factor complicates greatly the process of predetermining the time-interval values (t) whenever grades and track-curves have to be considered. In fact, the method is probably too cumbrous and tedious to be used for plotting speed-time curves directly. Its function is probably restricted, even by Mr. Simpson, to the preparation of interpolation charts by means of which the real work is done, by the interpolation method, devised and first published by me. Whenever a grade or curve has to be taken into account, Mr. Simpson's equation for t (given on p. 245) and also his slide-rule setting (see diagram on p. 244) lose their "extreme simplicity" because the term A in the denominator must now be increased for "down" grades and decreased for "up" grades, by an amount equal to

$$\frac{20\ G\ T}{M} \qquad \text{or } 20\ G\ w$$

where G = grade percentage,
T = total tons of train-weight,
M = number of motors per train,
$w = \frac{T}{M}$ = number of tons of train-weight per motor.

Thus, as we see, the introduction of the prized factor (w) in the scale of ordinates of Mr. Simpson's Fig. 1 forces him to introduce it also in his equation every time that a grade has to be considered. Since, as is well known, the increased train-resistance due to track curvature can be and is most conveniently expressed in terms of an equivalent "up" grade, the occurrence of track-curves also necessitates the same procedure. It would seem, then, that Mr. Simpson's theory and method lose much, if not all, of their extreme simplicity the moment he has to leave a straight and level track, and has to reckon with curves and grades. Now, it is precisely in such a case that the chart of coefficients is valuable and practical. It enables grades and curves to be "reckoned with" as easily and as quickly as if the track were straight and level. This is because the equivalent acceleration values for grades can be represented on a chart of coefficients, by straight lines which are parallel with the axis of x (i. e., the axis of velocities) and whose distances from that axis are always the same. On Mr. Simpson's "general curves" the distance for any grade would vary with w, the tons per motor. The "grade-lines" can be located once for all on a chart of coefficients. They change, for the same grade, every time that w (tons per motor) changes, on Mr. Simpson's "general curves." On a chart of coefficients, grades and curves are automatically included in the computation by simply taking the proper

grade-line as a new axis of x. Thus, suppose we have a "down" grade of $-G = -1.57$ per cent, on a curve of 3 degs. (having an "equivalent" grade-effect of $+ 0.12$ per cent). The net "equivalent" grade will be

$$-1.57 + 0.12 = -1.45 \text{ per cent.}$$

If we assume the x-axis of the chart of coefficients to be displaced *downward* to the "grade-line" corresponding to $-G = -1.45$ per cent, then, clearly, every ordinate value of the "coefficient" curve, measured from this new axis, will be proportional to the sum of the accelerations due to the motor and to the grade. If the net equivalent grade were an "up" grade, the x-axis would be displaced *upward* to the $+ 1.45$ per cent grade-line and the ordinate value would then be equal to the difference between these accelerations. On deducting, from this sum or difference, the equivalent acceleration of train-resistance, we obtain the "actual" acceleration value, by reference to which the time-increment is calculated. This is all done by means of dividers; and it is found, practically, that grades and curves make but little difference, if any, in the time required. The operation takes no more time than is required by Mr. Simpson to obtain, from his Fig. 1, by dividers, the difference between the ordinates of his general tractive effort and train-resistance curves. In much less time than Mr. Simpson requires to "translate," as he must, his divider measurements into "pounds per motor," by the ordinate scale of his "general curves," the entire operation of obtaining the time-interval itself has been completed, by the chart method, by the simple process of transferring the dividers to the chart of reciprocals and reading off the time-value, according to a scale which is always large and therefore can be read to fractions of a second without hesitation or eye-strain. After he has translated his divider measurement, Mr. Simpson still has a slide-rule manipulation and reading to make, even when the track has no grades and curves; and, of course, he has considerable more than that to do, when grades and curves are involved. The writer has, many times, used the chart method for plotting directly the service-runs, for cases where it was not deemed worth while to prepare the sets of acceleration and retardation charts necessary for using the interpolation method. In some cases, the work of preparing interpolation charts would have been greater than that of thus plotting the service runs directly. I am quite sure that Mr. Simpson's confidence in the superiority and celerity of his method would receive a slight "jolt" if he had to use it for the direct plotting of service-runs in competition with the chart method, for a few days, even though the person using the chart method had to produce a new curve of coefficients two or three times a day, owing to changes of train-weight. As a matter of fact, while such additional charts of coefficients may be convenient and desirable in some cases, they are not by any means as indispensable as Mr. Simpson imagined. They are at all events so easily produced that they do not really constitute an appreciable item in the total time involved in the detailed study of an electric railway project by means of service-run diagrams. The new curves of coefficients required when a change is made in tons per motor (w) differ from the original curve only in the scale of ordinates. They can, therefore, be very quickly derived from the original curve by means of proportional dividers. This method is simple and expeditious enough for all practical purposes, where the charts are not too large. The curves can also be redrawn to other scales by means of an instrument called an "ordinate pantagraph," devised by the writer for enlarging and reducing the scales of all kinds of curves. With this instrument the curve can be quite accurately enlarged or reduced in any proportion from 1:2 to 1:10 or more, as quickly as the original curve can be followed by a tracing point. This method is available for both large and small charts.

The work of producing a curve of coefficients of different scale is not, after all, such a gigantic task. Still, even this task can be avoided; for it is actually possible to get along with one set of curves for all cases, i. e., for all values of tons per motor" (w). It so happens that the range of variation of the tons per motor is not infinitely great, as one might perhaps infer from Mr. Simpson's remarks. This is because small motors are not often used for heavy cars or trains, and large motors are not often used for light cars or trains. Hence, in practice, the "tons per motor" for a given motor and kind of service will vary between values which are not very many tons apart. In one case, for instance, I find the maximum and minimum values to be $w = 35$ tons and $w = 15$ tons, respectively. In another case, I find $w = 15$ tons and $w = 8.75$ tons, respectively.

In the first case the maximum value is 2.33 times the minimum value. In the second case, it is 1.71 times greater. This ratio might, possibly, in some cases, amount to 3; it is doubtful if it would ever exceed 4. Such ratios are well within the range of proportional dividers and proportional scales. They would still be, even if they were as high as 7 or 8. Of course, it is obvious that if the original curves of coefficients have been plotted with reference to an average value or a value approximately midway between the extreme values, for the tons per motor (w), the ratio by which its ordinates must be enlarged to give the curve coefficients for the lowest tons per motor and the ratio by which its ordinates must be reduced to give the curve of coefficients for the highest tons per motor, will be only half as large, and, therefore, almost always under 2. Suppose, for instance, that, in the first example, the original curves of coefficients on the chart of coefficients have been plotted with reference to the value $w = 25$ tons.

The factor giving the new ordinate values for the case $w = 35$ tons will be

$$\frac{25}{35} = 0.71;$$

and the factor giving the new ordinate values for the case $w = 15$ tons will be

$$\frac{25}{15} = 1.67.$$

A proportional scale for either or both of these factors can be made very readily. On a piece of squared paper lay off an ordinate scale of 100 units of any convenient length, and an abscissa scale of 71 units of the same length. Join the ends of the two scales by a straight line, thus forming the hypothenuse of a right-angled triangle.

With ordinary dividers take the ordinate value from the curve of coefficients for any desired speed value. Transfer this measurement to the proportional scale and find the point of the hypothenuse of the triangle whose ordinate is equal to that divider measurement. Then the distance from the base of this ordinate to the end of the abscissa scale is equal to 71 per cent of that ordinate. Therefore this distance, which can be easily taken off by resetting the dividers, represents the "corrected" or "transformed" ordinate value of the new curve of coefficients required (i. e. for $w = 35$ instead of $w = 25$). This value can now be transferred back to the chart of coefficients and the equivalent actual acceleration can be quickly obtained by subtracting, by the dividers, the

ordinate of the proper train-resistance curve and adding or subtracting the ordinate value corresponding to the proper net "equivalent grade." The time-interval value would then be obtained, in the usual way, from the chart of reciprocals.

The correction for rotational inertia, though more conveniently made by means of proportional dividers, may also be made by means of a similar proportional scale prepared for the proper "kinetic ratio" in the same way as that used for transforming the ordinates of the curve of coefficients. The whole operation is really simple and is performed in much less time than is required to describe it. It is expeditious because only one appliance, the dividers, has to be manipulated, and no "translation" of the divider measurements is required until the end of the operation, when the final result which is sought, namely, the time-value, is obtained. This method of procedure is entirely practical and it is doubtless more expeditious than Mr. Simpson's method, especially in computations involving grades or curves, which, as is well known, constitute the great bulk of the computations and determinations required in actual work.

I venture the opinion that the chart method, even under these circumstances, is still more expeditious than Mr. Simpson's method, for the preparation of interpolation charts. In view of the ease and facility with which the curves of coefficients can be enlarged or reduced to suit changes in the tons per motor (w), it is preferable, because it saves time, to prepare new curves of coefficients, when the chart method is to be used for direct plotting. The new charts of coefficients can be preserved and they may, indeed they generally do, prove useful on other occasions, so that the work does not necessarily have to be done every time that w changes.

It is now quite clear that the introduction of the additional scale-factor w, by Mr. Simpson, in his general curves (Fig. 1) does not, after all, change the nature of the diagram very radically or materially. We could still treat this diagram as if it were a chart of coefficients having a scale of acceleration values 91.3 times larger (since 1 m. p. h. corresponds to 91.3 lbs. of tractive effort). The curves would then be correct curves of coefficients for the case corresponding to w = one ton per motor. The actual case, according to Mr. Simpson's description, corresponds to single-car operation with a four-motor equipment, the total train-weight being 35 tons. Therefore, we have, actually

$$w = \frac{35}{4} = 8.75 \text{ tons.}$$

This figure shows that the scale of the curves of coefficients still need to be reduced by the factor

$$\frac{1}{8.75} = 0.114.$$

Of course, if these curves had been originally drawn especially for a chart of coefficients a more rational and more nearly average value would have been taken for w, say 10 tons or 15 tons instead of 1 ton. The factor would then be a more wieldy one. But, even with w = 1, it would still be possible to utilize Mr. Simpson's Fig. 1 as a chart of coefficients, in the manner explained hereinabove. When used in this manner, "grade-lines" could now be added, for "up" and "down" grades, and, with a chart of reciprocals, we could proceed to plot service-runs directly, for any conditions whatever of track grade and alignment, with greater ease and celerity than by any other method, including Mr. Simpson's.

The superiority of the chart method from the point of view of precision, as a method, remains unquestioned, even by Mr. Simpson. This precision, as we know, can be made as great as desired by increasing the number of determinations, i. e., by plotting more points. The writer has always found it possible to obtain, by the chart method, in a given time, the co-ordinates for more points than can be done by any other method. It is a mistake, however, to suppose that the method is only a method of precision. It lends itself to "rough work," of the roughest kind, at least as well as any other method. Indeed, it is precisely in the case of "rough work" that it proves exceptionally useful, often to the extent of rendering the interpolation method unnecessary.

Mr. Simpson's reference to the 200-mile road is not at all conclusive or convincing without detailed information regarding the number of "types" of service-runs and the total number of stops, i. e., how many different individual service-runs had to be plotted. It would also be interesting to know something of the "quality" of the work done, the way the runs are made, the scales of ordinates used, the degree of precision sought, etc. It does not seem impossible that the same work could be done by the chart method, at least as well (if Mr. Simpson's Fig. 8 may be taken as a fair sample of the "quality" of the work), in a time at least as brief. If the case were one in which several different kinds of train-units are to be used, including single-car trains, also two-car, three-car, and longer trains, for both express, local and freight service, the number of different sets of interpolation charts required would be multiplied until their preparation constituted a task of some magnitude. In such a case, Mr. Simpson would probably be glad to take the time to prepare a "chart of reciprocals" and to use the chart method for direct plotting, even at the risk and under the necessity of being obliged, occasionally, to drew new curves of coefficients for different values of w, the tons per motor.

I am grateful to Mr. Simpson for furnishing me the text and pretext for these "notes." The "moral" which they aim to illustrate is that: (1) all innovations, however original and meritorious, are not always necessarily improvements on existing ways and means; (2) theories, and other explanations, are not necessarily simplified by being curtailed, especially when the omission involves circumstances which affect the case quite materially. I have not been able to get over the feeling that it is at least as important to do the work well as to do it quickly, when this work, in the case of the technical study of a railway project, may influence large investments and their financial outcome My feeling is that I prefer to entrust this kind of work to men who do know at least a little calculus, and who have sufficient application, industry, and perseverance to master the complete theory of the subject, instead of being content with a mere superficial smattering of it. I find that such men can be trusted to use their judgment, while the others usually require to be constantly watched and, often, to be "set straight." The frequent requests which I continue to receive for reprint copies of my original A. I. E. E. paper on speed-time curves, and the appreciative manner in which my lectures have been received by both students and teachers show that there is a demand for a presentation of the theory by calculus methods. It is to meet this demand that the preparation of a work on "Electric Train Movement" in two, possibly three, volumes has been undertaken by the writer. The first volume ("Kinematics and Dynamics of Train Motion") will appear during the present year.

C. O. MAILLOUX.

LECTURE ON SINGLE PHASE TRACTION

In a lecture by W. S. Murray before the Electrical Engineering Society of Columbia University on Wednesday, March 6, much interesting information was given concerning single-phase traction in general and the particular method employed by the New York, New Haven & Hartford Railroad in substituting electric for steam locomotives. It was shown that in changing over from steam to electricity during the early stage of transition it is desirable to employ as much of the old equipment as possible. Thus the old tracks can be used with the simple addition of proper bonds; and by using locomotives rather than motor cars neither the freight nor the passenger rolling stock need be altered. A determination of the exact type of locomotive will in general depend upon the service. For strictly local suburban work the low-voltage direct-current locomotive deserves careful consideration, but for long-distance service, high-tension alternating-current locomotives are preferable. One of the chief advantages of the single-phase equipment resides in its simplicity, because by selecting the proper voltage not only is there no need for rotary converters, but even both the step-up and step-down transformer equipments can be dispensed with. Eleven thousand volts being the potential adequately suited to the location of power centers, this voltage being common practice for transmission purposes and 25 cycles being as nearly standard frequency as the art to-day can dictate, this voltage and frequency were adopted.

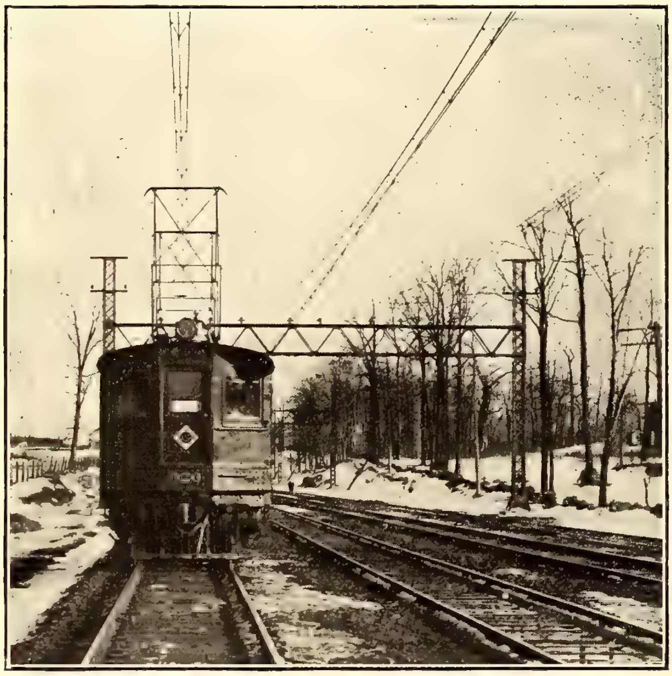


FIG. 1.—END VIEW OF ELECTRIC LOCOMOTIVE, SHOWING CATENARY CONSTRUCTION ON STRAIGHT TRACK

The simplicity of the single-phase equipment is well illustrated in the power house, where the major portion of the switchboard is designed for single-phase rather than polyphase work, although for convenience in interconnecting with other systems three-phase generators have been installed. The bus-bars are in duplicate throughout, for the purpose of maintaining immunity from breakdown.

Mr. Murray explained that the severest service to which the New Haven locomotives would be subjected would be in handling the local schedule. This service consists of the run between New York and New Haven, in which thirty-one stops are made. The average distance between stops is 2.2 miles, the average (or schedule) speed is 26 m. p. h., and the maximum speed does not exceed 45 m. p. h. The average trailing load of the New Haven trains is 210 tons, and while the locomotive will handle this tonnage in the above schedule with ease it will with equal facility handle a trailing load of 300 tons, in express service, within the zone of the present electrification.

In calculating the power required for hauling trains Mr. Murray assumed 40, 45 and 50 watt-hours per ton mile for express, express-local and local trains, respectively. By careful indication of steam locomotives in the above services he had found that these assumptions were well on the safe side, some trains, in express service, actually showing an energy consumption of only 31 watt-hours per ton-mile.

The locomotive is equipped with 62-in. drivers, which, together with the extra weight of the auxiliary devices and control mechanisms, give a center of gravity approximately 54 ins. above the rail. Although the motor is connected to the locomotive axle without gears, the whole motor equipment is spring suspended and the possibility of producing a hammer blow upon the track is practically eliminated. Electrically considered, each motor is provided with twelve

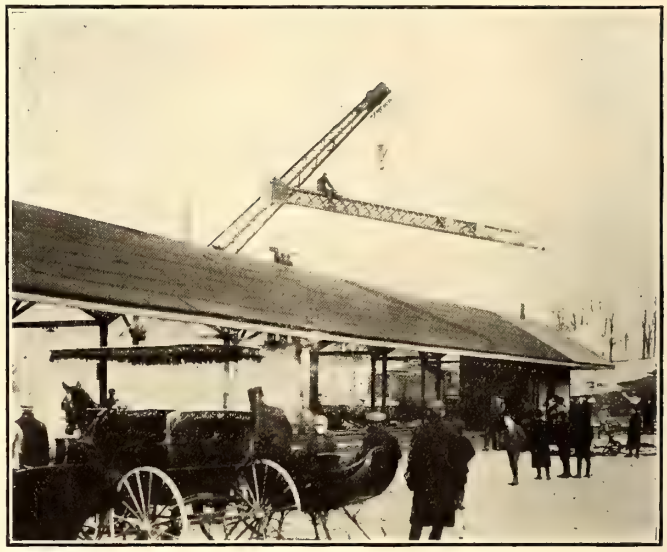


FIG. 3.—HOISTING POLE BY CRANE OVER SHED AT RYE WAITING STATION

poles. The field winding is of the compensated type in order to reduce the reactance of the armature. For the purpose of minimizing the sparking at the commutator, the armature is provided with a winding closed upon itself and connected to the commutator through resistance leads. Although some loss takes place in these leads, it is worthy of note that the loss is less when the leads are used than when they are omitted. The commutators of the motors on one of the locomotives which has traveled a total of 15,000 miles have never been sandpapered or trimmed down in any way, yet they appear to be in as good condition as when new. The motors are provided with forced ventilation supplied from electrically-driven blowers. The ventilation is so effective that the continuous rating of the equipment is nearly equal to the hour rating.

The lecture was well illustrated, numerous views being shown of the locomotive and of the overhead work. The locomotive is designed for use over the tracks of the New York Central Railroad in the neighborhood of New York City where a third-rail equipment is used. Throughout the alternating-current zone of the New Haven road the loco-

motives will receive current from an everhead catenary structure. Fig. 1 gives an end view of a locomotive showing the third-rail contact shoes turned up at an angle of about 40 degs., which position gives the proper running clearance to the locomotive over the New York, New Haven & Hartford alignment. It will be noted that the pantagraph mechanism is extended so that the alternating-current contactor reaches the overhead construction.

The overhead wiring is supported at points 300 ft. apart by means of bridges made of steel lattice-work. At every two miles the overhead bridge is of special form and is used both to anchor the line work and to contain switches for the purpose of disconnecting the trolley circuits or interconecting them with feeders, as may be desired. A general view of the catenary construction is given in Fig. 2, which is from a photo taken looking east from the New Rochelle anchor bridge No. 72. Sectionalizing oil switches and trolley wooden section insulators are carried on the anchor bridges only and are not shown in the photographs. A 110-volt electro-pneumatic operating device is provided for controlling each sectionalizing switch. At each anchor bridge there is arranged a complete encircling bus to which can be connected the feeders, and to which each section of the overhead work is normally joined. When so desired the track switches may be opened at two adjacent anchor bridges, and thus any section of track may be rendered dead, while the bus allows the feeder circuit to form a shunt around the overhead work for furnishing continuity of transmission beyond the disconnected section. The 110-volt circuit is controlled from a panel in the regular signal tower (adjacent to the anchor bridge), thus it is possible for the signal operator to stop any train on any section when emergency may require. Thus, should a locomotive engineer disobey the operator's signal, by joint action with the adjacent tower, voltage is removed from the tracks of the offending engineer. This train would then come to a standstill.

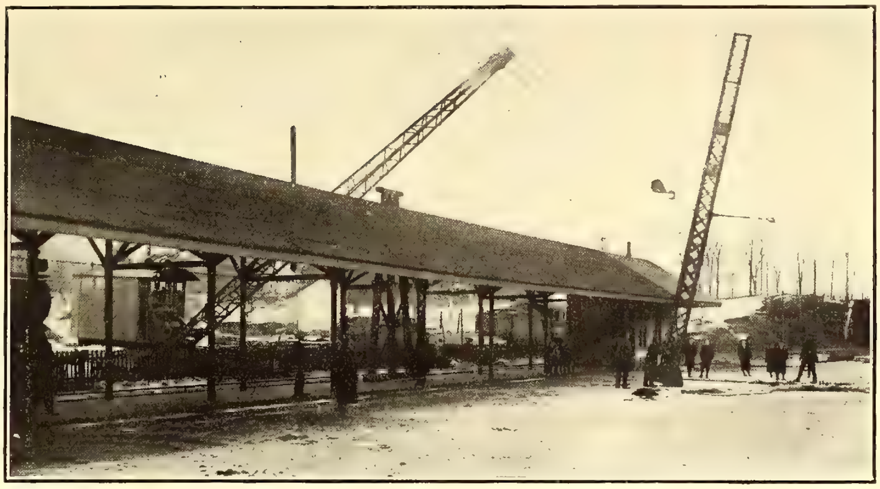


FIG. 4.—SETTING POLE IN PLACE AT RYE

FIG. 2.—VIEW FROM THE NEW ROCHELLE ANCHOR BRIDGE NO. 72, LOOKING EAST

No. 4-0 wire is used for the contact conductor; the feed-

ers, however, are of No. 2-0 wire. The larger size was used for the contact conductor on account of the required mechanical strength and not because so great a conductivity was needed. A delta-formed catenary structure serves to support the contact conductor. The main support is provided by two 9-16-in. steel cables to which the copper contact conductor is joined at frequent intervals as shown in Fig. 2.

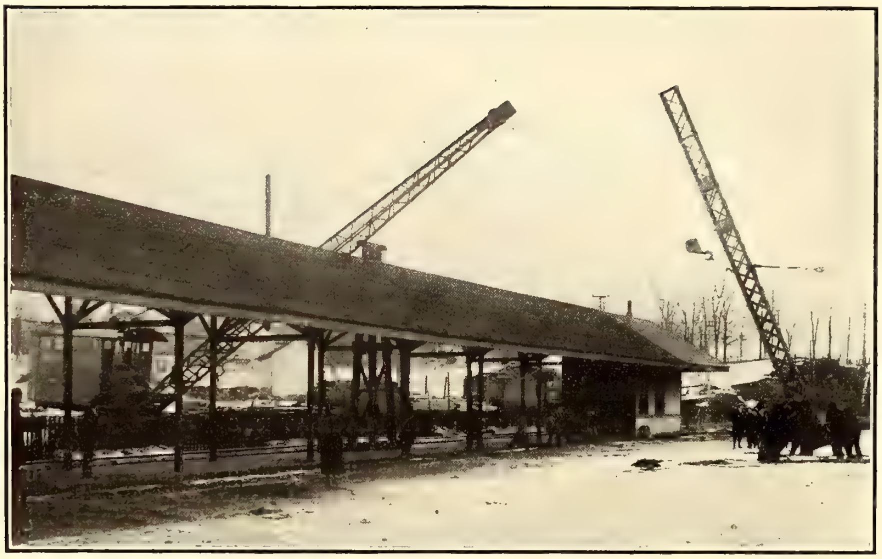


FIG. 5.—SETTING POLE IN PLACE AT RYE

On account of the fact that some of the overhead bridges span as many as seven tracks, it will be appreciated that extraordinary means had to be employed in their erection. For the purpose of placing the side poles in position on their concrete foundations and for lifting the overhead bridges into place, use was made of the locomotive crane shown in operation in Figs. 3 to 6. The crane served for lifting the steel fabricated posts from the flat cars and carrying them over to the proper foundations. Figs. 3 to 5 indicate one of the most difficult pieces of erection at Rye station, where the side post is just being placed on its foundation. It will be noted that the beam of the locomotive crane does not even clear the station shed, yet the horizontal distance from the end of the crane to the foundation on which the pole is to rest is at least 25 ft. The lattice-work post was first balanced at its central point and lowered to the ground on the foundation side of the shed. By means of a sheave block and a hitch connected to a conveniently located tree in a yard adjacent to the station grounds the improvised telpher system allowed the mass to be drawn over to a point sufficient to permit the post to be swung towards the foundation in pendulum order, the last act in the performance being shown in the figure indicated.

After the side posts have been erected the truss is lifted from the flat cars, balanced in the air, raised above the ends of the posts and then lowered into position. The whole operation of lifting a cross-bridge from the cars and lowering it into position consumes about fifteen minutes. Fig. 6 shows an end view of the locomotive crane. The work of erecting the bridges has been accomplished by the McClintic Marshall Construction Company, under the immediate direction of G. W. Tracy.

The Rochester Railway Company has petitioned for a number of extensions. Some of these are for double-tracking present lines and others for new ones in outlying territory.

STEEL TOWER AS A PARK ATTRACTION.

A steel tower recently removed from the World's Fair grounds to Creve Cœur Lake has been equipped with an elevator by the Florissant Improvement Company, a subsidiary corporation of the United Railways Company, of St. Louis. It is desired to carry passengers to the top of the tower, which is 225 ft. high and 500 ft. above the surface of the lake. The United Railways Company also will make improvements on its ground upon the edge of the lake, sowing blue grass and making a park out of that portion of the lake. Driveways and stairways will also be constructed. In addition the company has sunk an artesian well 1300 ft. deep.

TRAIN DEPARTURE SIGNALS AT TOLEDO.

Interurban trains at the union passenger station at Toledo, Ohio, are now receiving signals for their departure through a gong placed on the outside of the building. This is manipulated by means of a button by a man who occupies a little room just above the waiting room. He also announces trains and looks after matters in general. All ticket sellers, baggage agents and other employees of the office are now under the supervision of J. S. McGee.

NEW OFFICERS OF THE HONOLULU COMPANY

At the recent annual meeting of the stockholders of the Honolulu Rapid Transit & Land Company the following officers and directors were elected: L. T. Peck, president; L. A. Thurston, first vice-president; J. B. Castle, second vice-president; Wm. Williamson, secretary; C. H. Atherton, treasurer; F. W. Klehbahn, auditor.

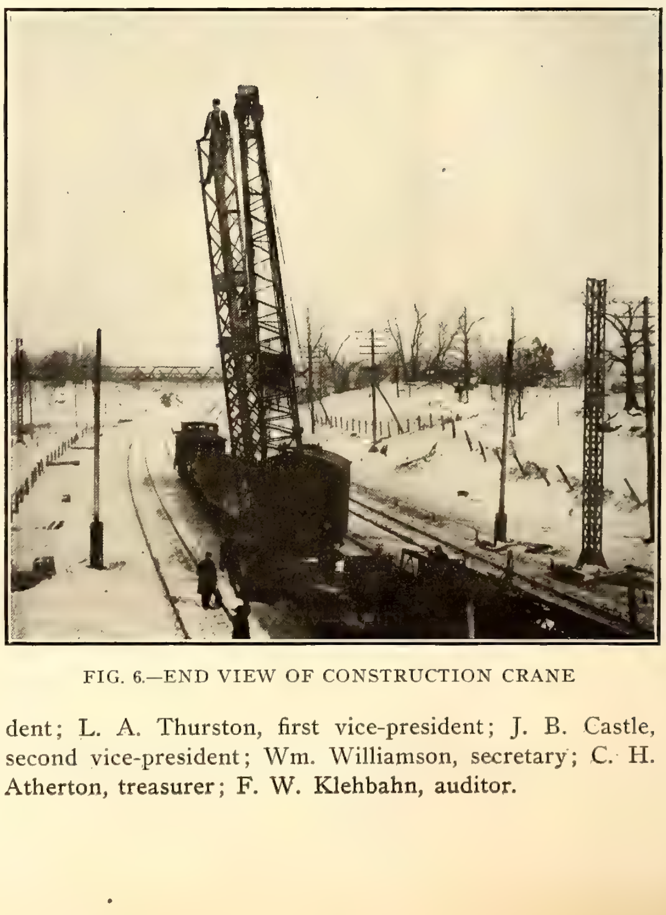


FIG. 6.—END VIEW OF CONSTRUCTION CRANE

THE STRAIN ON CURVE SPIKES

The subject of the strain placed on curve spikes is attracting a great deal of attention at present on account of the recent New York Central accident. Additional knowledge on this subject is given by some computations recently made by George F. Swain, professor of civil engineering at the Massachusetts Institute of Technology, who has been studying the subject. An abstract of Prof. Swain's report follows:

These computations are based upon a coefficient of friction between wheel and top of rail of .25, and the coefficient of friction between base of rail and tie-plate of the same. The action of the pony truck of the electric locomotive, which is transmitted to the rigid frame by means of the spring and pivot, has been taken account of in each case, but the friction on the sliding plate by which the vertical load is carried to the pony truck has been considered separately in order that it may be omitted, if it is thought that it ought not to be allowed for.

The second driving axle has a certain amount of play laterally, so that it would tend to work to the outside of the curve and make the pressure on the forward driver less than if the forward driver were the only one upon which the pressure were exerted. Whether the second driver will come into action in this manner depends upon its play laterally and upon the precise position which the locomotive assumes upon the track, as well as upon the perfection of the alignment of the track. This has been studied with various positions of the truck upon the track as follows:

(1) In which the rear driving axle is radial, with inside wheel close against the inside rail.

(2) In which the rear driving axle is pushed outward a little until outward wheel of rear pony is against rail but without compressing the spring.

(3) In which the rear driving axle is pushed outward still further until outer rear driver is in contact with the outer rail.

With the play of the second axle as given, it would be possible in each of these three cases for the second outer driver to be in contact with the outer rail, but the margin for possible inequalities in the track would be different in the three cases; for (1) it would be about 3-1000 in., for (2) it would be about ⅛ in., and for (3) it would be about ¼ in. In other words, it is more probable that the second driver would relieve the leading driver if the position were as assumed in case (2) than it would if the position were as assumed in case (1), and more probable still if the position were as assumed in case (3).

Table I. gives a summary of the conclusions arrived at.

Another point of some uncertainty in the problem is as to the distribution of the pressure of the forward driver upon the spikes. If this pressure is exerted directly over a tie, the outer spike on that tie will carry a greater portion of the pressure than any other spike, and if no yielding could occur either in tie or in spike, this spike would carry the whole of the load. Any yielding, however, no matter how slight, would distribute the load upon the two spikes on either side, these two carrying less than the first spike. In a similar manner, if the pressure were exerted midway between two ties, the two spikes on these ties would carry one-half the load, if no yielding could occur; but any yielding, however slight, would distribute the load upon other spikes on either side. It is impossible for anybody to tell just how much pressure would be carried upon the spike which is most stressed, but it would be the judgment of the writer that the pressure should be considered as distributed upon two spikes. It is possible to imagine cases in which nearly the whole load might be carried by one spike, but those would be cases where the track could not be said to be very perfect.

TABLE I.

	Speed—Miles Per Hour.				
	57.6	60	70	80	90
(1) Allowing for friction between base of rail and tie plate, but not for friction of sliding plate of pony truck or for pressure of second driver against outer rail, the pressure of leading driver against outer rail will not exceed.........	4,300	5,200	8,400	12,300	16,800
(2) If friction of sliding plate of pony truck is also allowed for pressure on leading driver against outer rail will not exceed..................	3,200	4,100	7,300	11,200	15,700
(3) If second driving axle slides laterally so as to bear against outer rail, pressure of leading driver will not exceed.......	2,100	3,000	6,200*	10,100†	14,000**
Friction on base of rail under outer leading driver.........	4,375	4,435	4,735	5,085	5,500
My belief is that on an approximately perfect track the pressure of the leading outer driver would not exceed the following................	3,000	3,000	3,500	7,500 to 8,000	11,000

* And will probably not be over 3,000. † And will probably not be over 6,800
** And will probably not be over 11,000.

Another uncertain element in the problem is the question of impact. The pressure upon the spikes is not suddenly applied, but is applied very quickly, and with a good track it would not be applied with a shock; there would be a steady pressure of the outer wheel against the rail in passing around a curve. If the load were applied instantaneously to a spike the impact would be 100 per cent; if the load is applied gradually, as it is in fact, the impact will depend upon whether it is applied more quickly than the strain can follow it.

Another element, also, must be taken into account—namely, the fact that although the load is quickly applied it is removed just as quickly. If the quick application of a load is a disadvantage the quick removal of it is an advantage, like skating over thin ice. Everybody knows that if his speed is considerable a skater can skate over ice so thin that it would not bear his weight for an instant without breaking. The quick removal of a load, therefore, tends to offset any impact caused by its quick application.

As a result of the writer's study of this problem, he is convinced that with a good track it would not be possible for these engines running around a 3-deg. curve at a speed of from 60 to 70 m. p. h., or even higher, to shear the spikes on the outer rail. The ultimate strength of a spike, the writer is informed, has been found by tests to be 17,000 lbs. If the cross-section of the spike were reduced by wear by one-ninth, as has been stated to be the case, the breaking strength would be reduced to 15,100 lbs. The writer does not believe the pressure of the leading driver against the outer rail at a speed of 60 m. p. h. would be above 3000 lbs. (and it assuredly would not be above 5200 lbs.) or at a speed of 70 m. p. h. above 3500 lbs. (and it would assuredly not exceed 8400), so that there would be a considerable margin in either case. It must further be borne in mind that it will require a stress considerably above the elastic limit in order to break a piece of metal, even with

many thousands or millions of applications, the number of applications required being less as the ultimate strength under a single application is approached. For instance, reliable tests indicate that for steel in tension a stress of seven-tenths of the ultimate strength would have to be applied some 40,000,000 times in order to break a piece, and that a stress of about five-eighths of the ultimate strength would require 6,000,000 or 7,000,000 applications. Experiments, of course, vary with regard to the number of applications necessary. If there is any defect in the material at any point, the effect of repeated applications is to cause a failure at this point and with a less number of repetitions than if the material is perfect, but even with a defect, a stress of seven-tenths the ultimate is likely to require half a million more applications.

TEST OF SPIKES

Robert W. Hunt & Company, engineers, have also made some tests on the shearing of spikes which are of interest. They are contained in a report made March 14, 1907, which is given in abstract below:

We made tests of six spikes in double shear, using the shearing blocks as shown on accompanying sketch, Fig. 1. These shearing blocks do not give a knife edge shear, but in our opinion approach very closely the actual shearing, bending and tension stresses obtaining in actual service where a spike is sheared off by flange of rail. The elastic limit, or rather the yield point, was obtained as closely as possible from the action of the beam of the testing machine and also from a close observation of the spike itself. We believe that the approximate elastic limit obtained under the given conditions does not vary more than 2½ per cent from the actual. There was practically no bending of the spike until the elastic limit was reached. The results are published in Table II.

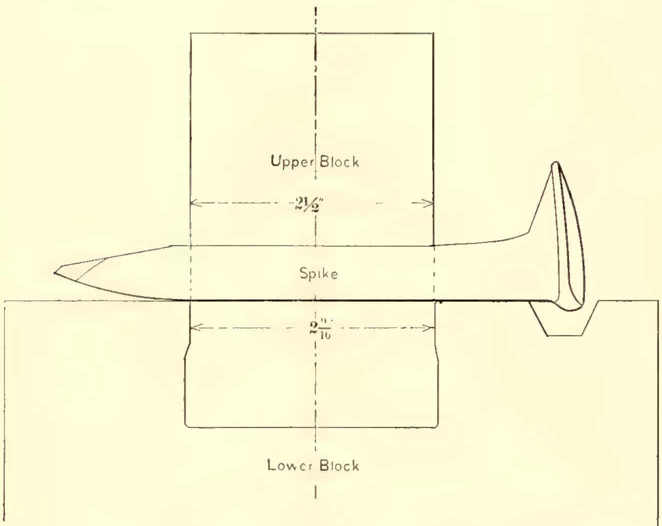


FIG. 1.—ROUND-CORNERED BLOCKS, APPROXIMATING BASE OF RAIL FOR SHEARING SPIKES

TABLE II.—RESULTS OF TESTS WITH SPIKES WITH ROUND-CORNERED BLOCKS

Test No.	Width of Spike.	Height of Spike.	Approximate Elastic Limit.	Maximum Load.
	Inch.	Inch.	Lbs.	Lbs.
1	.624	.622	9,500	37,880
2	.591	.608	10,500	40,460
3	.631	.592	10,500	38,640
4	.630	.597	12,000	38,820
5	.626	.601	10,900	40,930
6	.634	.609	10,000	40,160
Average	.6226	.6048	10,566	39,481

Average approximate elastic limit or yield point in either double or single shear, pounds actual = 10,566; average single shearing load of spike, pounds, actual, 19,740.5; average single shearing load of spike, pounds, per square inch, 52,420.

These results were obtained in the straight portion of the spike. While the spike in service would fail nearer the head where the area would be greater, the area of the spike where tested was .3765 sq. in., and the area of the spike at the base of rail where the shear would probably take place in about .4225 sq. in.; therefore, the approximate elastic limit and the shearing load at the latter point would be in the proportion of .4225 to .3765, when compared with those actually obtained in the straight portion of the spike. The approximate elastic limit and the shearing load of the spike at the base of rail would therefore be 11,855 lbs. and 22,145 lbs., respectively.

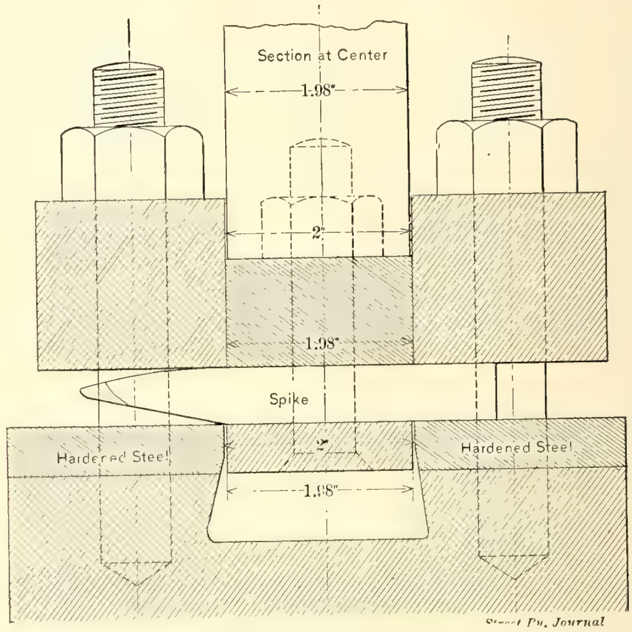


FIG. 2.—KNIFE-EDGED BLOCKS FOR SHEARING SPIKES

We also made some tests with blocks which would give a knife-edge shear (see Fig. 2). In these testing blocks the entire spike is rigidly clamped and there cannot be any bending of the portion of the spike corresponding to the head and a short length of the shank as would probably be the case in service. We had the heads cut off of four spikes and tested in this device, with the results given below. As will be noted, the approximate elastic limit or yield point is raised when tested under these conditions, and the maximum shearing load is lowered as shown in Table III.

TABLE III.—RESULTS OF TESTS WITH SPIKES WITH KNIFE-EDGE SHEAR

Test No.	Width of Spike.	Height of Spike.	Approximate Elastic Limit.	Maximum Load.
	Inch.	Inch.	Lbs.	Lbs.
8	.624	.608	13,000	36,550
9	.627	.593	14,000	38,790
10	.625	.592	12,000	37,810
11	.627	.608	11,500	36,880
Average	.6257	.601	12,625	37,507

Average approximate elastic limit of yield point in either double or single shear, pounds, actual, 12,625; average single-shearing load of spike, pounds, actual, 18,753; average single-shearing load of spike pounds per square inch, 49,807. The approximate elastic limit or yield point and the shearing

load of the spike at the base of the rail would, therefore, be 14,165 lbs. and 21,062 lbs., respectively.

Spike No. 2 was not sheared entirely in two, the testing machine being stopped after the maximum load was reached. This was done in order to indicate the shape of spike just before shearing took place.

In connection with Prof. Swain's letter and in view of the many conclusions that have been reached regarding the comparative effect on curves of steam and electric locomotives because of the different assumptions made by those investigating the matter, it seems wise to summarize all the results to see what the comparative shear on spikes will be under various conditions for an electric locomotive of the New York Central type and a steam locomotive of the Atlantic type, on a 3-deg. curve elevated for 46½ m. p. h. and with a train-speed of 70 m. p. h. These results would therefore show the effect on the spikes at the outer rail at a speed 23½ m. p. h. in excess of that for which the curve would be elevated.

The alternative elemental assumptions are:

(1) Shall the calculations be made on the basis of the front driver only bearing against the outer rail or both the first and the second drivers bearing against the outer rail? Prof. Swain's calculations, as explained in his report, are on the basis of the first two drivers bearing, but the counterclaim is made that under certain conditions only the bearing of the first driver should be considered.

(2) Shall full allowance be made for the friction between the rail and the tie-plate, based on a coefficient of, say, .25; or, as many claim, shall no allowance be made for friction between the rail base and the tie-plate due to the possibility of a thin layer of ice in cold weather that would practically eliminate this feature?

The accompanying tables (IV. to VI.) have been prepared summarizing the results of the calculations that have recently appeared in the technical press and which have been testified to before public investigating bodies, showing four sets of comparisons. From these it appears that at 70 m. p. h. (see Table IV.) in one instance, with the first driver only bearing against the outer rail and full allowance made for friction between the rail base and the tie-plate, the electric locomotive exerts 50 per cent greater shearing stress on the spikes than the steam locomotive. The stress per spike, however, shows a factor of safety of 4. In the other three cases the greatest shearing stress is caused by the steam locomotive, with factors of safety ranging from 2½ where the first driver only bears against the outer rail and with no allowance for friction between the rail base and the tie plate to a factor of safety of 8 where both drivers are assumed to bear against the outer rail and full allowance made for friction between the rail base and the tie-plate.

It will, of course, be borne in mind that these results are based upon a very much higher speed around the curve than that for which it is elevated.

It appears, therefore, that for most of the assumptions the steam locomotive shows greater stress on the outer rail than the electric locomotive, and that in all instances, even at 70 m. p. h. on a curve elevated for 46½ m. p. h., the shear on the spikes is well within the limits of safety.

TABLE IV.—COMPARATIVE SHEAR ON SPIKES FOR ELECTRIC AND STEAM LOCOMOTIVES ON THREE-DEGREE CURVE ELEVATED FOR 46½ MILES PER HOUR, TRAIN SPEED 70 M. P. H., *i.e.*, 23½ M. P. H. IN EXCESS OF EQUILIBRIUM SPEED.

ASSUMPTION OF DRIVER BEARING ON OUTER RAIL.	FULL ALLOWANCE FOR FRICTION BETWEEN RAIL AND TIE PLATE.						NO ALLOWANCE FOR FRICTION BETWEEN RAIL AND TIE PLATE.					
	Electric.	Steam.	Difference.		Spike Shear.*		Electric.	Steam.	Difference.		Spike Shear.*	
			Per Cent Greater.	Greatest Shear on.	Lbs. Per Spike.	Factor Safety.			Per Cent Greater.	Greatest Shear on.	Lbs. Per Spike.	Factor Safety.
First driver only against outer rail........................	D 9,130	D 5,970	50%	Electric.	4,565	4+	D 14,130	D 15,390	9%	Steam.	7,695	2.5+
First and second driver against outer rail..................	T 3,020	T 4,840	60%	Steam.	2,420	8+	D 7,460	T 8,170	10%	Steam.	4,085	5.—

D = Driver wheel. T = Truck wheel. * Spike shear data based on average result of full size tests of spikes, showing ultimate shear 19,740 lbs., two spikes assumed to carry the load with 100-lb. rail.

Table IV. gives an analysis of the results shown in Tables V. and VI.

TABLE V.—COMPARISON OF PRESSURE AGAINST OUTER RAIL. ELECTRIC LOCOMOTIVE AND STEAM LOCOMOTIVE ATLANTIC TYPE.

MILES PER HOUR.	FRONT DRIVER PRESSURE AGAINST OUTER RAIL.				GUIDING TRUCK PRESSURE AGAINST OUTER RAIL.	
	SUPPOSING 2D AXLE NOT THRUSTING AGAINST RAIL.		SUPPOSING 2D AXLE THRUSTING AGAINST RAIL.			
	Electric.	Steam.	Electric.	Steam.	Electric.	Steam.
40..........	4,740	6,120	3,860	6,260	6,410	7,830
50..........	7,400	7,450	4,120	6,220	6,600	7,950
60..........	10,470	11,230	4,480	5,460	6,830	8,130
70..........	14,130	15,390	7,460	7,570	7,100	8,170
80..........	18,360	21,160	11,000	13,020	7,400	8,200

TABLE VI.—COMPARATIVE SHEAR ON SPIKES AT LEADING TRUCK WHEEL AND AT DRIVER WHEELS FOR ELECTRIC LOCOMOTIVES AND CENTRAL-ATLANTIC TYPE STEAM LOCOMOTIVES, ON THREE-DEGREE CURVE, SUPER-ELEVATION—4½ INCHES.

MILES PER HOUR.	Rail Thrust Leading Truck Wheel.	Friction Bet. Rail and Tieplate Leading Truck Wheel.	Shear on Spikes by Leading Truck Wheel.	Rail Thrust Leading Driver, Second Driver Not Against Rail.	Rail Thrust Leading Driver, Second Driver Against Rail.	Friction Bet. Rail and Tieplate Leading Driver.	Shear on Spikes by Leading Driver, Second Driver Not Against Rail.	Shear on Spikes by Leading Driver, Second Driver Against Rail.
ELECTRIC LOCOMOTIVE.								
40.....	6,410	4,000	2,410	4,740	3,860	4,180	560	......
50.....	6,600	4,030	2,570	7,400	4,120	4,360	3,040	......
60.....	6,830	4,050	2,780	10,470	4,480	4,650	5,820	......
70.....	7,100	4,080	3,020	14,130	7,460	5,000	9,130	2,460
80.....	7,400	4,100	3,300	18,360	11,000	5,360	13,000	5,640
STEAM LOCOMOTIVE (ATLANTIC).								
40.....	7,830	3,200	4,630	6,120	6,260	6,280	......	......
50.....	7,950	3,210	4,740	7,450	6,220	6,720	730	......
60.....	8,130	3,240	4,890	11,230	5,460	8,170	3,060	......
70.....	8,170	3,330	4,840	15,390	7,570	9,420	5,970	......
80.....	8,200	3,430	4,770	21,160	13,020	11,250	9,910	1,820

Table V. shows the pressure against outer rail, ignoring the friction between the rail base and tie-plate.

Table VI. gives the comparative shear on spikes on the basis of the first driver and also of the first and second drivers against outer rail, making allowance for friction between the rail base and tie-plate.

STREET RAILWAY LEGISLATION IN PENNSYLVANIA

Several articles in recent issues of this paper have referred to important legislation which is being proposed in Pennsylvania in favor of the electric railway companies, but a general review of the situation at this time may be of interest. The law regulating the construction of lines in Pennsylvania presents an anomalous condition. Under the existing statutes permission to construct lines on highways within the State is contingent upon the railway company securing the permission of every abutting property owner. A single individual owning even 10 ft. along the highway on which the road is to be constructed can block the construction of the entire line. Where the title of the property rests with an infant, lunatic or other person legally incapable of giving consent, an insurmountable obstacle is encountered. The conditions for constructing lines over a private right of way are equally onerous and are practically prohibitive. The existing law gives no right of eminent domain to companies organized under the street railway act, and any property owner over whose land the line is projected can block its construction by refusing to sell or else offering to sell only at a prohibitive price. In some cases electric railway companies have been able to construct their lines by consenting to be held up for large payments at the whim or avarice of individuals along their lines of route, but the effect upon interurban railway construction in Pennsylvania has been and could not be anything else but disastrous. It has been suspected that the powerful steam railroad interests in the State were largely instrumental in retaining this oppressive law on the statute books, through fear of trolley competition for local business. Whether that is so or not, there seems to be at present a revolution of feeling throughout the State at the present state of affairs. The farmers are becoming cognizant of the fact that they lack the transportation facilities by trolley enjoyed by the residents of other States, as well as the ability to send their produce to market and receive their supplies in the same way.

The result has been a general agitation on the subject in the State of Pennsylvania which has culminated in the organization, early in the year, of what is being called for the present the Temporary Street Railway Association of the State of Pennsylvania. This association has elected Walter E. Harrington, president of the Pottsville Union Traction Company, as chairman, and now includes among its membership seventy-two of the electric railway companies of the State. Practically all of the companies outside of those in the larger cities, with whom the matter is not so important, have joined the association. An executive committee of fourteen has been elected, consisting of the following members: W. E. Harrington, Pottsville, chairman; T. A. H. Hay, Easton, vice-chairman; Murray A. Verner, Pittsburg; Hon. W. F. Bay Stewart, York; R. H. Koch, Pottsville; M. H. Kulp, Shamokin; H. E. Ahrens, Reading; A. M. Taylor, Philadelphia; C. L. S. Tingley, Scranton; H. J. Crowley, Altoona; H. C. Reynolds, Dalton; J. E. Rigg, Reading; F. B. Musser, Harrisburg, and David Young, Allentown.

From this executive committee two sub-committees have been appointed, one on legislation and the other on law. These committees are composed of the following gentlemen: Committee on legislation, F. B. Musser, Harrisburg, chairman; T. A. H. Hay, Easton; M. H. Kulp, Shamokin. Committee on law, R. H. Koch, Pottsville, chairman; A. Merritt Taylor, Philadelphia; John E. Rigg, Reading.

The principal object of the association at present is to present arguments before the Legislature showing the advantages to the commonwealth of granting street railway companies the right of eminent domain and the privilege to carry light freight. With this object in view, two bills were presented in the Legislature on March 4. That permitting the carriage of light freight was advanced to its second reading on March 21 with no change in the wording. The second, granting the right of eminent domain, was slightly amended March 19, on the motion of Mr. Moyer, of Lebanon. It was then recommitted, but was reported upon favorably on March 20 by the committee on electric railways of the House. As an investigation disclosed that there was nothing in the law giving street railways operating on the street the unquestioned right to depart from the highway to a private right of way, a third bill covering this point has been introduced in the House by Mr. Moyer.

The hearings on the bills before the committee on electric railways of the House of Representatives have been extremely instructive. Addresses on the subject were made, among others, by Hon. H. L. Carson and H. C. Reynolds. These speeches have since been reprinted by the association and have just been sent to all of the electric railway companies of the State. Copies have also been mailed to many of the Granger associations which have manifested their desire to co-operate in the proposed reforms as well as to others whose interests are affected by the bills under consideration. The principal argument was made by Mr. Carson. In urging the passage of the freight bill the speaker referred to the fact that every State immediately adjoining Pennsylvania permitted the haulage of light freight, and that it had been of great service in developing the resources of the rural districts. The effect of such means of communication were described by Mr. Carson in the following words:

> Every man likes to get into a community where there is life. This is an active age, and the whole theory of transportation is to get human business and those things which they need for their personal comfort or convenience transported as speedily as possible. Yet there are certain remote districts which at present are suffering from a lack of this very ease of transportation, even as far as passengers are concerned, because the population is so sparse as not to justify the building of a trolley road for passenger service alone. The expense of doing so and the returns would be so inadequate that no capitalist is willing to undertake the experiment. If, however, there were added the right to carry light freight which those passengers would require in that community, there would then be a temptation to build the road, and incidentally the communities would develop and benefit by the incidental advantages which are none the less incidental social intercourse. A community which lives by itself is like an individual living by himself, nothing more than the hermit with no interchange of thought or contact with the outside world, but when a community is brought into closer contact with its neighbors it can enjoy those advantages; people are happier, and although it may seem like dwelling upon the sentimental side, yet at the same time much of that which is valuable depends upon sentiment. In addition, there is an economical question involved, and nothing can be more concise than this resolution adopted by one of the State organizations of the farmers. I will give you its exact language: "The farmers have done more than their share in their liberal grants of rights of way to electric railways, which should not only be permitted but should be required to serve the public to the full extent of their facilities; to this immediate portion of the community, both the Legislature and the railways owe an immediate and important duty—their need for additional, frequent and quick service is urgent. They should no longer be deprived of it."

In connection with the proposal to grant the companies the right of eminent domain, Mr. Carson discussed each clause seriatim, and pointed out that under the bill it was

still necessary to secure the consent of 51 per cent of the abutting property owners as well as that of the local authorities.

Mr. Reynolds referred in his speech to the fact that he was constructing a short electric line in a community which was served at present by but one freight train in every twenty-four hours; 640 cans of milk were carried on this road per day during December, but owing to delays the milk frequently reached the city in such condition that much of it was spoiled. While securing the right of way for this electric line, the company had to pay for farm property in one instance at the rate of $43,000 an acre. He cited another case in which an electric railway company had expended about $5,000 for surveys for a projected line. The road was desired by the community but its construction was prevented by the refusal to grant its consent of a large corporation owning real estate along the line.

In furtherance of its policy of education, the temporary association has sent a letter to those whom it thought would be interested in the reform measures. Some abstracts from this letter follow.

POTTSVILLE, PA., March 19, 1907.

In response to a widely prevailing popular sentiment, voiced by the pledges of all political parties in Pennsylvania, there have been introduced into the General Assembly, bills conferring upon street railway companies the right to carry light freight and to exercise such powers of eminent domain as are essential to secure their rights of way and efficient operation. All these bills having been duly considered by the interests affected, two have been favorably reported to the House, viz.: the so-called "Homsher Bills."

The Temporary Street Railway Association of Pennsylvania, composed of seventy electric railway companies, formed for the purpose of advocating the legislation which is much needed by the electric railways in this State, in order that they may serve the public to the fullest extent of their ability, and respectfully submits for your consideration the following suggestions as to the merits of the pending measures:

AS TO THE EMINENT-DOMAIN BILL

As submitted by John G. Homsher and amended by Gabriel H. Moyer.

Most of the States have conferred upon their electric railways the right of eminent domain.

The right of eminent domain is exercised in Pennsylvania by railroad, telegraph, telephone, electric light, gas, water and oil pipe line companies.

We do not ask that the full and unrestricted right of eminent domain be extended to electric railways as it has heretofore been extended to railroad companies

The Constitution of this State provides, in Article XVII., Sec. 9, that "No street passenger railway shall be constructed within the limit of any city, borough or township without the consent of its local authorities." Therefore, in conferring upon electric railways the right of eminent domain, such right is only conferred subject to this constitutional provision. In applying to the local municipal authorities for permission it is necessary for the electric railway company to describe the proposed route in detail; it is, therefore, within the power of the municipal authorities to prescribe any changes in the location of the route, as a condition precedent to the passage of an ordinance. These restrictions will effectively prevent the use of the right of eminent domain except where it should be exercised in the interest of the entire community.

An additional safeguard has been provided by stipulating in the bill that the right of eminent domain shall not be exercised upon highways until consent of the owners of at least 51 per cent of the foot frontage of the entire distance to be traversed on such highways has been obtained. Then, having also obtained municipal consent, the rights of the owners of a minority of the foot frontage may be condemned. Under the law as it stands to-day, an electric railway company has to obtain consent for the construction of its lines from every abutting property owner on a highway and from the owner of every property through which it is proposed to operate upon a private right of way. The result is as follows:

Many communities are devoid of transportation facilities by reason of inability on the part of the electric railways to obtain the necessary consent from property owners to enable them to reach such communities.

At present it is in the power of any one large property owner to deny an entire community in this State much needed electric railway facilities.

It is also in the power of one property owner to predicate his consent upon the location of the railway upon his property in such manner as to entail steep grades and dangerous curves, which are a constant menace to the safety of the traveling public.

One small property owner may require an electric railway to go around his property, thereby placing awkward and dangerous curves in the tracks and increasing the distance and consequently the running time between terminal points to the disadvantage of the traveling public.

At present where it is necessary to establish an additional turnout or lay a second track to give a more frequent schedule, it is frequently impossible to give the public these added facilities on account of the excessive demands of property owners or their unwillingness to meet public requirements.

At present where a property is owned by a lunatic, by minor children or by others incapable of giving title or consent, it is impossible for an electric railway to operate over such property or along the highway in front of it under any conditions. The public is thereby denied necessary facilities or the railway company is compelled to locate its line around such property.

Almost monthly there is a serious accident in this State, caused by motormen losing control of cars on steep grades which have sharp curves at their base: a construction which has been made necessary by the cupidity of property owners and the inability of the electric railway companies to secure the necessary rights of way to eliminate these grades and curves. Such danger places, of which there are many in this State, cannot be eliminated unless the right of eminent domain is conferred.

Great corporations in the central and northern part of this State, owning vast tracts of land, are holding up many legitimate railway extensions against the protests of large communities. Where the whole people require the construction of an electric railway and show their desire by granting, through their local authorities, municipal consent to the construction of such lines, the State should certainly intervene by lending the electric railway companies the right of eminent domain where these corporate or individual property owners, through mercenary or other ulterior motives, withhold their consent.

Power houses are frequently located at points remote from railway lines so as to be near running water and railroad sidings upon which fuel is received. It is, therefore, important that the railway companies should be able to secure the necessary strips of land upon which to erect the feed wires from their power houses to their railway tracks.

The passage of the eminent domain bill will greatly stimulate electric railway building in Pennsylvania, and many new lines for passenger and other traffic will thereby be opened up to the advantage of the people of this State. The bill which has been reported has had the consideration of eminent counsel, who approve and affirm its constitutionality.

AS TO THE FREIGHT BILL

Every State bounding the State of Pennsylvania, and most of the other States of the Union, have granted to electric railways the right to carry freight. Every rural community in Pennsylvania recognizes the very great importance of the passage of this bill.

Rural communities which are remote from steam railroad stations, but are near electric lines, are now denied the right to ship and receive farm products and necessities by the most convenient routes, and the residents of these towns are compelled to drive long distances over heavy roads, regardless of weather conditions, to the steam railroad stations. In such communities it is impossible to raise perishable garden vegetables, fruit and other perishable products, which are very profitable, on account of the long, unnecessary and expensive hauls to the steam railroad stations. Such communities cannot produce and ship milk economically to the cities on account of the expense of the long haul and exposure to the hot sun inseparable from these conditions.

The handling of farm products by electric railways will result in a large increase in the value of farm lands along the lines and also in greatly added convenience to the residents of the rural districts, who will be able to order their supplies by telephone and receive them conveniently and quickly.

There are many sparsely settled districts in this State through which it would be unprofitable to extend electric railways for passenger business only, but with the added revenue which will be produced by the carrying of freight, electric railways can be extended through sparsely settled districts which are in great need of transportation facilities.

Under existing conditions, traveling men and others are compelled to take long roundabout routes to get from one point to another in order to have their baggage carried, where an electric railway connects such points by a direct route, but cannot extend the facilities for the carrying of baggage. The passage of the freight law will open up a new and efficient channel for commerce, and the electric railway will become a strong contributor to the welfare and comfort of the public at large. It will thus open up new channels of trade, with the resultant increase in consumption of manufactured articles and give great added convenience to the public.

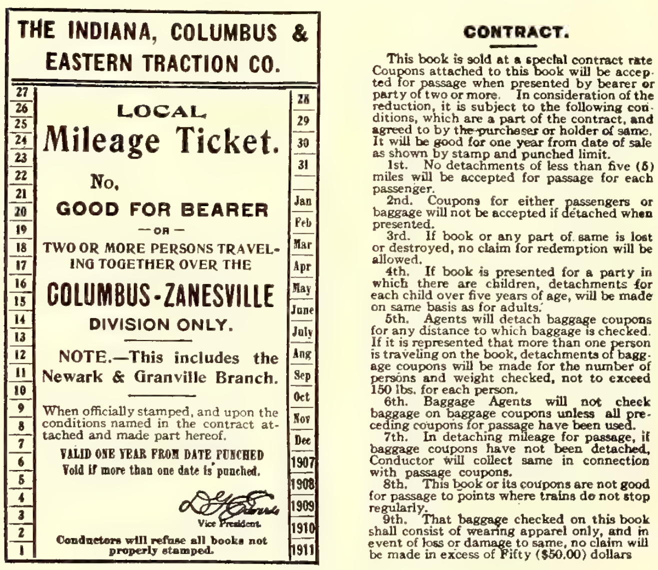
We ask the right to carry farm produce, etc., and other light freight, and this only under and subject to the consent of the authorities of communities through which our lines operate.

Very respectfully,

W. E. HARRINGTON, Chairman.

MILEAGE BOOKS ON INDIANA, COLUMBUS & EASTERN

The Indiana, Columbus & Eastern Traction Company placed on sale on three of its divisions, last week, a new form of mileage book, and it is expected that within the next few weeks similar books, good only on the divisions,



THE INDIANA, COLUMBUS & EASTERN TRACTION CO.

27 26 25 24 23 22 21 20 19 18 17 16 15 14 13 12 11 10 9 8 7 6 5 4 3 2 1

LOCAL

Mileage Ticket.

No.

GOOD FOR BEARER

— OR —

TWO OR MORE PERSONS TRAVELING TOGETHER OVER THE

COLUMBUS-ZANESVILLE

DIVISION ONLY.

NOTE.—This includes the Newark & Granville Branch.

When officially stamped, and upon the conditions named in the contract attached and made part hereof.

VALID ONE YEAR FROM DATE PUNCHED

Void if more than one date is punched.

Vice President.

Conductors will refuse all books not properly stamped.

28 29 30 31 Jan Feb Mar Apr May June July Aug Sep Oct Nov Dec 1907 1908 1909 1910 1911

CONTRACT.

This book is sold at a special contract rate Coupons attached to this book will be accepted for passage when presented by bearer or party of two or more. In consideration of the reduction, it is subject to the following conditions, which are a part of the contract, and agreed to by the purchaser or holder of same. It will be good for one year from date of sale as shown by stamp and punched limit.

1st. No detachments of less than five (5) miles will be accepted for passage for each passenger.

2nd. Coupons for either passengers or baggage will not be accepted if detached when presented.

3rd. If book or any part of same is lost or destroyed, no claim for redemption will be allowed.

4th. If book is presented for a party in which there are children, detachments for each child over five years of age, will be made on same basis as for adults.

5th. Agents will detach baggage coupons for any distance to which baggage is checked. If it is represented that more than one person is traveling on the book, detachments of baggage coupons will be made for the number of persons and weight checked, not to exceed 150 lbs. for each person.

6th. Baggage Agents will not check baggage on baggage coupons unless all preceding coupons for passage have been used.

7th. In detaching mileage for passage, if baggage coupons have not been detached, Conductor will collect same in connection with passage coupons.

8th. This book or its coupons are not good for passage to points where trains do not stop regularly.

9th. That baggage checked on this book shall consist of wearing apparel only, and in event of loss or damage to same, no claim will be made in excess of Fifty ($50.00) dollars

COVER AND CONTRACT FOR MILEAGE BOOK

will be sold on all of the divisions. The first divisions to get the books are the Columbus & Zanesville, the Dayton & Union and the Dayton & Richmond.

The books contain coupons for 350 miles and are sold for $5. This makes the rate 1 3-7 cents a mile. They also contain coupons for the checking of baggage. The accompanying illustration shows the cover of the book and the contract that the purchaser enters into with the company.

The baggage rules and regulations which the traffic department of the Schoepf traction lines has been working on for several months, and which were to have gone into effect Feb. 20, have just been completed and were put into effect March 20. The rules will probably be copied by a number of independent traction lines that are contemplating dropping the usual charge of 25 cents for each piece of baggage checked.

The rules are now in force on the lines of the following companies: Indiana, Columbus & Eastern Traction Company, Cincinnati Northern Traction Company, Lima & Toledo Traction Company, Indianapolis & Western Railway Company, Richmond Street & Interurban Railway Company, Indianapolis Coal Traction Company, Indianapolis & Eastern Railway Company, Indianapolis & Martinsville Rapid Transit Company, Indianapolis & Northwestern Traction Company, and Indiana Union Traction Company. They are, briefly, that no single piece of baggage must weigh over 250 lbs., that baggage must consist of wearing apparel or personal effects for the use of passengers and must be in trunks, valises or boxes with handles. Baggage not exceeding 150 lbs. in weight is checked free on one full ticket, and 70 lbs. on one half ticket. Where the fare is less than 25 cents excess baggage rates are charged, the excess rates varying from 15 cents to 40 cents per 100 lbs., depending on the fare up to a fare of $2. Bicycles, baby carriages, etc., are always considered excess baggage and a fee of 25 cents is made for them. There are storage charges if the baggage remains in any inbound or outbound station for more than twenty-four hours. Dogs when accompanied by the owner and properly tagged and provided with a collar and chain will be transported in baggage cars at the owner's risk. Transfer charges of from 10 cents to 25 cents are made between stations in Dayton.

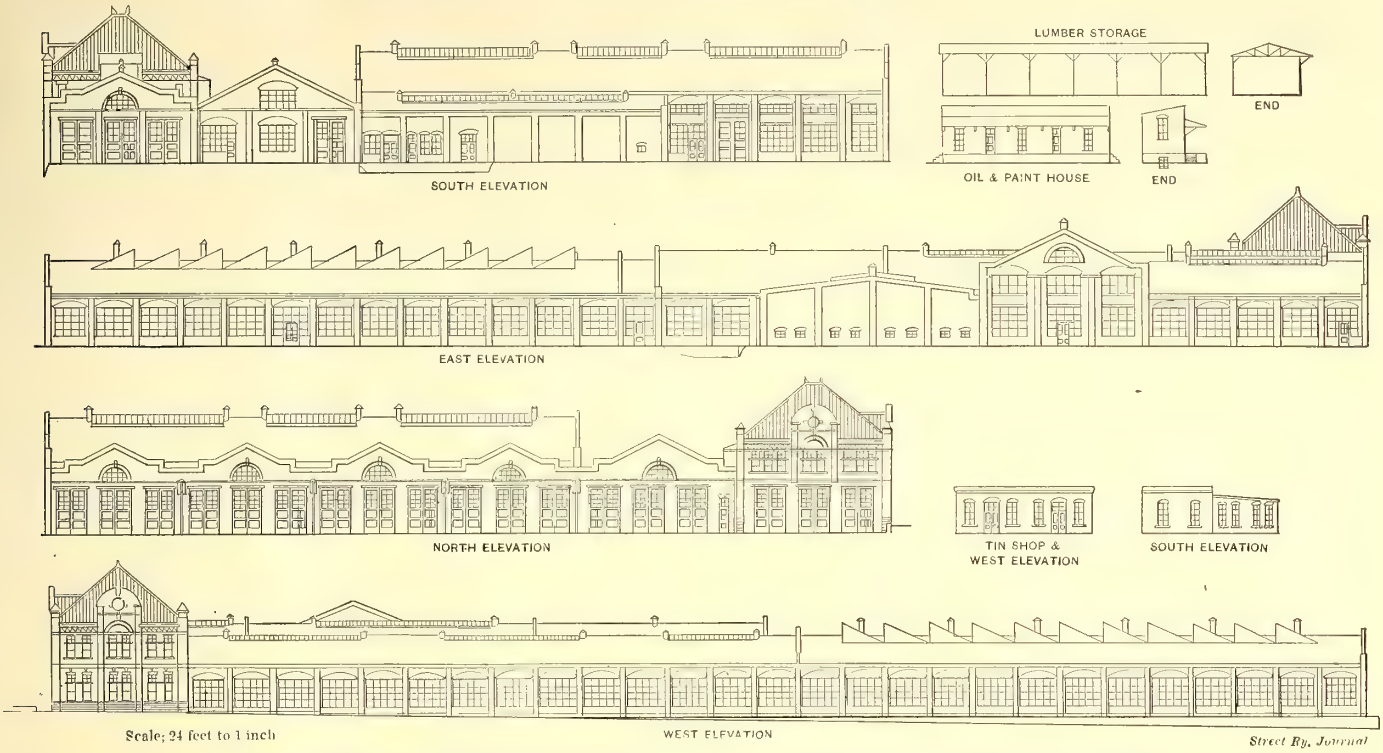
MEETING OF A. S. R. A. CONVENTION COMMITTEE

As announced in the STREET RAILWAY JOURNAL for Feb. 2, the selection of the city for the convention of the American Street and Interurban Railway Association next fall was left to a joint committee of the American Street and Interurban Railway Association and the American Street and Interurban Railway Manufacturers' Association. This committee was instructed to investigate the facilities for holding the convention at Norfolk, Atlantic City and any other places which they might consider desirable, and were authorized by their respective associations to make a decision on the subject. In conformity with this resolution, the following gentlemen met at Norfolk on the morning of March 25: Messrs. Beggs, Tingley and Swenson, representing the American Street and Interurban Railway Association, and Messrs. McGraw, Wilson, Martin, Gale and Keegan, representing the American Street and Interurban Railway Manufacturers' Association. Mr. Gale attended in the place of Mr. Pierce, of the Manufacturers' committee.

At Norfolk the committee was met by representatives of the Board of Trade of Norfolk and of the Jamestown Exposition. In the morning they made a tour of the city and investigated the facilities there for the convention. In the afternoon they visited the Jamestown Exposition grounds, where they made a similar tour of inspection. They left Norfolk in the evening and went by the Cape Charles route to Philadelphia and thence to Atlantic City, arriving in Atlantic City Tuesday morning. They were met there by representatives of the Board of Trade of that city, and inspected the various piers where the exhibits could be displayed in case that city was selected. They returned to New York Wednesday morning. Wednesday evening part of the committee went to Boston to attend the annual dinner of the New England Street Railway Club. In Boston another meeting will be held, at which Messrs. Shaw and Peirce, who were unable to be present at Norfolk and Atlantic City, will be consulted. Due notice of the decision will be issued by the secretary and published in this paper.

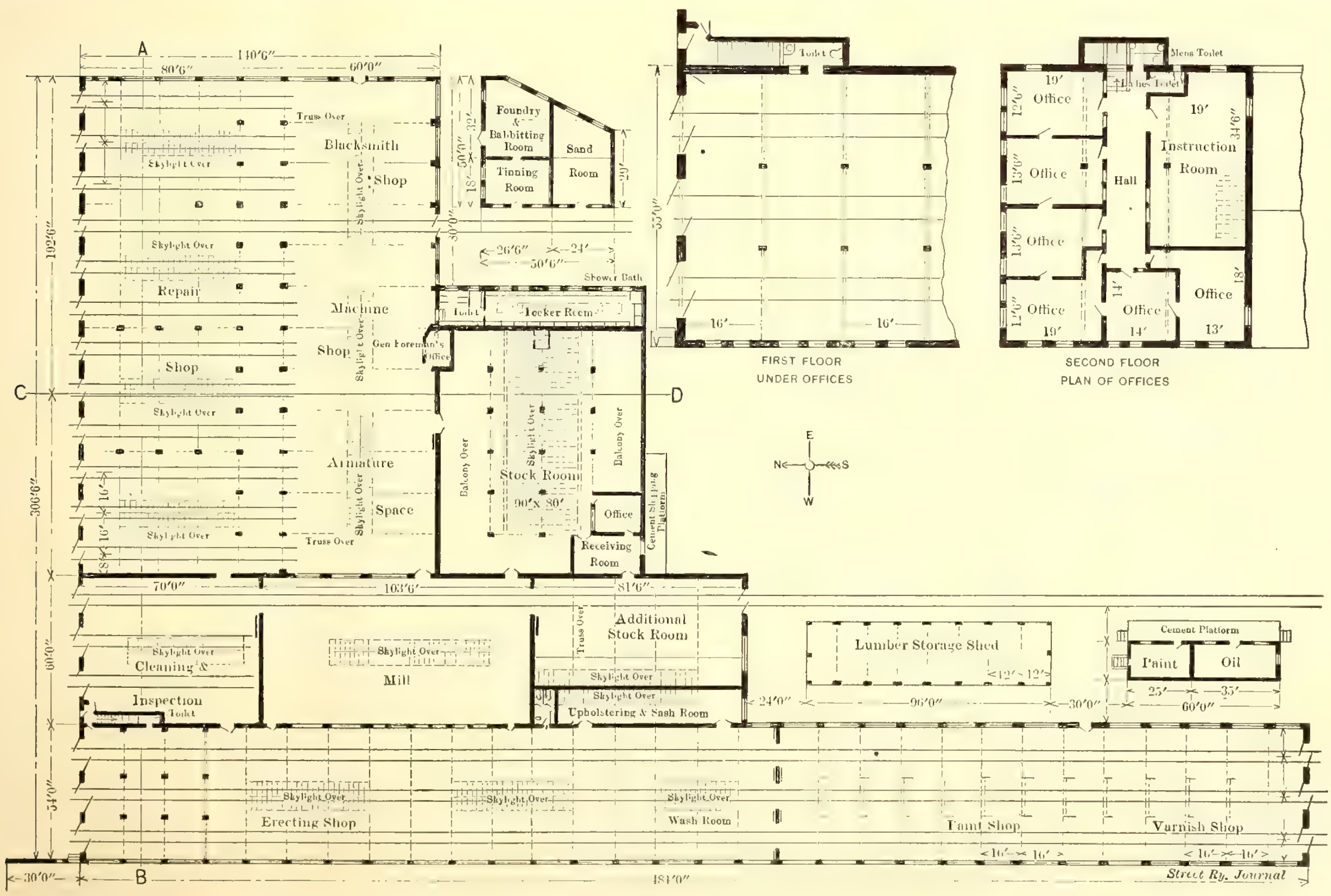
PLANS FOR THE NEW SHOPS OF THE INDIANA UNION TRACTION COMPANY

Construction work on the new shows of the Indiana Union Traction Company is progressing as rapidly as weather conditions will permit. The west wall, having a frontage of 481 ft., is practically completed and the foundations for other portions are in. The shops are being located south of the power house at Anderson, and the site includes that of the present shops. The main building of the new shops will in fact be built so as to include the buildings of the present shops.



ELEVATIONS OF NEW SHOP OF INDIANA UNION TRACTION COMPANY AT ANDERSON

This building will be L-shaped, 481 ft. long and 306 ft. 6 ins. deep. The westernmost bay, containing three tracks,



PLAN OF NEW SHOP OF INDIANA UNION TRACTION COMPANY AT ANDERSON

will constitute a paint shop and varnish room and an erecting shop. The present shop buildings just north of this will be remodeled to serve as a cleaning and inspection shop and storeroom. The repair shops proper will occupy the easternmost portion of the building. The twelve tracks in this portion will each hold one interurban car. The armature room, machine shop and blacksmith shop will be located at the head of the repair tracks so as to necessitate carrying armatures and other heavy repair parts as short distances as possible. An overhead system of car hoists will be employed which will permit cars over any tracks to be raised.

Locker and toilet rooms for the shop men will be located just east of the stock room, and additional toilet rooms will be located adjacent to the erecting shop. A detached building south of the blacksmith shop will contain a brass foundry, tin shop, sand room and facilities for babbitting bearings. Paints and oils will be kept in a detached building near the south end of the paint shop. A lumber storage shed will also be constructed east of the paint shop. The shop offices will be located in the only two-story portion of the shop at the northwest corner of the main building. In addition to several offices, this second-story portion will contain a trainmen's instruction room, which will be provided with apparatus to assist in instructing the men with regard to the car equipment.

In design of the shop particular attention has been given to the question of light. The side walls are made up almost entirely of windows. The pain shop will be supplied with a saw-tooth roof and skylights will be built in the roofs over other portions of the main building.

THE CITIZENS' NON-PARTISAN TRACTION SETTLEMENT ASSOCIATION OF CHICAGO

Although the Chicago Mayoralty campaign, of which the traction question is the chief issue, has been at its height for the last few weeks, nothing new in the traction situation has developed. The campaign is being given more attention by the voters than ever before, as is indicated by the registration, which is the highest in the city's history, and by the attendance at the political meetings. Practically all of these are limited to a discussion of the traction ordinances. Walter M. Fisher, who drew up the ordinances, is the chief spokesman of the Republican party at the meetings throughout the city and at the downtown noon meetings held in various theaters. Test ballots taken by newspapers indicate that Mayor Dunne will be defeated and that the traction ordinances will be recommended. Sunday, March 24, the vote taken by the Chicago "Daily News" showed the following votes: Busse, 8939; Dunne, 2695. For the ordinances, 9916; against the ordinances, 2092.

CITIZENS NON-PARTISAN
TRACTION SETTLEMENT ASSOCIATION
HEYWORTH BUILDING
CHICAGO · ILLINOIS

Mr. Chas. B. Maugham,
1755 Magnolia Av., City.

March 15, 1907.

Dear Sir:-

Help us put an end to the present wretched street car service.
For the first time in ten years a Remedy is in your hands.
That Remedy is the new Street Car Ordinances.
The time to use that Remedy is Election Day, April 2nd.

Don't judge these ordinances without reading them.
We -- 100,000 business men and neighborhood association members with the real welfare of Chicago at heart -- have raised money among ourselves to place in your hands a nut shell copy of these ordinances.

We appeal to you to read for yourself how these ordinances force the car companies to spend millions for new cars and heavy tracks -- beginning the next day after Election.
This means a comfortable seat for you, your family and all of us every time we take a car.

Voting for these ordinances brings Municipal Ownership any time the City wants it. Section 20 and 22 plainly says so.
In the meantime we can be riding in comfortable street cars.

Voting for these ordinances gives the City over half the profits. If we wish, this money can be used to lower the fares. See Section 24.

Voting for these ordinances means a ride from one end of the City to the other for 5 cents -- with transfers. See Sections 13 and 11.

Read the enclosed ordinances and find out these things for yourself -- just as we did. Then help us end the present intolerable service -- by voting for these ordinances Election Day.

Very truly yours,

CITIZENS' NON-PARTISAN TRACTION SETTLEMENT ASSOCIATION.

Frederick Bode Pres.

LETTER ADDRESSED TO VOTERS

The traction question in Chicago has resulted in a peculiar body known as the Citizens' Non-Partisan Traction Settlement Association, organized to further the interests of the traction ordinances. The association, as its name implies, is non-partisan, being allied with neither political party, and it is in no way connected with the traction companies. Its sole purpose is to put before the voting population the traction ordinances in their true light and encourage the passage of these ordinances at the election on April 2.

READ! READ!! READ!!!

VOTE FOR THE TRACTION ORDINANCES

They are clear definite contracts. If violated by the companies the penalty is forfeiture.

They provide

FOR IMMEDIATE COMPLETE MUNICIPAL CONTROL.

FOR THE ONLY PRACTICABLE METHODS OF OBTAINING MUNICIPAL OWNERSHIP.

FOR THROUGH-CITY ROUTES AND COMPREHENSIVE TRANSFERS FOR A SINGLE FARE.

FOR IMMEDIATE IMPROVEMENT IN SERVICE—2,000 MODERN CARS, SMOOTH TRACKS—DOWN-TOWN SUBWAYS—LOWERING OF TUNNELS.

The City gains rights and forfeits none. The City shares in profits toward purchasing properties.
Read the ordinances for yourself—we furnish copies.
If you really want municipal ownership, vote *for* the ordinances.
If they are passed, you will get municipal control.
The defeat of the ordinances and action by *Condemnation* means Immediate Beginning—but indefinite ending—of *complicated lawsuits*. On one side is an honorable, enlightened settlement, preserving every public right. On the other, fog, uncertainty and chaos.

VOTE "YES" AND VOTE RIGHT

We are citizens who want to advance the public welfare. Some of us *favor* municipal ownership and some of us do not; but we *all agree* that the ordinances *are right*, and we shall vote for them. We are telling you the truth.
Do not be misled. Read the ordinances, and you will vote for them.

The Citizens Non-Partisan Traction Settlement Association

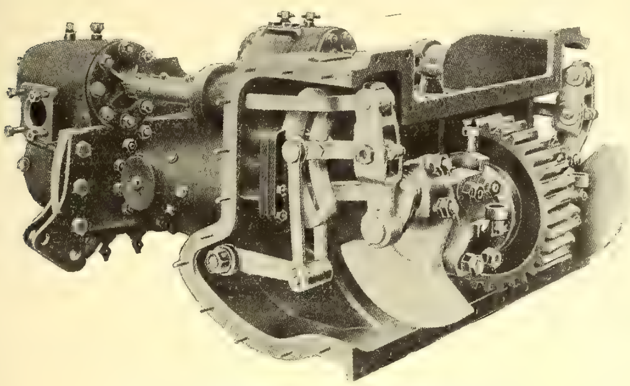
PLACARD POSTED IN WINDOWS

The association had its conception in the simultaneous passage of resolutions by the Chicago Real Estate Board and the Chicago Commercial Association, commending the course of the City Council in passing the traction ordinances over Mayor Dunne's veto. Committees of these two organizations held a joint meeting and decided on a broader organization such as has been effected. All non-partisan clubs favoring the traction ordinances were invited to send representatives to a joint meeting to organize an association. Thirty-one clubs responded and the present organization was effected. Permanent headquarters were engaged and the active work of disseminating information and creating enthusiasm with regard to the ordinances was begun. At the present time there are seventy-seven organizations identified with the association. An idea of the non-partisan character of these clubs may be gathered from the fact that the Architects' Business Association, the Chicago Butter and Egg Board, Chicago Grocers and Butchers' Association and the Chicago Women's Club are included among them. The various clubs include a membership of from 75,000 to 100,000 voters. The meetings of the association are attended by representatives of the various clubs, who later report to their individual clubs the actions taken.

Since its organization, Feb. 26, the association has been active in distributing literature concerning the traction ordinances, and badges urging voters for them. In all, about 400,000 badges have been distributed, 60,000 hangers printed on heavy cardboard have been sent out, and the association is now sending out a series of four appeals to every voter in the shape of folders. One of these urged registration on March 12 in order to vote on the ordinances. Another, entitled the "Traction Ordinances in a Nutshell," contained a copy of the ordinances stripped of legal verbiage. Enclosed in it is an article, "What Happens if We Reject These Ordinances," in which it is stated that in the event of the ordinances not being adopted traction facilities during the coming four or five years while condemnation proceedings are being effected will be worse than at present.

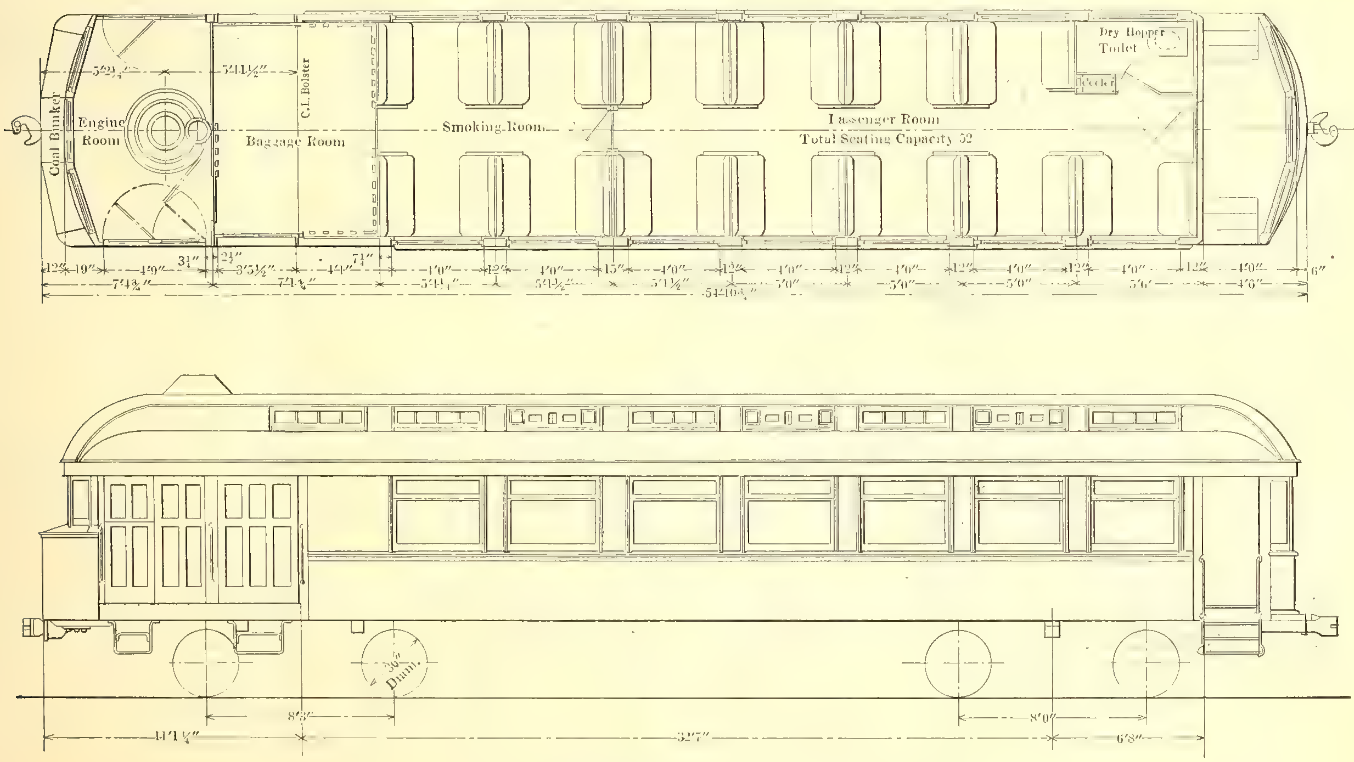
STEAM MOTOR CAR FOR THE ROCK ISLAND

The Chicago, Rock Island & Pacific Railway Company will soon receive a self-propelled steam motor car from the Railway Auto Car Company, of New York, the American company which controls the patents and manufacturing data for the Ganz system. From the general plan and elevation of this car shown herewith it will be seen that the total length over end sills is 54 ft. 10¾ ins. The car has seats



STEAM MOTOR WITH PARTS EXPOSED

for fifty-two passengers, including sixteen in the smoking compartment. The baggage room is 7 ft. 1¾ ins. long, and the motorman's compartment at the forward end of the car, which contains the generator and accessories, is but 6 ft. 4¾ ins. long over all. The coal bunker is supported over the



PLAN AND ELEVATION OF STEAM MOTOR CAR

front end sill and the coal is removed through a small sliding door opening into the motorman's compartment. The coal bunkers carry sufficient fuel for a continuous run of 50 miles.

The feed water for the steam generator is carried in two longitudinal steel tanks suspended from the underframe of the car. These have a total capacity of 600 gals., or sufficient for a continuous run of about 60 miles. The steam generator is of the standard Ganz type and 42 ins. in outside diameter. It is capable of developing a maximum of 120 hp in conjunction with the compound steam motor mounted in the forward truck and which drives on the rear axle thereof.

The half-tone view shows the steam motor with the cover enclosing the gears and link motion removed. This motor is compound and steam-jacketed and is entirely enclosed. The gear case is partly filled with oil so that all moving parts receive a continuous and thorough lubrication. The normal speed of this motor is 600 r. p. m., although it can be operated satisfactorily up to a speed of 900 r. p. m. The working pressure is 270 lbs. per square inch, and the steam is superheated. The motor is controlled absolutely from levers conveniently located at the right-hand side of the motorman's compartment.

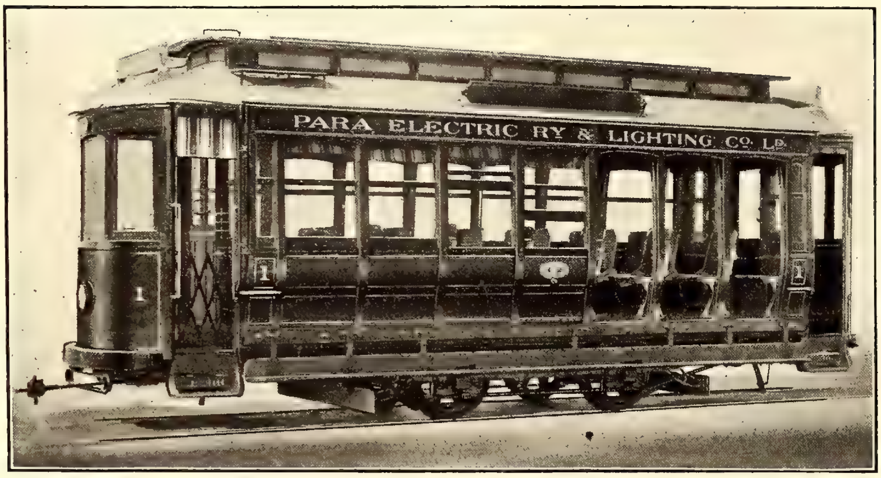
The car body is of all-steel construction with interior finished in quartered oak. Its design is in accordance with what is now considered to be the most advanced practice in passenger cars, that is, the vertical load of the car is cared for by the sides of the car, which form deep girders, while the buffer strains are taken care of by relatively light longitudinal center sills. The total weight of this car in working order fully loaded is 36 tons. It is equipped with Westinghouse automatic brakes with the axle-driven air compressor mounted on the trailer truck.

The car is designed to maintain 35 m. p. h. on a level track, 24 m. p. h. on a 1 per cent grade, and 15 m. p. h. on a 1 per cent grade. The car is also capable of hauling a trailer at 30 m. p. h. on a level track, and 15 m. p. h. on a 1 per cent grade. The fuel is to be coke and the consumption is not to exceed 16½ lbs. per mile.

This is the first standard car of the Railway Auto Car Company which will be built and delivered in this country, although orders for other cars of this general type are now being executed.

FULL CONVERTIBLE CAR FOR PARA, BRAZIL

Three years ago, residents of Para, Brazil, had to depend solely on mule tramways, which ran through Para, connecting it with the suburbs. Since the advent of the Para Electric Railway & Lighting Company, under the management of J. G. White & Company, the 50,000 inhabitants have at their disposal an electric railway system that is



EXTERIOR OF CAR FOR PARA

modern in every way. Para is situated in the northern part of Brazil, 62 miles from the ocean, on the River Para. It is a port of considerable importance and maintains a reg-

INTERIOR OF CAR FOR PARA

ular coasting service with Rio de Janeiro, Manoas and other Brazilian ports, and in addition has steamer communication with New York, Galveston and European ports. For some time the local authorities have been improving the city to the extent of widening, straightening and beautifying the streets, which in the new part of Para present a very modern appearance with their wide thoroughfares lined with palms and other tropical trees. The climate is exceedingly moist, and care had to be exercised in selecting wood for the cars suited to the climatic conditions as well as being insect-proof. Teak was found to contain all the necessary qualities and all cars are made of this wood throughout, which includes, in the case of the full-convertible Brill car illustrated, the slat seats, hand poles and other accessories. The curtains were made mildew-proof, and the ceilings of aluminum. There is a gutter along the side of the roof which connects with a ¾-in. pipe down the corner post. The short platforms, 3 ft. 2 ins. in length with 22-in. step openings, would indicate that not often will the loading and unloading of the car be suddenly taxed. The width of the car over the sills, including panels, is 6 ft. 8¼ ins.; over posts at belt, 7 ft. 3 ins., figures which permit seats for two passengers abreast on one side of the aisle only, the other seats accommodating one passenger each. The truck shown under the car in the picture is the No. 21-E with a 6-ft. wheel base; the motors used are of 40-hp capacity each. Included among the specialties on the car of the builders' own make are angle-iron bumpers, gongs and signal bells, radial drawbars, etc. The dimensions not already given are as follows: Length over end panels, 20 ft. 1 in.; over bumpers, 27 ft. 6 ins.; sweep of posts, 3½ ins.; centers of posts, 2 ft. 7 ins.; size of side sills, 4¾ ins. x 7 ins.; reinforced with Z-iron; end sills, 4¼ ins. x 7 ins.; thickness of corner posts, 3¾ ins.; side posts, 3⅜ ins.

PROPOSED EXTENSION TO TITUSVILLE SYSTEM.

William J. Smith, general manager of Titusville Electric Traction Company, of Titusville, has recently returned from a conference in New York City with Charles Pfizer, Charles Hart and W. R. Brown, directors of the company, concerning the work of the coming season with regard to extensions and improvements. Two or three things are considered necessary. The road must be extended to the westward. Cambridge Springs is now being considered as the most available opening in that direction, making connections with the main line of the Erie Railroad and with trolley lines for Erie and Meadville. The company owns Mystic Park, which Manager Smith believes should be improved. A line southward to Oil City has also been the subject of considerable discussion. Two routes have been surveyed, one over the old railroad grade southward from Pleasantville and the other directly from Titusville through Cherrytree to Rouseville. Such an extension of street railway service would open to local trade and local interest at Titusville a large section of country to the south and west and would bring the city in closer touch with a number of towns and hamlets and a large farming community. It has been suggested that the Titusville Chamber of Commerce meet the directors of the company upon their visit to the city and take up with them the general subject of extensions and improvements.

FINANCIAL INTELLIGENCE

WALL STREET, March 27, 1907.

The Money Market

The developments in the local money market during the past week have been of a favorable character, and at the close the situation was more encouraging than for some weeks past. Early in the week the heavy liquidation in the securities markets, and the active calling of loans on the part of the larger financial institutions, together with the disturbance in the foreign financial markets, caused an advance in the call loan rate to 14 per cent, while in the time loan branch of the market there was an advance in the rate for accommodations for the short periods. Thirty and sixty-day contracts commanded a premium, bringing the total charge to the borrower up to 6½ and 7 per cent, while for the longer periods 6 per cent was bid with practically no offerings. Toward the end of the week, however, there was a sharp reaction in demand money to 4 per cent, but the asking charges for fixed periods remained practically unchanged. The improvement was directly due to the action of the Treasury Department in authorizing the deposit of about $15,000,000 custom receipts in the national banks in this city, and also the anticipation of the payment of the April 1 interest on the public debt. It is estimated that this action will make available about $18,000,000 for market purposes, and there is assurance from Washington that further relief measures will be adopted should market conditions necessitate such action. In addition to this, there has been a decided change in the attitude of local bankers in the matter of gold withdrawals from the other side. For some time past our bankers have been reluctant to draw gold from London, notwithstanding the large balance in our favor, and the low rates prevailing for sterling exchange, which would have made imports of the yellow metal profitable, but some improvement in the foreign situation led to the engagement of $1,650,000 gold for shipment to this side, while further engagements are regarded as highly probable, although these will depend largely upon the amount of new gold laid down in the London market. A substantial amount of the metal is due to arrive from the Cape early next week, and doubtless New York bankers will be active, bidding for all or part of it. The disturbing rumors regarding the monetary situation abroad proved to have been grossly exaggerated, and the settlements at London and Berlin passed over without any serious disturbance. The utterance by a prominent foreign banker made it clear that there is no danger of the money markets abroad being seriously disturbed, as the scarcity of money the world over is due to the phenomenal activity in all lines of industry, and not to any excessive speculative activity. The fact that the demand for funds is not a speculative one means continued firmness in rates, but the banking interests appear to have the situation well in hand, and they assert that there is no reason whatever for any apprehension. The preparations for the April interest and dividend disbursements which will be made this week will doubtless cause a temporary flurry in the local money rates, but this should be followed by a return to easier conditions within a short time, as the money thus paid out promptly finds its way back to the banks. Corporate borrowings have practically ceased, and are not likely to be resumed on a liberal scale, owing to the policy of retrenchment adopted by many of the leading railroads and the cancellation of large orders for materials, etc.

The bank statement of last Saturday was somewhat better than had been expected. Loans decreased $3,487,000, due almost entirely to liquidation in the stock market. Deposits decreased $1,829,000, and cash increased $1,218,900. The legal reserve was $457,450 less than in the preceding week and which, added to the increases in cash, augmented the surplus reserve by $1,676,350. The surplus now stands at $4,709,450, as compared with $6,363,775 in the corresponding week of last year; $6,479,325 in 1905, $27,468,875 in 1904, $6,280,900 in 1903, $6,965,-575 in 1902, $10,272,425 in 1901 and $5,817,300 in 1900.

The Stock Market

The stock market has passed through another period of liquidation and demoralization which culminated in a very serious decline in prices in the middle of the week, although the downward movement was not attended with the same degree of excitement which characterized the break in values in the earlier part of the month. The selling movement was stimulated by active calling of loans by the banks and a sharp advance in the call loan rate, and by some very disquieting rumors regarding financial and speculative conditions in Berlin and London. This received attention more for the reason of the heavy selling for foreign account than through any confirmation of reports, which were sufficiently serious to call forth denial from one of the most prominent British financiers. Prices for many stocks made new low levels. and the execution of stop orders was responsible for rather large declines in certain quarters of the list. It would be difficult, however, to ascribe any specific reason for the continued liquidation. The engagement of $1,650,000 gold for import, together with the action of the Secretary of the Treasury in anticipating payment of the April interest on the public debt, and in depositing customs receipts with the national banks in New York City was received favorably as practical assistance to the money market, and was in a large measure responsible for the sharp recovery in prices which was in progress at the close. The larger financial interests appear to have at last come to the support of the market, and further serious drives are more unlikely with this fact now generally known. The copper stocks suffered severely, with heavy selling of Amalgamated, influenced by the rather sensational break in the copper metal price in London, and a corresponding decline in the price of the metal in New York, which appeared to indicate that the statistical position of the metal was less strong than had been the belief. The cancellation of contracts for improvements by the railroads, owing to the inability to raise fresh capital will have an important influence upon the iron, steel and metal industries, although, according to officials of the United States Steel Corporation, there is as yet no indication of any material falling off in the volume of business in the iron and steel trade. General conditions remain practically unchanged. The activity in trade is sufficient to absorb all the available capital, and this naturally acts against speculative activity in the stock market of the inauguration of any important sustained upward movement. Crop possibilities are now coming in for consideration, and these will later on prove an important speculative influence.

The local traction stocks followed the course of the general list, although quite a little selling was caused by the various and conflicting reports from Albany regarding the passage of the Public Utilities bill which would circumscribe the powers of these companies.

Philadelphia

Although the dealings in the traction shares were considerably smaller than in the preceding week, they were accompanied by a general decline in values, and in many instances prices made new low records for the present downward movement. Philadelphia Rapid Transit was again the center of interest. During the first half of the week the stock moved within narrow limits, but toward the close there was fresh selling which brought the price down to 15⅛. About 14,000 shares were traded in. Philadelphia Traction sold at 91 and 92, and American Railways ran off from 49½ to 49. Philadelphia Company common, after selling at 44, declined to 42⅞, while the preferred stock brought 45½. Union Traction sold to the extent of about 1500 shares at 54 and 53½, and Consolidated Traction of New Jersey sold at 70. Rochester Railway & Light preferred changed hands at 91, and Union Traction preferred of Pittsburg brought 50.

Baltimore

The local traction issues were extremely quiet and weak during the past week. About the only activity was in United Rail-

ways preferred, more than $50,000 of which sold at prices ranging fram 87¼ to 85¾. The income bonds were unusually dull, a few odd lots changing hands at 52 to 51¼. United Railway free stock brought 11, and the certificates representing pooled stock changed hands at the same figure. Other sales included Baltimore City Passenger 5s at 102½ and Washington City & Suburban 5s at 101.

Other Traction Securities

The feature of the Boston market was the break of several points in Massachusetts Electric preferred. Opening around 65, it broke to 55½ and later recovered to 57; upwards of 2500 shares were traded in. The common stock declined from 17 to 14½ and then recovered to 15⅞. Boston Elevated was steady at 145. West End common sold as low as 90 and the preferred at 106½ and 106. The Chicago market has continued quiet. Metropolitan Elevated preferred sold at 65. West Chicago brought 27, and Chicago City Railway brought 150 for a small lot. Union sold at 5.

Considerable activity was shown in the various traction securities on the Cleveland Stock Exchange the past week. Blocks of the Aurora, Elgin & Chicago, Cleveland Electric, Forest City and Northern Ohio Traction changed hands. In one day 250 shares of the Forest City was sold. This is the largest transaction in this stock for one day that has ever been reported. Cleveland Electric stood about 60 bid for several days, but on Tuesday it fluctuated widely, owing to the report of a disagreement on the leasing plan having been reported to the City Council on Monday evening. Forest City stood about where it has been for some time, with 98 asked and 94½ bid.

Security Quotations

The following table shows the present bid quotations for the leading traction stocks, and the active bonds, as compared with last week:

	Mch. 20	Mch. 27
American Railways	49	49
Boston Elevated	145	a143½
Brooklyn Rapid Transit	54	49⅜
Chicago City	150	150
Chicago Union Traction (common)	4¾	4⅝
Chicago Union Traction (preferred)	13	13¼
Cleveland Electric	—	54
Consolidated Traction of New Jersey	71	70
Detroit United	69	68
Interborough-Metropolitan	24	23⅝
Interborough-Metropolitan (preferred)	58½	56
International Traction (common)	54	45
International Traction (preferred), 4s	79	72½
Manhattan Railway	135	130½
Massachusetts Elec. Cos. (common)	16½	15
Massachusetts Electric Cos. (preferred)	63	56
Metropolitan Elevated, Chicago (common)	23	25
Metropolitan Elevated, Chicago (preferred)	64	a65
Metropolitan Street	—	a93
North American	73⅞	72⅝
North Jersey Street Railway	40	40
Philadelphia Company (common)	43	43½
Philadelphia Rapid Transit	16¾	15¾
Philadelphia Traction	92	91
Public Service Corporation certificates	65	66
Public Service Corporation 5 per cent notes	94	94
South Side Elevated (Chicago)	80	80
Third Avenue	106	105
Twin City, Minneapolis (common)	94½	93
Union Traction (Philadelphia)	54	53½

a Asked.

Metals

The "Iron Age" says: "So far as the current movement in crude and finished iron products is concerned, the situation is practically unaffected by the recent events in Wall Street and the numerous announcements of a proposed cessation of railroad work. It is idle to deny, however, that unless there is a resumption of that work during the next few months, consumption of iron and steel must be affected and values must be influenced. It has already had the effect of making buyers of crude iron and steel more cautious as to commitments for the last half of the year. In the Central West the scarcity of steel continues. Quite a large tonnage of structural material is in sight. Copper metal has ruled easier, in sympathy with the fall in the price of the metal in London. Quotations are: Lake, 24¾c. to 25¼c; electrolytic, 24¼c. to 25c.; castings, 23¾c. to 24¼c."

MEETING OF THE OKLAHOMA ELECTRIC LIGHT, RAILWAY & GAS ASSOCIATION

The first meeting of the Oklahoma Electric Light, Railway and Gas Association, notice of the organization of which appeared in a recent issue of the STREET RAILWAY JOURNAL, will be held April 22 and 23 at Oklahoma City, Okla. Ter.

TO OPEN UP BERKSHIRE REGION

The plans of the New York, New Haven & Hartford Railroad Company are definitely announced for the building of electric railway lines from Great Barrington to South Egremont, in Massachusetts, and to Canaan, Conn., the junction point of the Central New England and Housatonic steam railroad lines. The line from Great Barrington to Canaan will closely parallel the Housatonic Railroad. The immediate plans in the Berkshire region also include the building of a cog road to the top of Mount Greylock, the other terminal of which has not yet been definitely decided upon. None of these projects will be affected by the curtailment policy of the New Haven company regarding extensions. They form part of a large scheme of opening up the Berkshire region as a great summer resort.

IMPROVEMENTS AT PORTLAND

The budget of the Portland Railway, Light & Power Company, 1907, amounts to a trifle over $2,000,000. The items are not alone for new work on the railway and power systems, but include such incidentals as paving in connection with the improvements of thoroughfares over which the corporation operates its rolling stock.

Lump sums are given the Oregon Water Power Company and the original Portland Railway systems, each securing $600,000. The Oregon Water Power Company's lines cover about 90 miles, while the city system is approximately 115 miles long. It is the intention to do more city work this year than on the suburban and interurban runs.

This amount does not include the $1,000,000 terminal station on First and Pine Streets, which came up after the budget was compiled. Orders placed for 100 new cars, fifty of which are to be shipped next month, consumed considerable of the available cash. Nearly a mile of 72-pound rail has been laid on Dawson Street, where street improvements are being made. On Union Avenue, north of Weidler Street, about 2½ miles of 72-pound rails are to be put down in place of the 40-pound steel now used.

Two miles of new road will be built from East Twenty-Eighth and East Burnside Streets to Rose City Park, a new addition being laid out. That line will later be connected with the East Burnside Street branch at East Sixteenth Street. It has been reported several times the company intended to double track the line to Ivanhoe, but while it will ultimately be brought about, no provision has been made for such improvement this year.

Three new trailers, each the length of the regular sized motor car, have been turned out of the Oregon Water Power shops for the Mount Scott run, and three others are being completed. More cars have been added to the rolling stock on the Mount Scott division, and with the arrival of the open rolling stock, increased service will be given on various lines.

MR. ANDREWS AND MR. DU PONT DISAGREE ON CLEVELAND VALUATIONS

Horace E. Andrews, president of the Cleveland Electric Railway Company, and A. B. Du Pont, president of the Municipal Traction Company, who have spent two months in an endeavor to place a satisfactory leasing value on the property and franchises of the Cleveland Electric, reported to the City Council, Monday evening, March 25, that they had disagreed. Each made a report, and submitted figures widely divergent; Mr. Andrews stating that, under the plans laid down at the suggestion of Mr. Du Pont in the beginning, the value of the physical property and franchises is $33,888,888.88, while the best figures Mr. Du Pont could offer were $19,898,126.93. The first would give a stock value of 105, and the latter 45.10, with a possibility of reaching 49.61. Mr. Andrews stated that he had followed the plan of making the estimates that he and Mr. Du Pont had fixed upon right through and arrived at the conclusions given. This is what is known as the Chicago plan, under which a committee appointed by the city worked in fixing valuations on the street railways in that city.

Mr. Du Pont, so far as known, followed the same plan in making his estimates, but digressed by omitting contractors' profits, interest during construction, charges for management, brokerage, commissions and all consideration of franchises in Gleville, Collinwood, East Cleveland, Cleveland Heights, Newburg, Newburg Heights, South Brooklyn and Lakewood. This, of course, would make a big difference in the valuations. The money put into the first-named items is considerable, while the franchises in the thriving towns named are valuable.

The two gentlemen had progressed well until almost the middle of this month, when Mr. Andrews requested Mr. Du Pont to ascertain from Mayor Johnson a statement as to whether he was satisfied as to the methods used in arriving at the valuations. The answer was that he was not. Two or three days later a proposition was made by Mr. Du Pont to the effect that the negotiations be conducted without considerations of the long-time grants in the towns outside the limits of Cleveland, and that the estimates should not include certain items of expense that are always made a part of the cost of railways. This was refused by Mr. Andrews, who felt that the rules governing the work of fixing valuations were being departed from.

Since that time no conferences have been held, Mr. Andrews feeling that the time had come when further talk on the matter would merely be time wasted. Mr. Andrews and the officers of the Cleveland Electric Railway Company have refused to make any statements regarding the matter. The reports of Messrs. Andrews and Du Pont follow:

To the Council of the City of Cleveland:

Gentlemen—Under your resolution of Jan. 14, Mr. Andrews and I have met almost daily for two months in an effort to determine the value of the physical property and unexpired franchises of the Cleveland Electric Railway Company. We have been unable to agree, and I therefore report for your information my opinion, based upon a careful study of all phases of the problem.

Upon the valuation of many items of the physical property, the dates of expiration for most of the grants and the method of valuing physical property, we were able substantially to agree. The conclusion here expressed, of course, includes such agreed values, but neither Mr. Andrews nor his company are bound by the conclusions as a whole, nor the details entering into it.

The total value of the physical property and unexpired franchises of the company is $17,908,314.24. Adding to this one-ninth, we have $19,898,126.93, which makes for the outstanding stock a value of $45.10 per share, redeemable on the suggested plan at $49.61.

The value here given includes $1,533,566.84 as the value of the street paving done by the company, though I am informed that this paving is now the property of the city.

Nothing is included for contractors' profits, brokerage, commissions or interest during the construction, for two reasons; first, such items are not properly a part of the physical property; and second, if these items are not adequately covered by the bonus of 21 per cent, which is the basis of the suggested plan for determining the redemption value of the stock, any extra allowance on that account should be made by the Council.

The value of the physical property has been determined independently of the length of the franchises, and no deduction has been made from the amount so determined by reason of unprofitable grants. To all franchises I have assigned full value. Where, however, lines are composed of portions having different dates of expiration, the later in date being remote from the center of the city, and through unprofitable territory, I have assigned no value to the outlying portion after the expiration of the inlying connection. Such grants are operated even now at a loss, and are, in fact, a burden upon the inside lines, and, of course, are not susceptible of profitable operation after the expiration of the inside connection.

The conclusions here stated with detailed figures and reasons were submitted to Mr. Andrews on March 13, with a request that we discuss them in detail and that he suggest any revision that he thought just, with his reasons. I submitted also a schedule of disputed items now allowed, with my estimate of their value in dollars to the company as a basis for further discussion if reasons for allowing them could be advanced, professing myself entirely willing to consider such reasons. I have had no summary of the conclusions reached by Mr. Andrews, nor of the aggregate of his claims, and to my report to him I have had no reply except a verbal comment that we were apparently too far apart to make further conferences useful. Respectfully submitted,

Monday, March 25, 1907. A. B. DU PONT.

To the Honorable City Council of the City of Cleveland:

Gentlemen—Pursuant to the Council resolution of Jan. 14, A. B. Du Pont and I, together with the assistance of a large corps of engineers and accountants, have made a thorough examination of the property of the Cleveland Electric Railway Company.

In making this examination, the plan laid down by the commission appointed by the city of Chicago, consisting of Bion J. Arnold, Professor M. E. Cooley and A. B. Du Pont was followed, and the same method of valuing physical property and unexpired grants from the city of Cleveland and the municipalities surrounding Cleveland served by the Cleveland Electric Railway Company, was adopted.

In preparing the preliminary estimates of the value of the physical property, only the cost of labor and material was included, less depreciation, with the intention of adding later the customary percentages for administration, engineering, carrying charges, etc., aggregating, as an average, in the case of the Chicago valuation, 20 per cent of the cost of the material and labor.

The value of the unexpired grants was arrived at in accordance with a plan dictated by Mr. Du Pont following the method used in Chicago.

The result for the physical and franchise value thus obtained aggregated approximately $30,500,000, to which, under the proposal of the Municipal Traction Company, one-ninth should be added, making a total of $33,888,888.88; from this sum, the funded and unfunded debt of the company, as of Jan. 1, 1907, should be deducted, leaving a net result of $24,547,888.88, which, divided by the number of shares of stock of the Cleveland Electric Railway Company, outstanding, would show a present value approximately of $105 per share.

During the last week of the negotiations I suggested that Mr. Dupont confer with Mayor Johnson with a view of learning whether the method of valuation adopted met with his approval, and was informed that it did not. Whereupon, a day or two later a surprising proposition was submitted in writing by Mr. Du Pont, providing that no valuation should be given long-time grants in Glenville, Collinwood, East Cleveland, Cleveland Heights, Newburg, Newburg Heights, South Brooklyn or Lakewood, nor to certain grants in the city of Cleveland. The proposition also contained an estimate of the physical value which did not include all of the various items making up that value, and particularly excluded any consideration for any charges for management, superintendence, engineering, interest on cost during construction, contractors' profits, and other items which were included in the Chicago estimate and in the Detroit estimate prepared by Professor Bemis and others, and which are usual charges in the construction of any railway, and are necessary to and as much a part of the cost of construction as the cost of rail or any part of its track equipment is.

We are perfectly willing to abide by an arbitration based upon such methods of valuation as were adopted in Chicago by an impartial commission, of which Mr. Du Pont was one, but can not consider any offer by the Municipal Traction Company for a lease based upon a value which does not include proper charges for the items of cost enumerated above in making up physical value, and can consider no adjustment which does not contemplate the value of the property operated as a whole, as was the assumption in Chicago. Respectfully submitted,

H. E. ANDREWS.

Business men who know Mr. Andrews and the board of directors of the Cleveland Electric Railway Company have felt all along that they would not submit to leasing their property upon a valuation below what it should be. The company has made an offer eminently fair, and with a rate that is very low for a city of the size, and the general opinion seems to be that the offer of seven tickets for a quarter should have been accepted. It is further believed that, if put to a vote, there would be an almost unanimous decision in favor of the acceptance of the offer.

The City Council is in something of a quandary just now, it would seem, as there was little said regarding the reports Monday evening. A resolution was passed calling for a mass meeting Wednesday morning to discuss the matter, and another asking that the Cleveland Electric report the business done on the Central and Quincy Avenue lines since Jan. 10, when the company agreed to operate them on the 3-cent-fare basis, and, if an agreement was not reached, to submit reports to the city and pay everything above the expense of operating the lines.

There seems to be nothing left but arbitration, and it is believed that the Cleveland Electric will not submit to such a form of settlement, unless certain definite lines are laid down upon which to base a settlement. It is possible that the company might yield a little from the valuation fixed by Mr. Andrews, but at the same time there is small chance that any great concessions will be made.

This action breaks the truce in the legal battle that has existed between the Cleveland Electric Railway Company and the Municipal Traction Company. It is said that the attorneys for both sides have arranged with the courts to take up arms as soon as the word is given. However, it is not known how soon this will be. It is probable that the first move will have to be made by the Cleveland Electric in forcing the Municipal Traction cars from operating over its tracks on Superior Avenue. Since the truce was declared these cars have been running regularly to the Public Square and turning on the loop. An injunction against this exists and it only remains to ask the court to put it in force again. Then there are a number of suits that will have to be fought out, one of them being against the Forest City Railway Company, on the ground that Mayor Johnson is financially interested in it.

EARNINGS OF THE UNITED RAILWAYS OF ST. LOUIS

For the first time since the World's Fair period the United Railways Company reports a deficit in its net income account in the February statement of earnings. The two months of 1907 show a net income of only $1,802, as compared with nearly $77,000 for the same period last year. These two months cover the operation of the suburban system since it was taken over on Jan. 1. The gross earnings of last month show the comfortable increase of $51,000, as compared with February, 1906, but this is more than wiped out by increase in expenses and depreciation, amounting to $85,000. The official statement issued by the auditor is as follows:

February—	1907	1906
Gross earnings and other income....	$764,680	$713,664
Expenses, taxes and depreciation...	548,479	463,041
Net earnings	$216,201	$250,623
Charges	231,324	231,991
Net income	$15,123	$18,632
Jan. 1 to Feb. 28—		
Gross earnings and other income....	$1,591,017	$1,495,453
Expenses, taxes and depreciation...	1,126,349	954,409
Net earnings	$464,668	$541,044
Charges	462,866	464,046
Net income	$1,802	$76,998

Details of the earnings and expenditures of the United Railways Company during 1906 are presented in a report issued last week by President John I. Beggs. More than 183,000,000 passengers, not counting those who rode on transfers, paid into the treasury of the company $8,997,240. The rest of the company's income is derived from advertising privileges in cars, carrying United States mail, express business, rental of electric power, interest on deposits and securities and miscellaneous sources. Taking the figures given as a basis, the company received for each revenue passenger 4.91 cents per ride. Included in both the revenue and transfer service the average paid by the total number of passengers was 3.40 cents per ride. A summary of the business of the company follows:

Year's traffic of United Railways—	
Cash fares	183,237,886
Transfers	81,183,324
Total	264,421,210
Percentage of transfer.............	41.81
Gross earnings and income...........	$9,146,348
Net income	1,201,459
Dividends on preferred stock........	649,160
Surplus	552,299
Assets	108,204,746
Value of property and plant.........	102,608,623

Length of track since consolidation 456.14 miles—350.09 in city and 106.05 in county.

NEW POWER PLANT FOR DELAWARE AND HUDSON INTERESTS

The Hudson Valley Construction Company, of Troy, has secured the contract for constructing a steam turbine power plant at Mechanicsville, N. Y., for generating electric power for the Hudson Valley Railway Company and the United Traction Company, of Albany and Troy. Spurs from the main line of the Delaware & Hudson Railroad will run to the property from both north and south, and, according to the plans prepared by J. G. White & Company, of New York City, the engineers, the power station will be erected about 1000 ft. north of the dam of the Hudson River Electric Power Company. The engineers of the Hudson Valley Construction Company have made measurements at the property and will begin excavating at once for the intake canal from the river through the site of the power station. This canal will be 480 ft. long and 12 ft. wide, and will furnish water for the condensing plant. The engine room to be constructed will be about 180 ft. x 70 ft., and the boiler room about 180 ft. x 75 ft. The plant proper will be 165 ft. long by 155 ft. wide. The Delaware & Hudson Company will spend between $500,000 and $600,000 in the construction of the plant. It is expected to have a part of it ready for operation in August of this year.

ANNUAL REPORT OF HAVANA ELECTRIC RAILWAY

The Havana Electric Railway Company's report for the year ended Dec. 31, 1906, shows a deficit of $67,000 comparing with a surplus of $370,000 in the previous year, as follows:

Income account—	1906.	1905.
Gross receipts	$1,621,209	$1,504,837
Expenses, taxes, etc..................	1,031,373	776,052
Net earnings	$589,836	$728,785
Other income	40,863	38,033
Total income	$630,699	$766,818
Charges	498,313	395,897
Surplus	$132,386	$370,921
Preferred dividends	200,000	......
Deficit	$67,614	*$370,921
Previous surplus	509,073	138,152
Profit and loss surplus	$441,459	$509,073

* Surplus.

The general balance sheet as of Dec. 31, 1906, compares as follows:

Assets.		
Properties	$20,502,940	$20,102,101
Stage lines	225,000	225,000
Insular railway	280,646	230,982
Cash	33,264	359,545
Accounts receivable	75,085	4,305
Materials on hand	569,690	174,632
Fuel on hand	15,567	3,541
Insurance prepaid	17,267	11,054
Taxes prepaid	2,025	1,819
Deposits made as securities..........	12,700	2,300
Treasury bonds	168,630	89,113
Treasury stock	36,040	36,040
Total	$21,938,854	$21,237,433
Liabilities.		
Common stock	$7,500,000	$7,500,000
Preferred stock	5,000,000	5,000,000
Funded debt	8,311,561	8,031,037
Accrued interest	171,958	166,835
Interest on sinking fund bonds	......	......
Outstanding coupons	6,422	5,216
Employees' deposits	18,400	10,101
Unclaimed wages	......	2,396
Dividends	50,000	......
Balance due on first mortgage bonds..	......	......
Spec. loan on stage property..........	......	......
Accounts and wages payable.........	189,055	12,775
Profit and loss account	441,458	509,073
Total	$21,938,854	$21,237,433

INTERBOROUGH REPORT FOR YEAR

The report of the Interborough Rapid Transit Company, of New York, for the year ended Dec. 31, shows an increase in the number of passengers carried of 54,127,910, as compared with the preceding year, and a gain in gross earnings of $2,697,881. Net earnings were large, increasing $2,149,398. After the payment of the 7 per cent guaranteed dividend on Manhattan stock there was a surplus of $3,545,192, compared with a surplus in 1905 of $2,504,142. Detailed figures follow:

	1906.	1905.
Gross earnings	$20,916,147	$18,218,266
Operating expenses	8,793,486	8,245,004
Net earnings	$12,122,660	$9,973,261
Other income	673,598	701,660
Gross income	$12,796,259	$10,674,922
Interest on bonds	3,961,991	3,018,166
Taxes	1,341,074	1,288,613
Total	$5,303,066	$4,306,780
Net income	7,493,192	6,368,142
Seven per cent on Manhattan Railway Company stock	3,948,000	3,864,000
Surplus	$3,545,192	$2,504,142
Operating per cent	42.04	45.26
Passengers carried	420,302,389	366,174,479

FROM LANCASTER TO PHILADELPHIA BY TROLLEY

By Jan. 1 there will be through trolley connection between Lancaster and Philadelphia. The Lancaster & Eastern Street Railway Company now has in operation a line from Lancaster to Christiana, 20 miles east of Lancaster, and the engineers of the company started work last week surveying for a line to connect Christiana with Coatesville, 12 miles further east, to which point there are trolley lines from Philadelphia. These lines will give through connection between Lancaster and Philadelphia.

ENGINEER RICE THINKS THE BROOKLYN SUBWAY WILL BE READY FOR USE TO CITY HALL STATION BY JUNE 1

George S. Rice, engineer for the New York Rapid Transit Commission, addressed the department of engineering of the Brooklyn Institute Thursday evening, March 21, on "The Subways of Greater New York and Their Engineering Problems." After a rapid survey of the planning and carrying out of the subway work already finished, Mr. Rice spoke of the fact that it is but a week ago Wednesday since permission was given to take up further work, and the Commission, which had its contracts ready in advance, is now advertising for bids. "There is so much comment on the Rapid Transit Commission," said Mr. Rice, "that I would like to have this department appreciate this. Three or four hearings are to be held next month, but I suspect there will be few bidders in Manhattan, because, by the provisions of the Elsberg bill, twenty years is the limit of any franchise. I am afraid capital will be chary about going into these subway contracts." Because of other public works the city can have but about $30,000,000 to spend on necessary immediate work, and Mr. Rice thought that would not go very far toward meeting the demand of the traveling public. Computations made earlier in the lecture showed that, at the present rate of increase, in 1910 there will be a population of 4,720,000 in this city, who will pay 1,500,000,000 single fares. The population is doubling in an average of twenty-five years, but the amount of travel is doubling in an average of ten to eleven years. Mr. Rice expressed the opinion that the Brooklyn subway, as far as the Borough Hall station, would be ready for use in June, and to the Long Island Railroad station, Flatbush Avenue, in September. He said that the work on Fulton Street, when all the conditions are considered—one of the most crowded streets in the world, from the Borough Hall to above Flatbush Avenue, the surface and elevated tracks and the late decision to four-track the tunnel, is the quickest piece of subway work ever done.

INDIANA TRACTION MERGER

The Terre Haute, Indianapolis & Eastern Traction Company, with an authorized issue of $25,000,000 worth of stock and $10,000,000 worth of bonds, filed articles of incorporation with the Secretary of State, at Indianapolis, Ind., Saturday, March 23. This is the holding company toward which the plans of the Philadelphia syndicate, represented in Indianapolis by Hugh J. McGowan, have been shaping for nearly two years.

The Terre Haute, Indianapolis & Eastern, as previously stated in the Street Railway Journal, will acquire by purchase or lease all the Indiana syndicate lines. These include the Indianapolis & Northwestern, the Indianapolis & Western, the Indianapolis Coal Traction Company (Plainfield line), the Indianapolis & Martinsville, the Indianapolis & Eastern, and the Richmond Street & Interurban Companies. The holding company will not acquire the lines of the Indianapolis Union Traction Company, the Ft. Wayne & Wabash Valley Traction Company, nor the Evansville & South Bend properties, which have recently come under syndicate control.

It is practically assured that the new company will acquire the lines owned by the Terre Haute Traction & Light Company, including the city lines in Terre Haute and interurbans to Clinton, Brazil and Sullivan. It is understood that a proposition will be made at once by the new company to the Stone & Webster syndicate for the lease for a period of ninety-nine years of the Terre Haute properties. The terms of the proposed lease have not been made known. The new company will control 363 miles of traction line in operation.

The Terre Haute, Indianapolis & Eastern, as a holding company for the syndicate lines in Indiana, corresponds to the recently incorporated Indiana, Columbus & Eastern Railway Company, which is a holding company for the lines in Ohio owned by the same interests as the syndicate lines in Indiana. The two holding companies will operate in close relation and establish through service over their roads.

PROGRESS ON THE PENNSYLVANIA TUNNELS IN NEW YORK

Now that a period of favorable weather conditions has begun work on the Pennsylvania Railroad's New York terminal and tunnels is going forward with great rapidity. A considerable section of the tunneling is actually completed. There has been another "meeting" of tunnels—this time in Long Island City. The southernmost of the four tubes being driven from East Avenue under the Long Island Railroad passenger terminal toward the East River has reached the river shaft, and is now connected with the tubes that go out under the water. A few days ago the "headings," bound in opposite directions under Thirty-Second Street, Manhattan, came together nearly under Third Avenue, so that there are continuous passages from the East River to Fifth Avenue under both Thirty-Second and Thirty-Third Streets.

Under the East River the tubes have gone about 500 yards. Those going east from Manhattan, having started a full year earlier, are more advanced. The three to the south, known as B, C and D, are now piercing through the rock of Blackwell's Island reef. The tubes bound from the Long Island City side toward Manhattan are about 350 ft. out under the water. The meeting of the eastbound and westbound tubes will take place considerably to the east of the middle of the river.

About 85 per cent of the excavation work in the area bounded by Seventh and Ninth Avenues and Thirty-First and Thirty-Second Streets is done. Between Seventh and Eighth Avenues practically all the excavation is completed. The greater part of the steel work which is to support Eighth Avenue over the underground tracks is in place. The foundations for the station columns are being laid.

Between Harrison, on the present main line of the Pennsylvania, and the Bergen Hill tunnels several bridges have been constructed. The one over the Hackensack River is nearly finished. Under Bergen Hill itself, through the hard Palisades rock, the tunnelers are making more rapid progress than at any previous time. They are now at work in four sets of "headings"—west from the Weehawken shaft, east from the Hackensack portal on the edge of the Meadows, and east and west from the central shaft, 220 ft. beneath the crest of the hill.

COMMITTEES OF THE CENTRAL ELECTRIC RAILWAY ASSOCIATION

President H. A. Nicholl, of the Central Electric Railway Association, has announced the appointment of the following standard committees:

Subject Committee.—E. C. Spring, West Milton; J. L. Adams, Dayton; J. C. Rothery, East Liverpool; Thos. Elliott, Cincinnati; C. F. Smith, Findlay.

Insurance Committee.—H. N. Staats, Cleveland; H. J. Davies, Cleveland; Harry P. Clegg, Dayton.

Finance Committee.—C. N. Wilcoxon, Kamms; Geo. Whysall, Marion; Thos. McReynolds, Kokomo; W. B. Wright, Rushville; H. E. Vordemark, Ft. Wayne.

Standardization Committee.—R. C. Taylor, Anderson; W. H. Evans, Indianapolis; F. Heckler, Fremont; M. E. Baxter, Wapakoneta; W. A. Gibbs, Newark.

Publicity Committee.—F. D. Norveil, Indianapolis; George Davis, "Traction Weekly," Cleveland; Cale Gough, STREET RAILWAY JOURNAL, Chicago; L. E. Gould, "Electric Railway Review"; Mr. Grimes, Ohmer Fare Register Company, Dayton.

Transportation Committee.—F. J. J. Sloat, Hamilton; F. T. Hepburn, Lima; F. J. Stout, Norwalk; Chas. G. Lohman, South Bend; F. S. Davis, Columbus.

Committee to Report on Lighting Car for Interurban Service.—R. C. Taylor, Anderson, Ind.; W. H. Evans, Indianapolis, Ind.; Mr. Tracy, master mechanic Cleveland & S. W., Kamms, Ohio; W. P. Jackson, Columbus, Ohio.

Committee on Express Companies' Contracts with Interurban Railways.—A. A. Anderson, Columbus, Ind.; Geo. Whysall, Marion, Ohio; F. D. Carpenter, Lima, Ohio.

PLANS PERFECTED FOR BUILDING LONG ISLAND SYSTEM

At a meeting held in New York, Friday, March 22, the organization was perfected of the company with which Cleveland interests formerly identified with the New York & Long Island Traction Company are connected, and which has for its object the construction of a system of interurban lines on Long Island with a connection for New York. The officers of the company elected on Friday are as follows: George A. Stanley, of Cleveland, president; C. S. Thrasher, of Cleveland, vice-president; Joseph Nutt, of Cleveland, treasurer; J. A. MacElhinney, 120 Broadway, New York, secretary; G. A. Stanley, of Cleveland; C. S. Thrasher, of Cleveland; Joseph Nutt, of Cleveland; William Christy, of Akron; B. F. Hamilton, of New York; B. R. Duff, of New York; J. A. MacElhinney, of New York; F. B. Jordan, of New York, and T. Kerrigan, of Sea Cliff, directors.

The company's plan is to build first to connect Mineola, Rosyln and Port Washington. Later from Roslyn a line will be built to Manhassett and Great Neck, and eventually to the New York City line at Little Neck. All the franchises have been secured, and there are on deposit a bond for $5,000 and $5,000 in cash to insure the construction of the line. The contract for building has been placed with the Cleveland Construction Company and work will be begun at once. The plan is to rush construction, and it is hoped to have the Mineola, Roslyn and Port Washington line, some 10 miles long, completed and in operation by Sept. 1. At Mineola connection will be made with the New York & Long Island Traction Company's system, which connects Mineola, Hempstead and Freeport, and affords a connection with the lines of the Brooklyn Rapid Transit Company through the medium of the Long Island Electric Railway, which operates between Jamaica and Queens. The company has arranged with the Nassau Electric Light & Power Company for securing power from that company's plant at Glen Cove. The Nassau Power Company had its beginning in the desire of wealthy residents of Long Island to light their grounds and buildings by electricity, and from a private enterprise has grown into a company operating generally throughout the part of the island proposed to be traversed by the new railroad.

The Chicago City Railway notified its employees Thursday, March 28, that wages will be increased from 1 to 4 cents per hour if the traction ordinances are successful next Tuesday.

MEETING OF MUNICIPAL OWNERSHIP AND PUBLIC RELATIONS COMMITTEES

A joint meeting of the committees on municipal ownership and public relations of the American Street and Interurban Railway Association was held in New York, March 22, 1907. A conference was held later with similar committees representing the electric light, gas and telephone interests. Among those present were: C. D. Wyman, W. Caryl Ely, H. A. Robinson, B. F. Swenson, Walton Clark, J. B. McCall, C. L. Edgar, Arthur Williams, W. H. Gardner, H. L. Doherty, E. W. Burdett. The meeting was devoted to a general discussion of the relations of corporations to the public and to the State, and concluded in the evening with a dinner at the Waldorf-Astoria.

Both of the committees of the American Association will probably issue within the next few weeks a series of questions to be answered by the street railway companies of the country. The data obtained in this way will be used as a basis for the reports which will be presented by the committees at the 1907 convention.

NO REDUCED RATE OVER STEAM LINES FOR VETERANS

The Central Passenger Association has refused to grant the members of the Grand Army of the Republic reduced rates over the steam lines to Ft. Wayne, where their annual encampment is to be held in May. Heretofore they have granted a 1-cent rate to the veterans. In reply to the request the president of the association said: "The Indiana Legislature having fixed a rate of 2 cents a mile the transportation lines consider that they may not reasonably be asked further to deplete their revenues by conceding reductions from this probable unprofitable basis."

AMERICAN MUSEUM OF SAFETY DEVICES

With the purpose of arranging the preliminary plans connected with the establishment of a permanent museum of safety devices in America, a dinner conference was held by Dr. Josiah Strong as president, and Dr. W. H. Tolman as director, of the American Institute of Social Service, at the Aldine Club, New York City, on Friday evening, March 22, at which a number of the leading editors and publicists of New York City were in attendance The business portion of the evening was devoted to a discussion of the facts which render desirable the establishment in this country of such a museum. It was stated that even in New York City alone, taking the statistics for certain years, an average of from nine to thirteen persons meet with violent death per day. Most of the accidents to which these deaths can be attributed are preventable by the use of proper safety devices.

It is the intention to establish in New York City a museum in which approved safety devices can be permanently located and to which the public will have free access at all times. During the evening lantern slides were shown of a considerable number of the great museums already established abroad, notably those at Amsterdam, Berlin, Paris, Madrid and Milan.

It will be recalled that an exposition of safety appliances and industrial hygiene was held at the American Museum of Natural History from Jan. 29 to Feb. 12, 1907. At this exposition marked interest was aroused in the general movement, and it is believed that the time is now ripe for making the exposition permanent. Present estimates seem to indicate that about $25,000 will be needed as an initial fund. About $1,500 has already been raised for this purpose, $1,000 of which has been pledged by the Non-Explosive Safety Naphtha Container Company, of New York. Subscriptions will be solicited from those who will profit from the application of safety devices as well as from those who are interested in the movement from the humanitarian aspect. The "Scientific American" announced its intention of presenting annually a gold medal to be awarded for the invention of the best safety device, with the single suggestion that the medal in successive years should be given for inventions in widely differing lines. A pronounced step was taken in the organization by the appointment of an advisory committee consisting of the editors of a number of the technical and trade journals.

AMERICAN RAILWAY INSURANCE COMPANY TO BEGIN BUSINESS IN APRIL

The American Railway Insurance Company, of Cleveland, organized by the traction interests to carry their risks, will not begin business until some time next month, as its $500,000 of capital and surplus is not to be fully paid until April 1. In the meantime Henry N. Staats, its manager, has been placing with stock companies the entire business of any traction companies which wish to turn over their business to the new organization, returning to them the commissions paid. Mr. Staats also has arranged with these companies to reinsure any excess lines after the American Railway Insurance Company begins business. Much interest is taken as to the identity of these companies.

Mr. Staats reports pledges from twenty-eight traction companies to place their insurance with the new concern, and negotiations pending with sixteen more. The activity with which the new organization will be pushed will depend upon the rates made by the stock companies in competition. If these are at a figure so low that no profit can be seen by the new company, as is claimed to be the case at Cleveland, where the sprinklered risks of the Cleveland Electric Railway Company are being carried at 15 cents, it will decline to compete, holding that it has achieved its purpose.

PROGRAM OF IOWA STREET AND INTERURBAN RAILWAY ASSOCIATION

The program of papers just announced to be presented at the meeting of the Iowa Street and Interurban Railway Association at Clinton, Ia., April 19 and 20, includes the following: "The Steam Motor Car—Its Value for Interurban Service," by W. G. Wagenhals; "Amusements—How Should This Feature be Handled by Operating Companies," by H. W. Garner; "Freight Handling by Electric Lines," by H. H. Polk; "Joint Operation of City and Interurban Cars Over City Tracks," by Isaac B. Smith; "Effective Methods of Handling Peak, or Rush-Hour Traffic on City Lines," by E. L. Kirk; "Modern Train Dispatching Methods on Electric Railways," by P. P. Crafts.

This program is one which will be of great interest and value, not only to the members of the Iowa association, but to the street railway fraternity at large. Mr. Wagenhals, who has the paper on the "Steam Motor Car," is the inventor of the car, which he will describe in connection with his paper. He has given years of attention to the application of the steam motor in interurban service, and his latest type of car has excited much favorable comment. Mr. Garner, who handles the park or amusement feature, will embody in his paper the best practice and idea of the companies operating in this section of the country. Mr. Polk, who handles the paper on "Freight Handling by Electric Lines," is the president of the companies which are conspicuous for the success they have met with in the freight field. Mr. Smith, of Cedar Rapids, is expected to produce an interesting paper on prevailing practice, which covers the "Joint Operation of City and Interurban Cars Over City Trackage."

Mr. Kirk is general manager of the Sioux City systems, and has for years handled an enormous summer business, the pleasure resorts of Sioux City being admirably located from a street railway point of view. Mr. Crafts, the general manager of the I. & I. Railway at Clinton, is giving much attention to "Train Dispatching Methods," through the fact that he is operating an electric railway maintaining a schedule of 35 m. p. h., a service which has been successful in competing with parallel steam lines.

There will be ample entertainment features provided by the local committee of Clinton, which consists of P. P. Crafts, general manager of the I. & I. Railway Company; R. M. Howard, general manager of the Clinton Street Railway Company, and Thos. Crawford, superintendent of the Clinton Gas, Light & Coke Company. As stated in the Street Railway Journal last week, managers desiring to exhibit will be cared for, ample arrangements having been made for space for exhibitors. For this space there is no charge. The Clinton Gas, Light & Coke Company will furnish service and connections complimentary to those who make exhibits.

FAREWELL DINNER TO MR. STANLEY

Albert H. Stanley, who has just resigned his position as general manager of the railway lines of the Public Service Corporation of New Jersey to accept that of general manager of the Underground Electric Railway Company, Ltd., of London, was the guest of honor at a banquet held at the Waldorf-Astoria Hotel, in New York, on Friday evening, March 22. Mr. Stanley expects to leave for London about April 1, as has already been announced in this paper. The dinner, which was held in the Astor Galleries at the Waldorf, was an elaborate one in all its details. It was characterized by great cordiality, and the desire of all those present to express the high esteem in which they held the guest of the evening and bear tribute to his high ability and strong personality. The tables were arranged in the form of a large circle and were banked with flowers. About one hundred were present, including many of Mr. Stanley's former associates on the Public Service Corporation, representatives from the transportation companies of New York City, Central New York State, Buffalo, Cleveland and elsewhere, together with others prominent in the electric railway industry.

ALBERT H. STANLEY

C. Loomis Allen, vice-president and general manager of the Oneida Railway Company, the operating company of the New York Central's trolley lines in Central New York State, acted as toastmaster in the unavoidable absence of Thos. N. McCarter, president of the Public Service Corporation. Mr. Allen portrayed the great regard and affection with which Mr. Stanley is held by all the railway men who have become acqainted with him, sketched the services which he has accomplished both for the companies with which he has been connected and the industry at large, and extented to him the most cordial wishes of all his friends for success in the new and important work in which he is so soon to become engaged. The remarks of Mr. Allen formed a most graceful tribute to the guest of the evening to whom they were addressed, and were most enthusiastically received. At their close the speaker, in behalf of those present, presented Mr. Stanley a handsome fob and Jurgensen watch as a perpetual reminder of his friends and experience in America. Colonel Sterling, of the Public Service Corporation, followed Mr. Allen. He referred to the unavoidable absence of President McCarter, but said that he voiced the sentiment of the latter, as well as all of Mr. Stanley's other associates on the Public Service Corporation, in the high tribute which he paid to him as a man and to his ability as a manager.

The committee had arranged for no formal speeches at the banquet, and the menu card bore no names of speakers, nevertheless, at the close of Colonel Sterling's remarks, Mr. Allen called upon a few among those present to say a few words. Among those who spoke were Frank Bergen and Howard MacSherry, of the legal department of the Public Service Corporation, who represented Mr. Stanley's late associates in the operating department of that company; James H. McGraw, of the Street Railway Journal, who spoke as the representative of the technical press, and Charles G. Castle and Daniel M. Brady, who represented the manufacturers. Mr. Stanley was the last speaker of the evening. He was greeted with great applause and responded to the many wishes for his success in an acceptable and graceful manner.

The occasion was one of the most delightful in all its appointments of any of the kind which has been held in New York and was a striking evidence of the worth and regard in which the late railway manager of the Public Service Corporation is held by his fellow railway men. The committee in charge of the banquet were: Col. E. W. Hine, assistant to president Public Service Corporation of New Jersey; C. Loomis Allen, vice-president and general manager, Utica & Mohawk Valley Railway Company; J. N. Shannahan, general superintendent, Fonda, Johnstown & Gloversville Railroad; Frederick V. Green, Westinghouse Air Brake Company, and Charles G. Castle, vice-president, Hildreth Varnish Company.

NEW PUBLICATIONS

"Electric Railway Engineering." By H. F. Parshall and H. M. Hobart. New York: D. Van Nostrand & Company, 1907. 475 pages. Illustrated. Price, $10,00.

This is the most voluminous book published on the subject of electric railway engineering, and like others written by the same authors is in royal octavo form and a fine specimen of typography. The extent to which electricity is being applied to heavy electric traction is given as one reason for the publication of the work at this time, but in this connection the authors sound a note of warning that "except in the case of exceedingly dense and heavy traffic the cost of working by electricity will apparently for a long time to come be greater than that of working by steam." This may perhaps be based upon the opinions of the authors in regard to the commercial possibility of the alternating-current motor, because on this point they say:

> In our judgment, the limitation of the alternating-current motor is fixed, in its relation of energy output to weight, by the inherent properties of single-phase commutator apparatus, and the limitation of the continuous-current motor will be determined by the maximum safe voltage at which a commutating machine can be worked. While the development of each class of machine has advanced beyond the point that could reasonably have been foreseen, and while, in our judgment, it is impossible at the present time to predict where the limitations will be reached, we are satisfied that a careful comparison of the two types at the present time is decidedly to the advantage of the high-tension, continuous-current motor.

The primary mechanical advantage of electrification over steam is considered "the ability to apply power to as many axles as may be necessary to secure the best mechanical results."

The work as a whole is divided into three parts, viz.: (1) The Mechanics of Electric Traction. (2) The Generation and Transmission of the Electrical Energy. (3) The Rolling Stock. Part I. considers tractive resistance, acceleration, motor characteristics, etc. In the first chapter all of the well-known formulæ on train resistance are quoted. That of Mr. Aspinall seems to be the one the authors prefer, although they consider there is a lack of reliable data upon the subject. Some interesting figures are given as to the tractive resistance in tube railways, and from the Central London Railway the authors have obtained results represented by the formula:

$$\text{Resistance in pounds per ton} = 6 + 0.5 \frac{V^2}{W},$$

where V is the speed in miles per hour and W is the weight of the train in metric tons. As will be seen the length of the train is immaterial. For some plotted results of a 130-ton Central London train on the surface, as compared with operation in tubes, the additional resistance, due to the tube, varies from 3 lbs. per ton at 8 m. p. h. to 2 lbs. per ton at 30 m. p. h. These figures are based on level track, but on the Central London the use of accelerating grades at starting and of retarding grades at stopping contributes, according to the authors, as much as one-fourth of the energy supplied to the train.

The chapter on acceleration opens with the "useful rule," discovered by the authors, that on a level track a tractive force of 100 lbs. per metric ton, in addition to the force required to overcome the tractive resistance, imparts to a train an acceleration of 1 m. p. h. per second. This does not make allowance for the rotational energy of the wheels and armatures, which is from 3 to 7 per cent of the whole kinetic energy of the train, so that practically the rule is equally adapted to the ordinary ton. As the metric ton (which is taken as 2200 lbs.) is used frequently throughout the book, with all the other dimensions in the English system, we assume that the authors favor its use in some instances as a compromise between American and English methods. They then take up, in a clear manner, the theory of acceleration with its application to different schedule speeds, and discuss the various forms of curves previously considered by Messrs. Armstrong, Gotshall, Carter and others. An acceleration and retardation of 2 m. p. h. per second is usually assumed, although the authors give curves obtained in practice in which as high an acceleration as 3 m. p. h. per second was obtained. In their general treatment of the subject of tractive force they offer an interesting endorsement of the regenerative control system when used on a relatively high schedule speed with frequent stops; more so in fact than for commercial systems of regeneration, for after referring to the "brief periods of notoriety which these systems enjoy, prior to disappearing from the scene," they remark that "their inventors, or rather the exploiters and their technical staff, have not themselves yet arrived at a clear understanding of the matter."

The efficiency of different control systems and the relation of number of station stops to a maximum and average speed under different maximum and average rates of acceleration are considered in detail. In connection with the latter subject the authors have succeeded by plotting as abscissæ (schedule speed in miles per hour) $\times$ (stops per mile), and as ordinates (kilowatts per ton) $\times$ (stops per mile)^2 in reducing Mr. Armstrong's well-known curves on the effect of frequent stops in high-speed railroading (see STREET RAILWAY JOURNAL for Jan. 19, 1904, page 70) to a single curve. The authors warn the reader, however, that their treatment of the subject is based on d. c. motor performance, and the greater weight, lower efficiency and presumably poorer commutation performance of the single-phase motor without rapid acceleration would affect the result so far as that type of machine is concerned. This matter is considered important in suburban work, where the use of accelerating rates of 2 m. p. h. per second or so are desirable.

The second part of the book, or that relating to the generation and transmission of electrical energy, is divided into four chapters, viz.: the high-tension transmission system, the sub-stations and the distributing system. In the first the general principles of station construction are reviewed, diagrams are given of typical installations and the cost of operation of various stations is compared. The transmission chapter is devoted principally to city distribution, as the reference to aerial lines is slight, and the recommendation of restriction of the voltage to 11,000 would indicate. The chapter on sub-stations opens with a very interesting discussion of the relative cost of motor generators and rotaries, in which the authors favor the former from economical grounds except where the transmission is short and the voltage drop small. Further on storage batteries and sub-station layouts are considered. In the chapter on the distribution system the third rail, overhead system and track return are in turn discussed, the former with especial completeness.

The part of the book on rolling stock is devoted almost entirely to heavy electric traction. After a description of the different well-known forms of geared and gearless locomotives the authors discuss the relative weights and costs of different types of equipments. This leads up to a comparison of types in which the authors refer to the high-voltage d. c. system as greatly neglected. Upon this point they say:

> High-tension continuous-current railway motors are already on the market, and it is the writer's belief that half the sum spent in developing the single-phase commutator motor to its present condition (in which it still remains less efficient, more bulky, and less satisfactory in several respects than the 600-volt continuous-current motor) will result in the development of thoroughly satisfactory high-tension continuous-current motors. These motors will be as efficient and as light for a given temperature rating and a given speed as the present standard 600-volt motors. The commutation will be better. As traction motors increased in size they were designed successively with five, four, three, two, and finally one turn per segment. Beyond that point, the commutation difficulties with increasing capacity can only be met with reversing poles, or their equivalent. Going up to 1500 volts and higher it will again be practicable in motors of large capacity to improve the commutation in virtue of the decreased current, and, when, in addition to this, reversing poles are employed (in the cases where they are suitable), there need be no apprehension that commutation will present any difficulties. Indeed, the commutator of a 1500-volt, continuous-current motor will be much shorter than that of a 600-volt, continuous-current motor, since the current to be collected is so much less. The total brush surface will be correspondingly reduced. Thus a greater space between wheels may be devoted to armature and winding, and motors of larger capacity will be practicable for a given driving-wheel diameter and gear ratio. In other words, the limiting areas will become larger. The very slightly increased space necessary for high-voltage slot insulation will be an almost negligible factor as affecting the bulk of the motor for a given rated capacity when this rated capacity is a matter of 100 hp and upward. If, on the other hand, we turn our attention to the single-phase commutator motor, we find it in possession of over twice as large a commutator (as this is for 250 volts) as its 600-volt, continuous-current equivalent. This alone takes away valuable space between wheels, and leaves a less available width for the armature. As, however, the latter also is large for its rated output (for equal rated speeds), the areas are, for single-phase commutator motors, very restricted, indeed. There will be a tendency to keep down the dimensions by employing a higher rated speed and ratio of gearing. This means, in motors of high rated capacity, serious losses in gearing and rapid deterioration of gearing. It is also unfavorable for commutator and brushes. There thus appears good reason to anticipate better results from high-voltage, continuous-current traction than from single-phase traction with commutator motors.

This opinion does not prevent a full description of the different types of single-phase and polyphase motors in use. Subsequently a comparison of construction and operating cost is worked out on the 1300-volt d. c. and 20,000-volt single-phase system. The example selected is that used by Mr. Lincoln in his Canadian Engineers' paper (Street Railway Journal, Dec. 12, 1903), and a very satisfactory economy for high-voltage d. c. construction is the result. These quotations from Messrs. Parshall and Hobart's book of high-voltage d. c. and a. c. motors, are not given because they form a prominent portion of the volume or because they interfere with a full treatment of all of the different systems. They do neither. But they are given on account of the extent to which the same subject has recently been debated in this country. A chapter on trucks completes the volume.

The volume is certainly a very important addition to the literature upon the subject and reflects great credit on both authors and publishers.

"Report of the Third Annual Convention of the Iowa Street and Interurban Railway Association." Published by the Association. 123 pages.

Although the Iowa Association is one of the youngest of the State associations, being organized in 1904, the report of its Des Moines meeting in April, 1905, indicates an enthusiasm and readiness for work worthy of emulation. Six papers in all were presented at the convention, and the resulting discussion was extremely instructive. The association is to be congratulated both on the meeting and the report.

"Long Distance Electric Power Transmission." By Rollin W. Hutchinson, Jr. New York: D. Van Nostrand & Company. 345 pages. Illustrated. Price, $3.00.

The importance in the commercial world which the construction of long distance electric power transmission plants has assumed has brought forth a wealth of literature on this subject. The author of the present volume has gathered together the principal facts in connection with both the hydraulic and electrical features of the problem and has put them in concise and readable form. Examples are given of the methods of making the main determinations necessary, and each chapter concludes with a bibliography of the subject treated.

WORK ON THE DENVER & INTERURBAN SYSTEM

The Denver & Interurban Railroad Company, which was incorporated to build an electric line in Northern Colorado, at present is constructing a line from Denver to Boulder, the entire length of which is 44 miles. Sixteen miles of this is a new line, on private right of way, and entirely independent of the steam lines. At Louisville Junction, however, 16 miles from Denver, the electric line is connected with the company's present steam line, operated under the title of the Colorado & Southern Railway, and runs over the same track to Boulder, and from Boulder, by way of the loop, back to Louisville Junction.

The company is not constructing its own power house, but will purchase power from the Northern Colorado Power Company, located at Louisville, which is about half way between Denver and Boulder.

The line will be overhead construction, poles on one side, with brackets and suspended catenary construction. The trolley line will be alternating current, 11,000 volts.

At Denver city limits, this line connects with the Denver Tramway Company's tracks, and from the city limits into the heart of the city will run over the tramway tracks, transferring passengers to all parts of the city, the tramway being overhead construction, direct current. The company expects to install its service about Dec. 1, of this year, and will purchase ten motor cars and six trailers, cars to run in multiple. Plans for these cars are not yet perfected, but they will be 56 ft. in length, 9 ft. in width, seating capacity of sixty, except the combination cars, which will carry baggage compartments. Cars will be equipped with four 125-hp a. c. motors and Baldwin trucks.

In addition to this line, the company also is constructing a street railway in the city of Fort Collins, building this year about 7 miles of line. The power will be furnished by the Northern Colorado Power Company, delivered to the company's street-car house in Fort Collins at 60,000 volts and there converted. Contracts have been placed in Denver for four motor cars, and two additional motor cars and four trailers will be purchased in the East.

STREET RAILWAY PATENTS

[This department is conducted by Rosenbaum & Stockbridge patent attorneys, 140 Nassau Street, New York.]

UNITED STATES PATENTS ISSUED MARCH 19, 1907

847,304. Toboggan Slide; Orcenith F. Allen, Temple, Tex. App. filed July 2, 1906. A pleasure railway or toboggan slide formed of a plurality of sections detachably secured together, whereby the slide may be quickly set up for use and readily knocked down and compactly assembled for transportation.

847,337. Electrical Rail Bond; Alonzo F. Hooton, Greenfield, Ind. App. filed May 24, 1906. A sheet metal plate is cut and bent so as to closely fit upon the adjoining rails beneath the fish-plates which connect them.

847,400. Rail Joint; Sterling H. Campbell, Detroit, Mich. App. filed Nov. 8, 1905. A combined fish-plate and chair-plate and a wedge-plate adapted to be interposed between the chair-plate and the rail base, the chair-plate and wedge-plate being adapted to extend across the rail base from side to side thereof.

847,437. Car Fender; William Pickett, Lynn, Mass. App. filed Feb. 8, 1906. A car fender having a main supporting strip with downwardly extending arms integral therewith, in combination with a pivotally secured frame, one extremity of which is provided with an upwardly extending arm adapted to engage with a latch held normally in position by a spring.

847,453. Ice Remover; Gerald P. Ayers, Chicago, Ill. App. filed April 30, 1906. A power-operated hammer carried by the car truck directly above the third rail and means for operating said hammer to force it downwardly into close contact with the top of the rail.

847,559. Binding for Car Trap Doors; Oliver M. Edwards, Syracuse, N. Y. App. filed March 5, 1904. A binding for the trap doors of car platforms to preclude wedging in damp weather, said binding tapering in thickness from one edge toward the other and adapted to be applied with the lessening thickness extending toward the under side of the platform.

847,642. Rail Tie; William E. Boyles, Grafton, W. Va. App. filed July 11, 1906. Means for fastening the rail to a metal tie of peculiar construction.

847,701. Trolley and Crossover; Fredrich Schmunk and Paul B. Schmunk, Beaver Falls, Pa. App. filed July 10, 1906. The harp has upwardly projecting arms with rounded shoes closing over the trolley wire at their extremities. These separate by their resiliency in passing hangers, etc. An arch-shaped frame supports conductors crossing at right angles.

847,711. Fluid Pressure Brake; Henry H. Westinghouse, Pittsburg, Pa. App. filed April 1, 1903. Provides means for maintaining the train-pipe pressure substantially constant at whatever point it may be intentionally reduced at the engineer's brake-valve for applying the brakes.

847,732. Car Replacer; William Cook, Hoboken, N. J. App. filed Jan. 14, 1907. Consists of a block adapted to be applied to the side of the rail and presenting an inclined face extending upwardly from the inner edge of the rail-head and having shoulders projecting upwardly from said face near the ends of said body, said shoulders being adapted to deflect a wheel off of said inclined face onto the rail-head, and means for guiding a wheel onto said block.

847,743. Current Controller; Richard Duckworth, Preston, England. App. filed Jan. 3, 1906. A form of mechanically actuated switch for sectionally energizing the third rail of an electric railway while the train is passing. A tappet adjacent the track is mechanically depressed by the wheel flanges of the train.

847,745. Metallic Railway Tie; Alexander Durand, Toledo, Ohio. App. filed Dec. 24, 1906. The tie is of inverted U-shape in cross section and recesses are provided in the top of greater width than a rail base, said recesses each having like walls thereof grooved to engage like flanges of different rails, and a clamp secured in each recess and co-operating with the groove to retain a rail in its seat in the recess.

847,780. Railroad Tie; Joseph H. Jennings, Middleway, W. Va. App. filed June 5, 1906. A tie comprising a top plate having oppositely disposed depending side walls at its ends, and inwardly extending overlapped flaps carried by the walls, said overlapping flaps being punched one into the other to prevent separation thereof.

847,783. Railway Tie; Henry S. Kilbourne, Nashville, Tenn. App. filed April 5, 1906. A reinforced concrete tie embodying means for effectually insulating the rails.

847,808. Fare Register and Recorder; Wilfred I. Ohmer, Albert J. Kirchner, Dayton, Ohio, and John W. Hill, Providence, R. I. App. filed Dec. 16, 1905. Details of construction.

847,905. Electric Signal System; Eugenio Chouteau, Jr., St. Louis, Mo. App. filed Oct. 24, 1906. A trolley wire is mounted upon the web of the rail and is adapted to be engaged by a specially constructed trolley wheel or shoe depending from an arm on the train. The purpose is to complete signal circuits within the locomotive cab. Has resistance bonds at intervals along the track.

847,931. Switch; Oscar S. Gage, Tecumseh, Okla. Ter. App. filed Feb. 23, 1907. A tappet at the end of the switch point is engaged by a shoe on the car platform to throw the switch.

847,936. Air Brake Mechanism; Alva L. Goodknight, Council Bluffs, Ia. App. filed Nov. 21, 1906. One of the objects of this invention is to secure a graduated release of the brakes throughout the entire length of the train and to provide means whereby when full release pressure is turned on by the engineer's brake-valve the brake on the rearmost car of the train will be fully released while the brake on the head car will be only partly released.

847,937. Insulated Rail Joint; George L. Hall, New York, N. Y. App. filed Oct. 22, 1906. The fish-plates have sections dovetailed together and sheets of insulating material are clamped between the sections. Bolts with insulating bushings are used for clamping the plates on the rails.

847,989. Trolley Wire Crossing; James N. Hayes, St. Louis, Mo. App. filed Jan. 29, 1906. A trolley wire crossing employing two castings mortised together with depending rails which guide the trolley wheel in passing. Has a pyramidal stud at the center which guides the wheel in passing across the usual gap thereat.

PERSONAL MENTION

MR. A. V. SCHROEDER has resigned as division superintendent of the Illinois Traction System at Decatur, Ill., to become general manager of the La Crosse Water & Power Company, of La Crosse, Wis., which is building a line between La Crosse, Wis., and Winona, Minn.

MR. S. L. VAUGHAN, of the Grand Rapids, Grand Haven & Muskegon Interurban Railway has been appointed traffic manager of that line. Mr. Vaughan, for the past year, has been auditor of the road, and prior to that was traffic manager of the Barry line of steamers plying between Muskegon, Grand Haven and Chicago. He was for a number of years connected with the Pere Marquette Railroad.

MR. C. M. BAYNE, who was with the Detroit & Ypsilanti Electric Railroad Company for some time, has been appointed master mechanic and superintendent of motive power at the power house of the Northern Ohio Traction & Light Company, in Canton. He succeeds William E. Ralston, who resigned some time ago to accept a similar position with the Buffalo & Erie Traction Company, at Fredonia, N. Y.

MR. M. INOUYE, manager of the Kwansai Railway Company, Japan, is on a visit to the United States to look into the subject of electrification of steam railroads. He is accompanied while in this country by Prof. Ogura, of the University of Kgoto. Mr. Inouye will return to Japan by way of the United States after visiting Europe. The Kwansai line is at present equipped with steam locomotives, but the matter of changing to electric traction is now under consideration.

MR. ALEXANDER K. CUTHBERT has been appointed agent of the express department of the United Traction Company by Traffic Manager Charles H. Armatage. This is the position which Mr. Armatage held before his appointment as traffic manager. Mr. Cuthbert has been connected with the express department of the Traction Company as cashier for about thirteen years. Previous to that he was with the General Electric Works, at Schenectady, and the Edison Electric & Illuminating Company, in New York, for ten years.

MR. JOHN C. REILLY, a director of the Pittsburg Railway Company, is dead. Mr. Reilly was born in Pittsburg in 1844, and was connected with transit development in that city from the time of the inception of the first horse-car line. In fact, it was while he was a member of the livery firm of Burns & Reilly that the omnibus line was established by that firm from which later developed the street railway system. Mr. Reilly, Mr. Bigelow and James D. Callery, the present president of the Pittsburg Railways Company, all were associated in the building of this line.

MR. I. R. NELSON, the retiring general foreman of the Public Service Corporation of New Jersey, was tendered a farewell dinner in Newark, Tuesday evening, March 26, by the shop foremen of districts Nos. 2 and 3 of the company and business associates and personal friends. Mr. J. R. Case was chairman, and Mr. Thomas Kelly, Mr. John Amberg, Mr. H. W. Wightman, Mr. J. Nichols and Mr. John Murphy were the committee in charge. Mr. Case, who is foreman of the South Orange Avenue shops, was the toastmaster, and Mr. J. G. Buehler, president of the Columbia Machine Works, of Brooklyn, acted as speechmaker in presenting Mr. Nelson with a silver set as a present from all of the shopmen in the districts mentioned. Mr. Nelson responded, thanking the men for the honor they had bestowed upon him and the help they gave him in making the mechanical department a success. Mr. Nelson, it is announced, will go into business for himself as a contractor, and in this capacity has already accepted from the Westinghouse Company a contract for equipping all of the cars turned out from the works of the John Stephenson Company for which Westinghouse apparatus is specified.

MR. THEODORE P. SHONTS, president of the Interborough Rapid Transit Company, of New York, was given a dinner by the Phi Kappa Psi fraternity at the Hotel Knickerbocker, Friday evening, March 23. Mr. Walter L. McCorkle was the toastmaster, and Mr. Guy Morrison Walker, of New York, formerly associated with the Everett-Moore syndicate, made the address of welcome. Mr. Walker welcomed the guest of honor to New York as "the man who can." He analyzed from the point of view of an expert the importance of transportation in the development of modern society. Mr. Shonts responded briefly, taking as his theme "Team Work." He told of his early days in the fraternity and its influence upon him. He drew a comparison between the good results obtained by a fraternity and the work of a large corporation. Mr. Shonts emphasized the fact that large corporations could be handled successfully only by the application of one of the first principles of fraternal organizations, namely, the thorough co-operation of persons in authority. Both, he said, called for the continual training of men fitted to assume high responsibilities and the willingness of those men to work with or under others as the cause might determine.

MR. R. E. DANFORTH, vice-president and general manager of the Rochester Railway Company, of Rochester, N. Y., has been appointed general manager of the Public Service Corporation to succeed Mr. Albert H. Stanley who, as noted elsewhere in this issue, sails for Europe April 1 to assume the management of the Underground United Railway Company, Ltd., of London. Mr. Danforth has been identified with traction interests since 1891, when he graduated from Cornell University. His first work was in the mechanical department of one of the constituents of what is now the International Traction Company. He continued with this company until 1901, serving for part of the time during this connection as superintendent of the system. In 1901 he was appointed to the position of general manager of the Lake Shore Electric Railway Company, a consolidation of the Lorain & Cleveland, the Sandusky & Interurban Railway and the Sandusky, Norwalk & Southern Railway Company. Mr. Danforth, however, was greatly handicapped in his work with the Lake Shore Company by lack of funds to place the road in a paying condition, and when the property was placed in the hands of a receiver at the time of the Everett-Moore embarrassment, his authority was curtailed considerably, so that his resignation followed on April 1, 1902, at which time he accepted the position of general manager of the Rochester Railway. Mr. Danforth expects to assume his new duties May 1. During the interval between Mr. Stanley's leaving and Mr. Danforth's taking up of his duties the responsibility for the management of the property will devolve upon Mr. George J. Roberts, the representative in the Public Service Corporation of the interests of the United Gas Improvement Company, of Philadelphia.

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Changes of advertising copy should reach this office by 10 a. m. Monday preceding the date of publication, except the first issue of the month, for which changes of copy should be received two weeks prior to publication date. New advertisements for any issue will be accepted up to noon of Tuesday for the paper dated the following Saturday.

Of this issue of the Street Railway Journal 8500 *copies are printed. Total circulation for* 1907 *to date* 114,650 *copies, an average of* 8189 *copies per week.*

Immediate Municipal Ownership Defeated in Chicago

To all appearances the traction question in Chicago has been settled for a long time to come. The beautiful theories of the advocates of municipal ownership did not appeal to the voters at last Tuesday's election as strongly as did the prospects of relief from the present miserably bad transportation facilities. As a result the voters have declared themselves in favor of progress, rather than of making themselves the subject of experiments by municipal ownership faddists. The traction ordinances were passed with a very comfortable majority, and now, according to the agreements embodied in them, the surface railway properties will be at once rehabilitated.

It is to be hoped that no other American municipality will ever be compelled to go through the experiences of Chicago. For ten years comparatively few improvements have been made in the surface traction facilities. The cars on a considerable number of the lines were ready for the scrap heap years ago. The tracks in most portions of the city are in as bad condition as the cars, and it will be necessary to rebuild them entirely before satisfactory service can be given.

The effects of extending good service over all parts of the city can hardly be anticipated. In the past the majority of the people to whom time and the certainty of reaching business at certain hours were important have been compelled to take up their residence either along the elevated lines or adjacent to the steam roads operating suburban service. The result has been that these sections of the city have been built up and rents and land values have consequently risen abnormally. The extension of adequate service to other sections will no doubt tend to cause an equalization of values throughout the city.

The cost to the city of the traction conditions during the past ten years can hardly be estimated. The continual litigation has been the source of thousands of dollars of expense, but the retardation of the growth and development of the city has of course amounted to a sum much greater. The experience has been dearly bought; but if other cities will profit by the lessons taught, the loss of Chicago may be the gain of other communities.

A Startling Admission

In a recently published letter, President Tuttle, of the Boston & Maine railway system, puts himself squarely upon record as inclined to throw up the sponge on suburban traffic and as ready to pass it over to the trolley lines. He intimates that the suburban traffic as conducted by ordinary railroads does not pay, and that the community is better served by trolley cars. He also emphasizes his belief that in the larger work of railroading electricity is a far more expensive motive power than steam. The position thus taken is curiously self-contradictory, since the trolley lines are undeniably making a profit in carrying passengers, and every suburban line that has changed to electric traction has bettered both its service and its business. If we understand President Tuttle aright, he holds that while short-distance passenger traffic can be handled better by electric power than by steam, freight business is an insuperable obstacle. This may be so, but is the gentleman willing to

put his belief into practice, and would his stockholders back him up in so doing? It has been for years a common practice for railway presidents to meet complaints of bad suburban service by saying that passenger traffic is generally conducted at a loss and is really done as a favor, but do they really believe it? The trolley lines about Boston would doubtless be glad to have the railroads throw up the sponge and quit. They would eagerly grasp the opportunity, but would the railroads really stand by and see them make the most of it? Electric railway men generally believe that they could profitably handle freight if the steam roads would give them a fair share of it. If the latter really believe that electric freight haulage would be at prohibitive cost, why do they so strenuously object to trolley freight franchises and block even passenger lines when they can? It would be amusing if the trolley lines really took President Tuttle at his word and started in to parallel his suburban system for an electric express service.

Safety in Electrical Operation

So much has been said in the daily and technical press in connection with the recent accident on the New York Central Railroad about the relative safety of steam and electrical operation, that it seems worth while to take a general, though brief, review of this important subject. An examination of the statistics of the serious accidents upon the trunk line railroads of this country will show that a large proportion of them are collisions, either head-end or rear-end, which no ordinary precautions seem able to avert. Just why engine drivers disregard danger signals at times is a very singular psychological problem, but nevertheless they do. It sometimes seems as though the mind, strained by long attention, passed into a sort of hypnotic state, in which it became blunted to ordinary impressions or misinterpreted them when received. It may be uncertain whether it was a green or a red light that flashed by, much as one may be in a brown study and forget whether he has or has not locked his desk. But the engineer cannot go back and look, and the real fact often breaks through into full consciousness too late to avert a catastrophe.

One of the common disadvantages ascribed to electrical operation is the lack of independence in the operation of the units, the possibility of a single failure in the system affecting many trains. Although this exists, it brings with it the exceedingly valuable power of instituting an absolute block system in which a train may be prevented from invading an occupied block by actual lack of motive power. So long as trains are run by self-contained and independent locomotives, just so long is it possible for them to be run beyond danger signals at a high rate of speed. The ingenuity of inventors has been exercised for years on absolute safety devices for use under these conditions, but while many of them have been approximately successful none is absolutely so.

With electrical operation every locomotive is dependent on the conducting system for power, and unless this is in a normal condition the locomotive is out of business. If it is necessary to stop a train which has run into danger the feeder switches can be made to do it at once, and, as pointed out by Mr. Murray in this paper last week, such a plan will be employed on the New Haven road. Undoubtedly this plan could be extended, if necessary, to keep dead sections of the working conductor ahead of and behind every train, or cautionary running can be imposed by dropping the working voltage by an amount that would very definitely indicate to the engineer that danger was ahead. If, for instance, the pressure suddenly dropped by a half, even the most blunted nerves would realize that something had happened. It is certainly no small thing to gain the possibility of an absolute and automatic block system in addition to the other and more fully understood advantages of electrical traction.

Something of this gain ought properly to belong to the large interurban systems now in existence, for they are far from being immune from serious collisions. It is on the big, through lines that are coming, however, that the greatest improvements are to be expected. They are upon a scale and with a density of traffic that make a positive block system a necessity. Automatic braking is another easy precaution along the same line of action. The rudiments of such a complete safety system have been well worked out and some of the essential features are already in very successful use. Certain it is that electric operation of railroads gives a possibility of safety precautions far beyond anything yet realized.

Behavior of Motors on Down Grades

The behavior of the railway motor when running at high speeds on down grades is frequently misunderstood, especially among trainmen and others not especially well versed in electrical subjects, however well they may be acquainted with the actual operation of the apparatus. The assertion is frequently made by such persons that under such conditions a car will run faster with the power off than with it on. This evidently is not possible. The direct-current railway motor is of the series type, in which the relation between speed and current approaches an inverse ratio, that is, as the speed increases, the current decreases. But let the speed increase to whatever possible value, the current, although it approaches a zero value, never reaches it. This remains true whether the motor itself is furnishing all the driving power, or part is being obtained from some outside source—in the case under consideration from the action of gravity on the car running down grade. Whatever current is passing through the motor is producing torque and aiding in the propulsion of the car. If the speed is very high, the current and torque may be very small, perhaps not enough to overcome the mechanical friction of the motor; but to the extent that it does exist, it is a help in propelling the car, and must therefore add to the speed. The idea that after a certain speed is reached there is a generator action of the motors is an erroneous one, as this is not possible with a series motor unless the armature connections be reversed with relation to the field.

This "generator action" is often wrongly given as an explanation of the cause of cars sometimes "bucking" or opening their automatic circuit-breakers when running at high speed down grade with the power on. It should be obvious that such an explanation is not correct, from the fact that the same conditions regarding speed, line voltage, etc., do not

always produce this effect. If a careful examination of the motors be made immediately after such an occurrence, evidence will nearly always be found of "flashing over" or arcing from brush-holder to brush-holder or from positive brush-holder to ground in the motor frame. It may be interesting to consider why this should occur most frequently when the car is running at high speed down grade. As the speed of the motor increases, the counter electromotive force increases, and at the same time, as the current decreases, the voltage drop across the fields decreases. Consequently, as the speed increases, the difference of potential between the brushes and between commutator bars increases. With the weak field existing at high speeds, due to the small current, commutation is worse than with a stronger field, and under such conditions, combined with the high peripheral speed of the commutator, the high voltage between brush-holders and that between commutator bars, flashing over is very likely to occur. With the speed further increased by the down grade, all of the conditions tending to cause such an effect are still further increased, so that some apparently trivial additional disturbance, such as the chattering of a brush away from the commutator, a little carbon dust across insulation, or a sudden variation in the line voltage caused by another car on the same feeder throwing off power, may constitute the last necessary factor, under the conditions, to cause the flashing over.

This flashing over of motors on long down grades occurs to a much greater extent on some roads than on others. In some cases it is so common that motormen are instructed always to descend such grades with the power off, while on other roads no attention is paid to the matter, as such trouble is rarely, if ever, experienced. The trouble is most likely to occur in cases where the grades are steep enough and long enough to produce speeds considerably in excess of that for which the motors are designed.

The Copper Situation

In spite of the recent recession in the price of copper stocks, the present situation so far as that metal is concerned is a very sinister one. Without any exceptional demand for copper in the way of new uses, the price of the metal has risen more than 50 per cent above anything that could be called a normal base price and has consistently stayed there. Nothing approaching it has ever been known, although the demand for copper has at times been rather suddenly increased. The causes operating to produce the result are difficult to analyze. There is, of course, immense activity in many lines requiring the use of copper, but one cannot put his finger on any causes that have not been operative before without any such startling results. Some have claimed that great stores of copper are being held for further rise, and that the increase in price has been largely artificial. It is quite possible that there may be a large amount so held, but the situation does not so far bear the earmarks of a successful corner. It looks very much as if the growth of the world's normal demand for copper has reached a point, hastened by several years of great commercial activity, at which the balance between supply and demand is pretty narrow. In other words, the condition is one which makes the price run up at very small cause—natural or artificial. Among the precious metals, platinum has been exposed to similar conditions, with similar results.

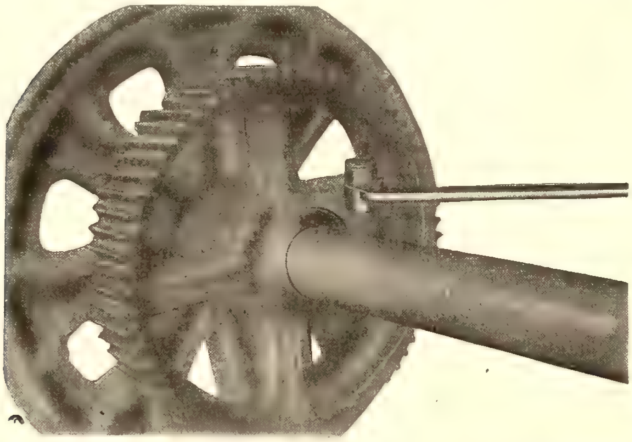
Unless, therefore, copper is more freely mined than now, or the demand for it is checked by the use of substitutes, the price may remain very sensitive to minor causes of fluctuation. Copper is very widely distributed, and many new mines are being opened, which, if they should produce largely, would have a considerable effect upon the market. There is great danger, however, that unless some remarkably rich and accessible mines are developed, the production will remain at a point where manipulation of the market will be too easy. Such a condition would be most disastrous in its effect on the industries that utilize large amounts of the metal, for they could never depend on stable prices. In the electrical industries the possibility that copper might at any time be pushed to 30 cents per pound would be very serious in planning for deliveries. The matter of substitutes for copper, therefore, becomes very important.

For electrical machinery as such no substitute seems to be available, since copper stands alone in its conductivity for unit volume, save for silver, an impossible substitute. But lines as we have time and again noted can very well be made of aluminum. When the basic patents expire in a few years there will be a great reduction of price and the battle with copper will be fairly on. We have before now discussed the use of iron conductors, chiefly as rails. At the present time conditions are not far off in which stranded iron cables may be used for direct-current service at a good profit. Heavy they certainly are, but they are likewise strong and can do good service when the price permits. At one-seventh or one-eighth the conductivity of copper, the economic advantage could be put on the side of iron with a comparatively small advance in copper. In subways and on elevated structures and in conduits filled with insulating compounds iron can even now be used to very good advantage. Certainly between iron for direct current and aluminum for general use there will be a perceptible check to the use of copper. Still more important is the general stiffening of working voltage to decrease the demand for copper. A new line going in at 40,000 volts instead of 20,000 or at 60,000 instead of 40,000 means a great saving with copper around 25 cents per pound. The rise in that metal has queered all calculations based on old prices, and Kelvin's law applied to-day would lead to some unexpected conclusions. Perhaps the rise in price may be of service to the world in revising antiquated methods and putting electrical distribution on a better basis of voltage. In the same way it will at the present rate soon be pertinent to inquire whether machines should not be redesigned. To a certain extent copper and iron are interchangeable in the design, and by extreme care in ventilation it is feasible considerably to reduce the amount of copper required.

The present exigency is hardly enough to produce at once such radical changes, but a continuance of present conditions is bound to bring them about. High voltage in distribution and high output for the copper—these are surely good things to aim at on general principles, and if they are hastened by the present situation one can well afford to view it with some degree of complacency.

SHOP PRACTICE AT HOT SPRINGS, ARKANSAS

Hot Springs, Ark., is located out of the regions where interurban lines throw shop men into frequent communication with each other, and as a consequence the devices and the practice in the shops of the Hot Springs Street Railroad Company possess more originality than is ordinarily found in the shops where the men have frequent opportunity to visit neighboring systems. All of the devices described



VIEW SHOWING THE APPLICATION OF THE GEAR WRENCH ON THE NUT

herewith were worked out by Edw. Hardin, superintendent of the system, and F. A. S. Williams, master mechanic of the shops.

GEAR WRENCHES

The difficulties of getting at bolts of split gears have been greatly lessened by the use of several special gear wrenches. The design of these wrenches is shown in an accompanying reproduction, while another reproduction shows how one of them fits on a bolt in a most difficult place. Most of the gear bolts may be gotten at with the double-headed wrench, but those bolts used with the Westinghouse No. 101 equipments require both right and left-hand wrenches. Difficulty

RIGHT-HAND, LEFT-HAND AND DOUBLE-END GEAR WRENCHES

of getting at gear bolts is greater than usual on this system because of the limited space occasioned by the narrow track, the gage being only 4 ft. 4 ins.

BABBITTING DEVICES

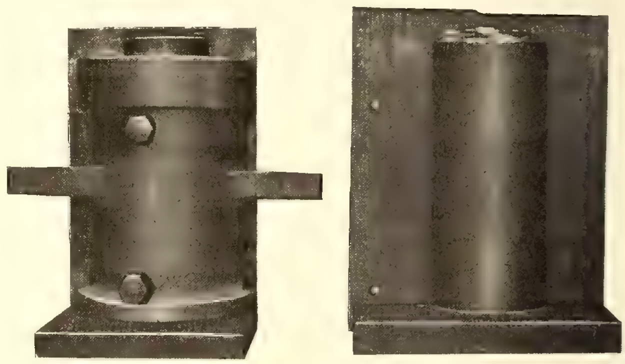
Bearings are babbitted in special devices made in the shops. The device for babbitting split bearings consists of a half mandrel bolted to a cast-iron angle. The half shell is held in the proper position and the metal is prevented running out by a heavy cast-iron cover which is clamped to the upright. Dowel pins in the upright assure the cover being placed in the proper position.

The babbitting device for commutator end bearings consists of a mandrel standing upright in a circular base and around which is clamped two half sections of a heavy cover, containing the brass shell to be babbitted. Bearings of the same general design and diameter, but which differ in length, are babbitted in one device. A reproduction shows

DEVICE FOR BABBITTING COMMUTATOR END BEARINGS

the ring which is placed on the base plate and around the mandrel when the shorter bearings are to be babbitted.

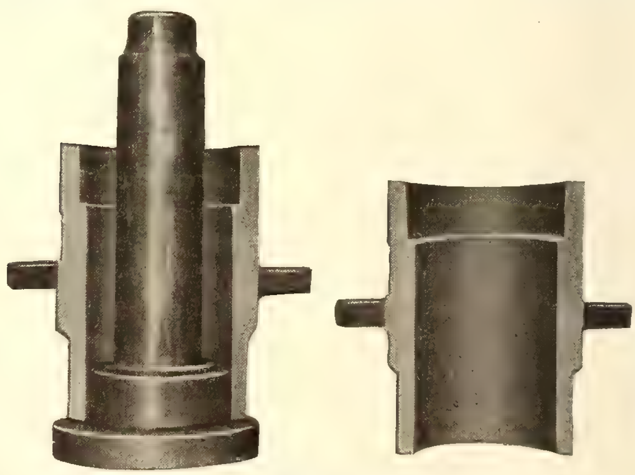
The location of the shop at quite a distance from manufacturing concerns and supply houses is partly responsible for the fact that bearing shells are cast in local foundries and finished in the shop. From seven to eight pairs of split



CONTRIVANCE FOR BABBITTING SPLIT-BEARING SHELLS

bearings and from twelve to fifteen sets of commutator end bearings are turned and finished per day.

Armature and axle bearing wear is very great in Hot Springs, due to the rock underlying the soil being of a



BABBITTING DEVICES: THE RING RESTING ON THE BASE PERMITS BEARINGS OF DIFFERENT LENGTHS TO BE BABBITTED

flinty, gritty nature. It is, in fact, the material from which the Arkansas whetstones are made. Troubles are increased through the fact that the road is narrow gage, and space is so limited between the wheels that there is only about ¼ in. clearance between the wheel and the end of the commutator bearing and other bearings are close to the wheels.

REMOVING AND REPLACING COMMUTATORS

A reproduction shows a device used in removing the commutator thrust collar previous to pulling the commutator. After the two half collars have been placed over the thrust collar they are bolted together and the end of the long screw is centered in the end of the shaft. By turning the screw with a wrench the thrust collar is pulled off.

Commutators are pulled on by a device which resembles somewhat that just described. It consists of two bars held together with rods of such a length that while one bar which has a hole bored in it large enough to fit over the shaft is placed over the commutator end of the shaft the other is held beyond the opposite end. Screwing up nuts shortens the rods and pulls the commutator into position. When putting them on, commutators are wound up with a blow torch before being given the final tightening.

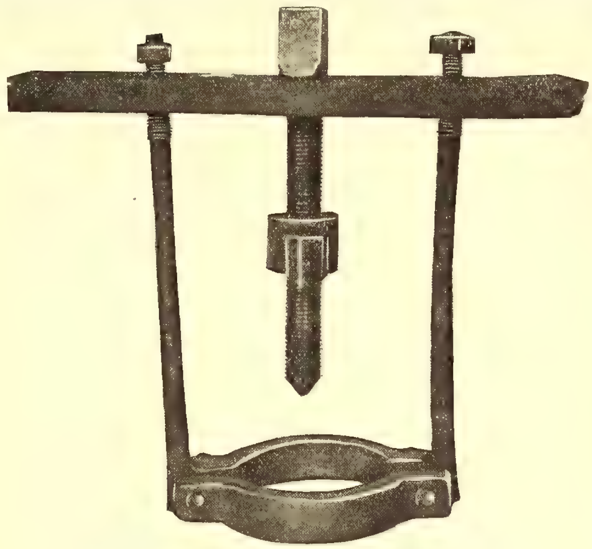
CHANGING ARMATURES

In changing armatures when the hinge pins are not removed it is the usual custom to employ a chain hoist suspended from a horse inside the car to lower and raise the lower half shell of the motor. This often results in marring the finish of the car more or less in getting the horse in and out of the car, and always results in a great deal of dirt being carried in the car by the workmen. To avoid these objections and to save time, the shell is raised and lowered in the Hot Springs shops by a special bar and a block and tackle, which remove the necessity of any one getting in the car or of lifting the trap doors. The bar is about 2½ ft. long. A hook on one end is engaged in that eye of the lower half of the shell nearest the hinges. The bar extends horizontally under the shell, and under the axle of the car and to its opposite end is hooked the lower block of a tackle. The upper block of this tackle is hooked to a bolt in one of the cross bridgings of the car. The man pulling the rope is in a position where he can see what is required and act accordingly instead of having to be told what to do as when operating a chain hoist in the car.

ONE STYLE OF ARMATURE TRUCK USED IN HOT SPRINGS

ARMATURE WAGONS

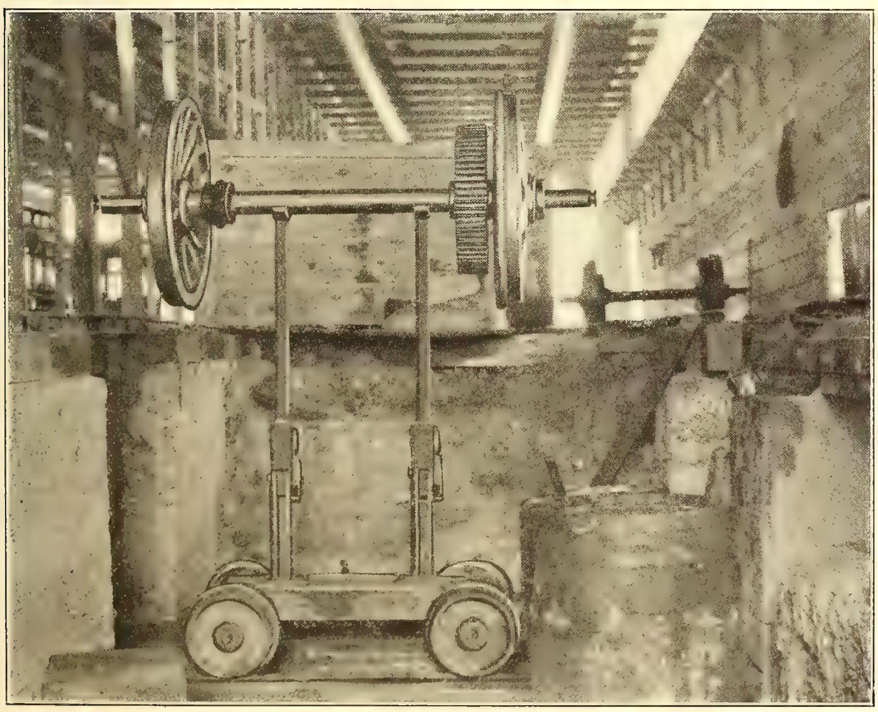
The shop is well provided with armature wagons and pit jacks, all of which were made in the shop. One type of wagon used is shown in a reproduction. A wagon of this type should be so made that when the handle is lowered the center of gravity of the armature falls on the side of the axle nearest the handle and prevents the wagon tipping up.



APPARATUS FOR REMOVING COMMUTATORS

CHANGING WHEELS

When wheels are to be changed, the car is placed on the track shown to the right of the accompanying illustration so that the defective wheels are over removable sections of the rails. The end of the car is raised by a jack placed under the center of the truck frame, and the rear of the motor is suspended from a screw-eye which in turn is supported by a long wood bar placed across the car floor. After the sections of the track have been removed the wheels are dropped down to clear the truck by means of two track jacks mounted on a small truck. This truck runs on a transverse track which extends under an adjacent track which has one movable rail section. After the wheels have been dropped the truck is shoved out from under the car and the wheels are raised. This one section of the second track is then removed and the truck is run under this track. The rail section is replaced and the wheels are let down on the track and run off the movable section. The new wheels are then placed on the jack, and after the one rail section has been removed they are carried under the car. The track for the wheel



DOUBLE JACK USED IN CHANGING WHEELS

jack is 54 ins. below the car track rails and is of 22-in. gage. The rams of the two Barret jacks on the truck are extra long and permit wheels to be raised or lowered 44 ins.

TRUCK FOR CARS WITH BROKEN AXLES

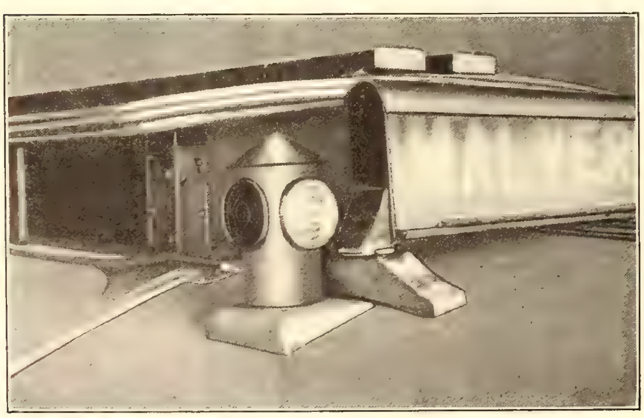
When a car with a broken axle is reported, three timbers and two pairs of small flanged wheels and axles, all of which, when assembled, form a truck, are put in a car and, together with jacks, are hauled to the disabled car. One

LAMP IN RECESS OF CONCRETE PIT

end of this car is then jacked up to raise the wheels of the disabled axle clear of the track, the truck is assembled, is placed under the platform to take the weight, and the car is then returned to the shop under its own power and without injury to the wheels.

PIT LIGHTS

In the construction of concrete pits in the shops, recently,



CAR SIGNAL LAMP WITH REVOLVING COLORED LENSES

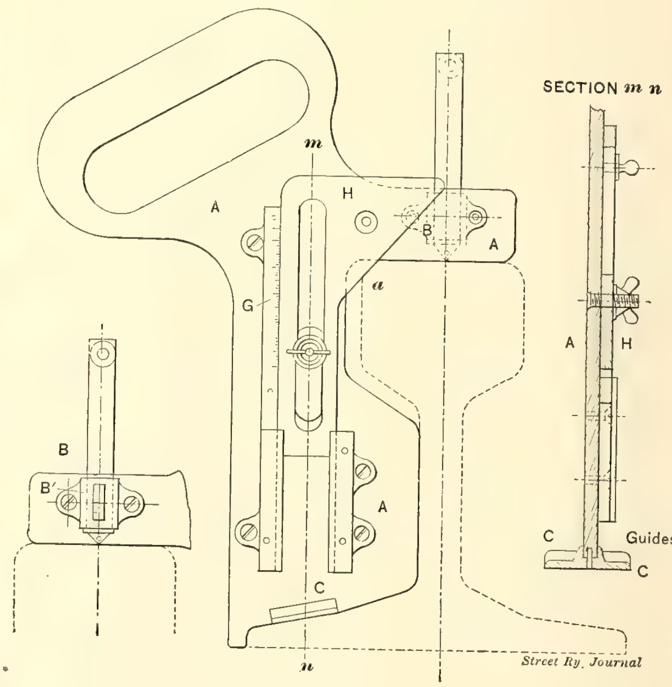
particular attention was given to the question of lighting them. The lights were placed at about 10-ft. intervals in recesses in the concrete immediately under the stringers supporting the rails. The bottom of each recess was slanted in such a manner that the light falling upon it is reflected up against the truck of a car over the pit. In laying the concrete circular loom, ducts were embedded in it for the wires between the lights.

CAR SIGNAL LAMPS

To enable passengers to distinguish the cars of different lines at night, in addition to illuminated signs, colored signals are used. The signal lamp contains four bull's-eyes of different colors and is so placed over an electric light that it may be turned when it is desired to show different colored lights. Three colors, red, green and white, distinguish the cars of the three different lines in the city, while the fourth color, yellow, is used for special cars. Mr. Hardin has applied for a patent on the idea of the revolving lamp.

GAGE FOR MEASURING RAIL WEAR

Messrs. Calvi and Perrot, track engineers of the Metropolitan Underground Railway, of Paris, have recently designed a micrometer gage for measuring the wear of rail heads and gage line. Its construction is shown in the accompanying design, which is reproduced from "Le Genie Civil." The piece *A*, which fits the contour of the base of the rail as well as the side of the web and top of the head,



PORTABLE GAGE FOR MEASURING RAIL WEAR, USED ON THE PARIS METROPOLITAN RAILWAY

is provided with a handle. The vertical wear is measused by the graduated screw *B*, which is threaded in the socket *B'*. The wear at the gage line of the rail is read by means of the sliding plate *H* and the scale *G*. This reading, of course, gives the resultant of the vertical and horizontal wear at this point, but as the incline at the corner of the rail is always at an angle of 45 degs. all readings can be corrected by the same constant. Both scales are provided with verniers. The gage has been found very useful on the Metropolitan Railway, where curves of 150 ft. radius are common and where the radius in some cases is as low as 93 ft.

THREE-PHASE LOCOMOTIVE WITH THREE RANGES OF SPEED FOR THE ITALIAN STATE RAILWAYS

BY BELA VALATIN

One of the objections most frequently raised against the use of the three-phase system of traction on main line railways is that in practical operation it is very often desirable for a locomotive to be capable of running at various speeds, but that three-phase locomotives possess only one main running speed. This latter claim is incorrect. The three-phase motor, like the direct-current motor, has only one running speed for any given draw-bar pull, but with the series parallel connection of direct-current motor or by using the cascade connection for three-phase motors, or by changing the number of poles, locomotives having two main speeds have been constructed. In the majority of cases two ranges of speed meet all practical requirements. It has also been proved theoretically that by a combination of the cascade connection and varying pole methods several ranges of speed can be attained with the three-phase locomotive. This plan, however, is not the only way by which more than two main speeds can be obtained with three-phase locomotives, as the following description of a large railway locomotive having three ranges of speed will show.

Toward the end of 1905 the Italian State Railways ordered from the Ganz Electric Company, Ltd., of Budapest, for their Valtellina line two electric locomotives, one of which was exhibited at the International Exhibition in Milan. These locomotives took the place of two electric locomotives which were taken from the Valtellina road and were put in service on the Simplon tunnel line. These new locomotives, as regards mechanical construction, are similar to those supplied previously by the Ganz Company and now used for the working of the Simplon tunnel, and a full description of them has already been published in these columns.* Electrically, however, they are different, as they have three ranges of speed. Unlike the previous type, which was equipped with two twin-motors and therefore really had four motors, these locomotives have only two motors, one of which has eight poles and the other twelve poles. Both motors are designed for high tension, viz: for 3000 volts at 15 cycles. When one or the other motor alone is in operation the two higher ranges of speed are obtained, while by connecting the two motors in cascade the third range or lowest speed is secured.

The connection of two high-tension motors in cascade

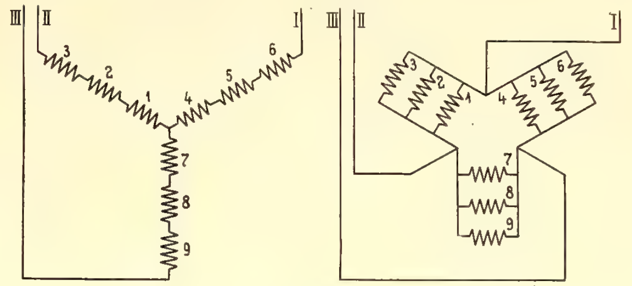
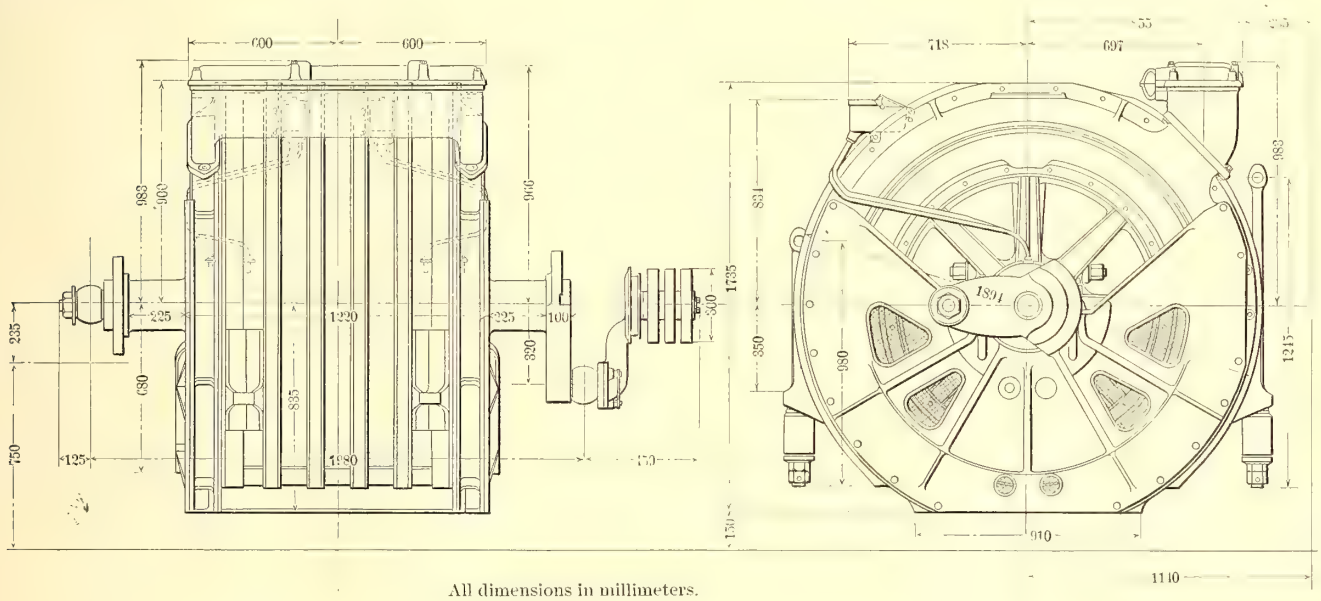


FIG. 1.—DIAGRAM OF CONNECTIONS OF WINDING OF 12-POLE MOTOR

presents some difficulties, because under normal conditions the high-tension part of the one motor would have to work on resistance. To avoid this an auxiliary transformer could be used during the starting. In these locomotives, how-



All dimensions in millimeters.

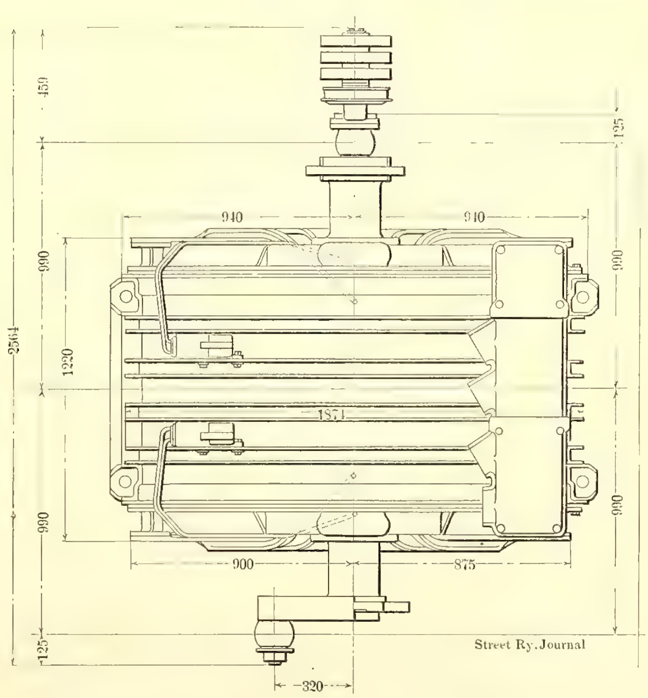


FIG. 2.—PLAN AND ELEVATIONS OF 12-POLE MOTOR

* See Street Railway Journal for Aug. 5, 1905.

ever, a method, proposed by Koloman de Kandó, was adopted, which with large motor sets is more advantageous than that mentioned, especially when frequent stops and starts are made, a condition which would necessitate an increase of the dimensions of the starting transformer.

The new method is as follows: When the two motors are connected in cascade the high-tension winding of the twelve-pole machine is arranged for a potential about one-fifth that of the normal high potential value. This is accomplished by a combination of the stator primary windings of the twelve-pole motor, which has three winding groups per phase, the eighteen ends of the windings being brought out from the motor. Fig. 1 shows the two combinations employed. When the stator primary is used for 3000 volts, the three coils per phase are connected in series and the three combinations of three coils are connected in star, as shown in the left-hand diagram in Fig. 1. For cascade connection of the two motors, the three coils of each phase of the primary of the secondary motor are connected in parallel, and the three combinations are connected in delta as shown by the right-hand portion of Fig. 1. As will be seen by this method, the initial tension of the winding decreases in the proportion of $\frac{1}{3 \times 53}$ or 1 : 5.2. It is possible then, by using 8, 12 or 20 poles, to obtain the three ranges of

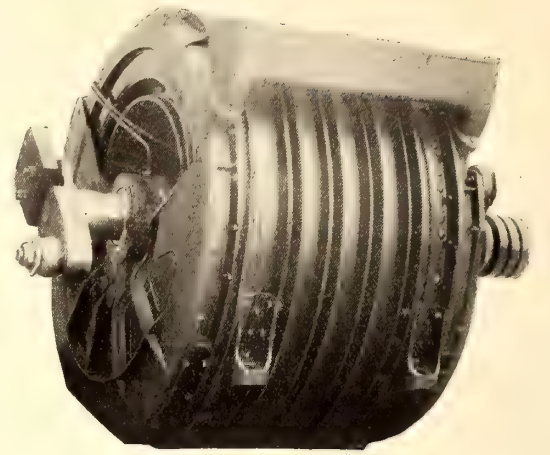


FIG. 3.—12-POLE MOTOR WITH STATOR FOR TWO DIFFERENT VOLTAGES—RATED CAPACITY, 1200 H. P.

speed of the locomotives of 64, 42 or 25.5 kilometers per hour.

As regards capacity, the locomotives at the two higher speeds have the same capacities as the locomotives supplied previously had at full speed, viz: a normal drawbar pull of 3500 kg. At the lowest speed they have the same capacity as the previous locomotives at half speed, viz: a normal drawbar pull of 6000 kg. This normal capacity is based upon

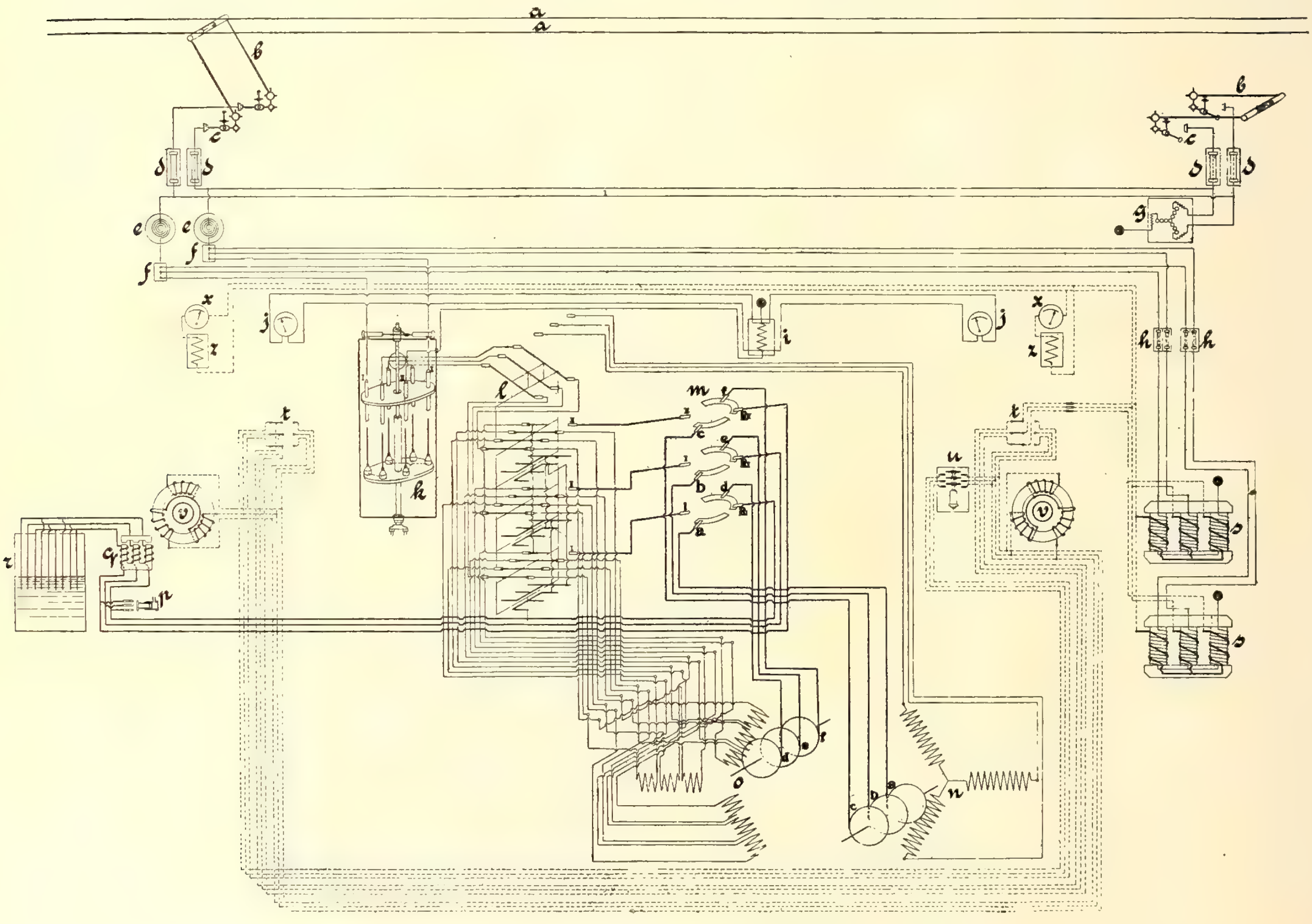


FIG. 4.—WIRING DIAGRAM OF THREE-PHASE LOCOMOTIVE

a—Trolley wires
b—Trolley
c—Trolley cut-out
d—Main safety fuses
e—Choking coil
f—Distributing box
g—Lightning arrester
h—Safety fuses of transformer
i—Shunt for ammeter
j—Ammeter
k—Primary switch
l—Motor commutating switch
m—Speed regulator
n—12-pole motor
o—8-pole motor
p—Short circuiter
q—Automatic governor of the rheostat
r—Water rheostat
s—Transformer
t—Hand switch
u—Switch governor of compressor
v—Compressor motor
x—Voltmeter
z—Additional resistance of voltmeter

the usual ten-hour rating test of the locomotive motors in the laboratory, during which the temperature of the motors does not rise above 60 degs. C. The motors have also a 50 per cent overload capacity for two hours and a 100 per cent overload capacity for a short time.

To provide amply for this overload capacity the motors have been dimensioned larger than called for by the specifications. The output per hour of rated capacity of the eight-pole motor for a rise of temperature of 75 degs. C. is about 1500 B. H. P.; that of the twelve-pole motor 1200 B. H. P.

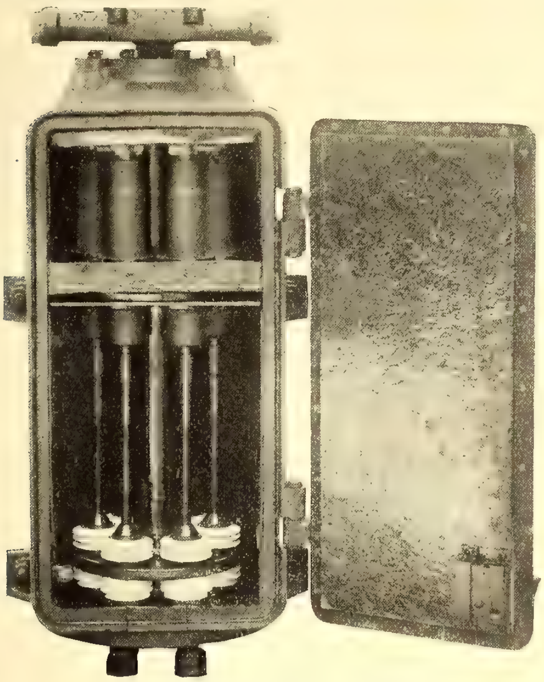


FIG. 5.—PRIMARY SWITCH

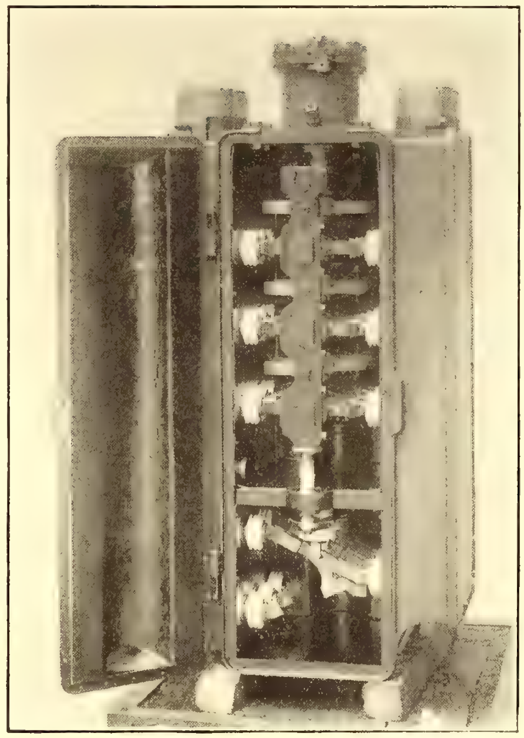
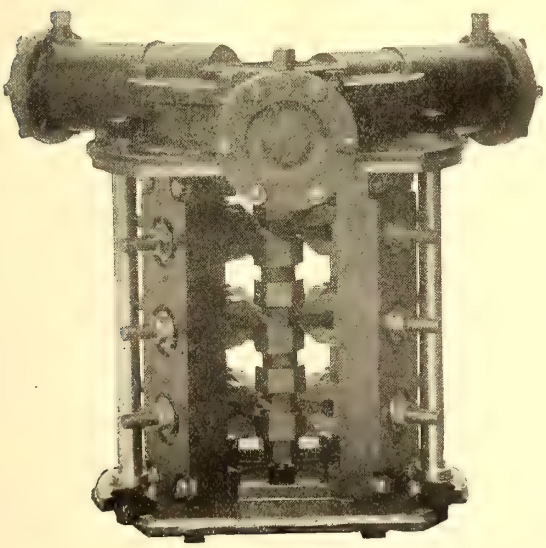


FIG. 6.—MOTOR COMMUTATING SWITCH



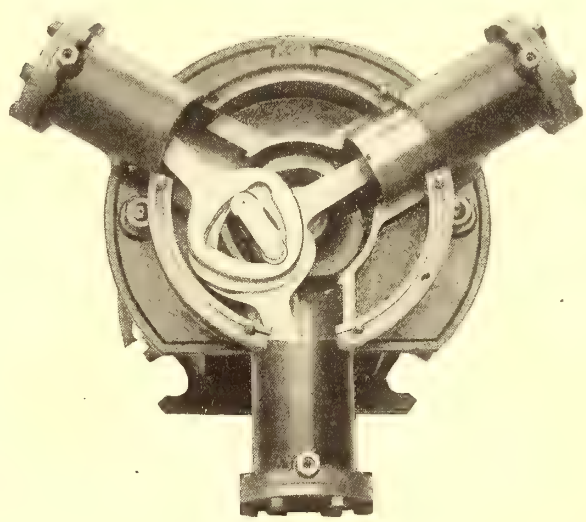


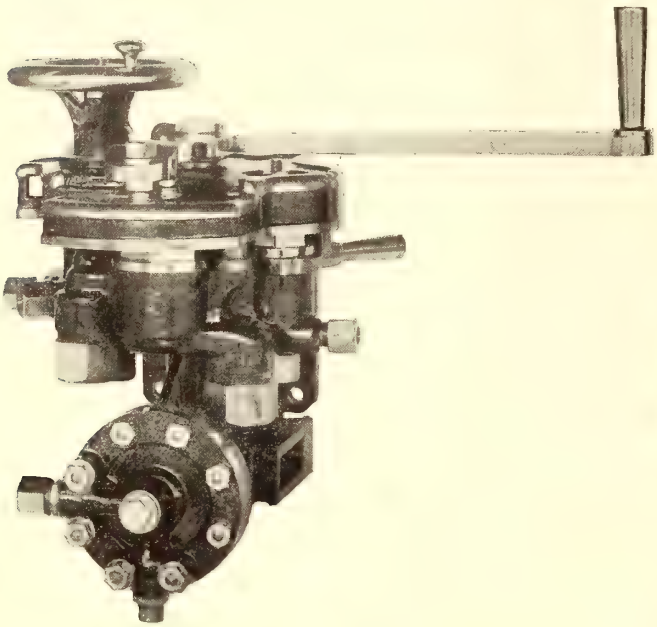
FIG. 7.—SIDE AND TOP VIEWS OF SPEED REGULATOR

The possibility of having three ranges of speed is advantageous in permitting the regulation of power according to drawbar pull and grades and starting with better economy, by reducing the losses in resistances. For this reason the resistances are smaller than with the two-speed locomotive.

The connections described above are equally well adapted for motors provided with an equal number of poles. In this case at full speed both motors can be connected in parallel and a very large motor capacity obtained at full speed. Under ordinary working conditions, however, this arrangement has no particular advantage because high speed is desired only when the tractive effort required is low. Under these circumstances it is better to use only half the number of motors. There are cases, however, when it is very convenient to operate the locomotive at half speed, such as at starting, during switching operations, etc., and in such cases the method of connections mentioned can be employed to advantage.

The motors as shown in Fig. 3 are of similar design to those used on previous locomotives. An interesting difference, however, consists in the fact that the frame is not a steel casting but is made up of steel sheets and U-iron. The slip rings, as in the former locomotives, are located outside the locomotive frame on the crank shaft. The brush holders, which are suspended from above, are protected by a sheet-iron casing opening sideways on hinges. Since every motor is complete in itself and is designed as a normal

three-phase motor, the disposition of the parts can be made to better advantage than with the previous motors, and the output per ton is also higher. The weight of the eight-pole motor is 13.4 tons and that of the twelve-pole motor 11.4 tons.



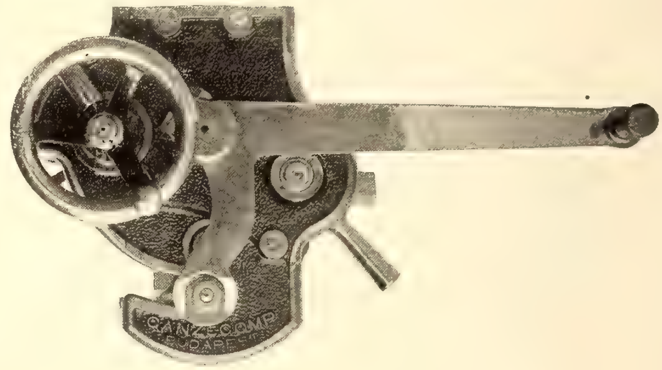


FIG. 8.—SIDE AND TOP VIEW OF MASTER CONTROLLER

As already explained, the stator of the twelve-pole motor is changed at cascade connection from high tension to low tension. For this purpose it is necessary to carry out from the motor eighteen terminals, which in view of the high tension used, requires a particularly careful construction. Fig. 2 is a drawing of the twelve-pole motor, from which the general arrangement of the wire terminals is apparent.

The arrangement of current collectors and regulating and starting apparatus, shown on the wiring diagram Fig. 4, is in general the same as with the previous locomotives. The current collector used is the double-roller, which has given excellent satisfaction in the operation of the Valtellina Railway and which, like the regulating apparatus, is actuated pneumatically. The lightning arresters, air compressor, switch governor, distributing box, etc., are the same as before. The construction of the primary switch, Fig. 5, is the same in principle, but in view of the higher demands upon it some slight changes have been made.

The new apparatus required are the motor throw-over switch and the speed controller, Figs. 6 and 7. The first serves for connecting the windings of the stator of the twelve-pole motor alternately for high or low tension. It is a cast-iron box containing a vertical shaft carrying two sets of knife contacts, leading to the motor windings and to the primary switch and speed controller respectively, and corresponding to the high and low-voltage connections. This shaft terminates in a piston which is actuated by compressed air controlled from the pneumatic master controller. The inside walls of the box are lined with micanite. The speed controller serves to connect the motors and starting resistances with one another corresponding to the three rates of speed. Accordingly three positions are necessary. The fixed contacts are arranged on vertical columns and the movable ones around a vertical shaft which is actuated by compressed air. Fig. 7 shows a side and top view of the speed controller. To bring the shaft into each of the three operating positions there are three air cylinders separated 120 degs. from each other, which turn the shaft according to the cylinder into which the air pressure is admitted.

The compressed air master controller, Fig. 8, has also been altered to correspond to the three ranges of speed. As will be seen from the wiring diagram, this locomotive has only one water resistance, Figs. 10 and 11, whose capacity is greater than previously used. This increase is secured by passing vertical pipes through the water for air circulation and cooling. By the use of this water resistance the current, and consequently the torque at starting, can be kept constant and as high as may be desired. Its operation has been highly satisfactory in continued service through many years.

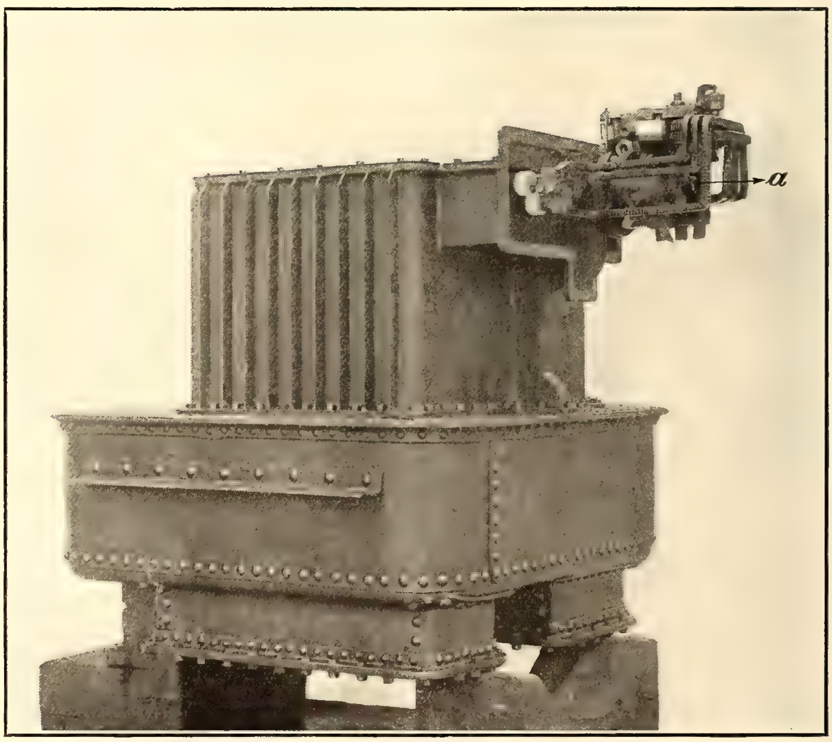


FIG. 10.—WATER RHEOSTAT

In the operation of mountain railways it very frequently

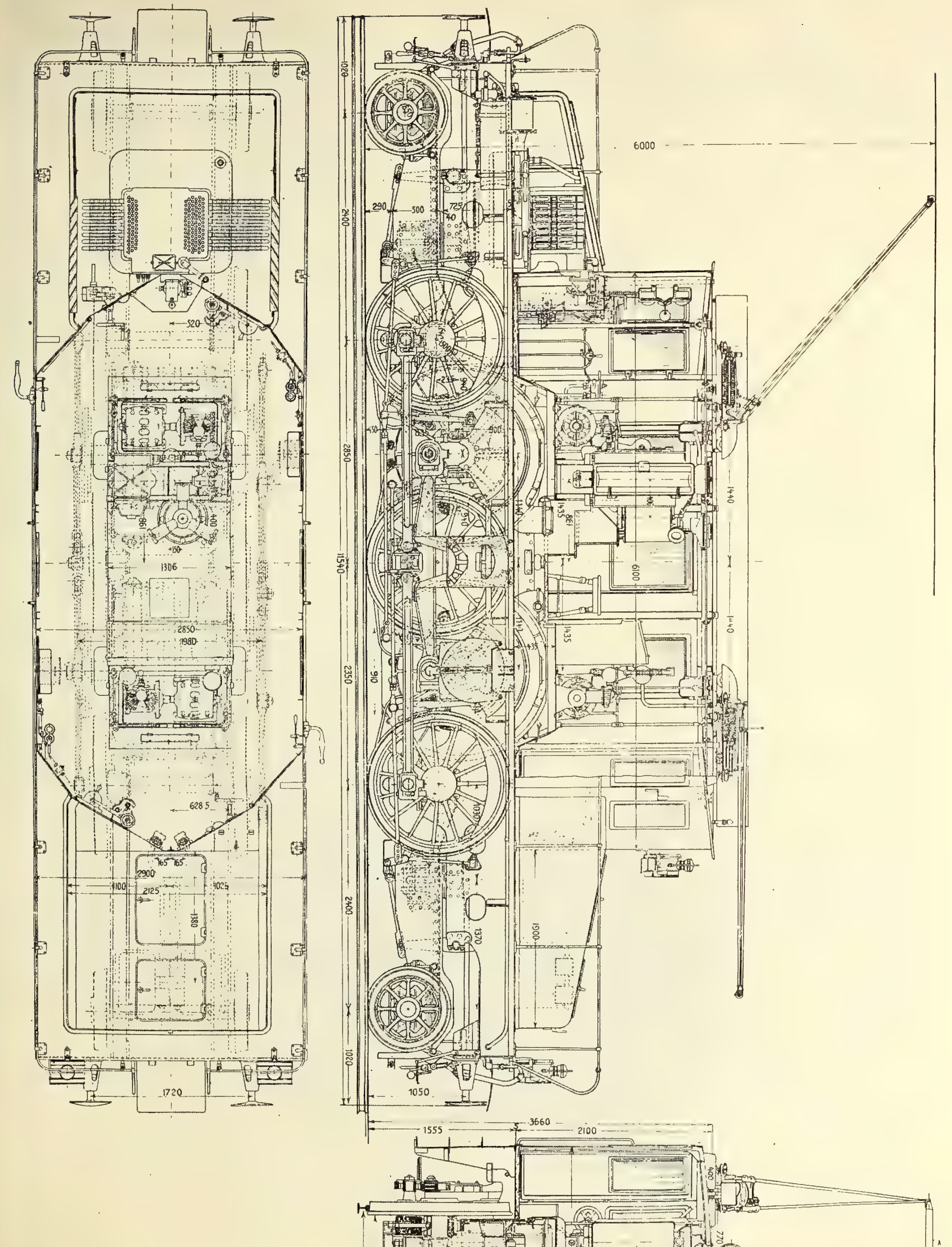


FIG. 9.—LONGITUDINAL AND CROSS SECTIONS AND PLAN OF NEW LOCOMOTIVE

happens that heavy freight trains must be provided with a pushing locomotive in addition to the locomotive at the head of the train. In such cases it is practically out of the question to connect the two locomotives on the multiple-unit system, since all the cars between the two locomotives cannot possibly be equipped with an electric train line. The two locomotives must therefore operate independently of one another and, as with steam operation, be controlled by signals. With the same types of locomotives and with exactly the same driving-wheel diameters an equal distribution of the load between the two locomotives is assured with three-phase current. With unequal driving-wheel diameters, however, the load would be distributed very unequally, owing to the fact that with three-phase motors a slight difference in the speed is accompanied by a great difference in output. Since differences of 2 to 3 per cent in wheel diameters may occur, and since the speed difference of three-phase motors between no load and full load is no more than this percentage, one locomotive in this double service may be fully loaded or even overloaded while the other would run without load or even work as a generator.

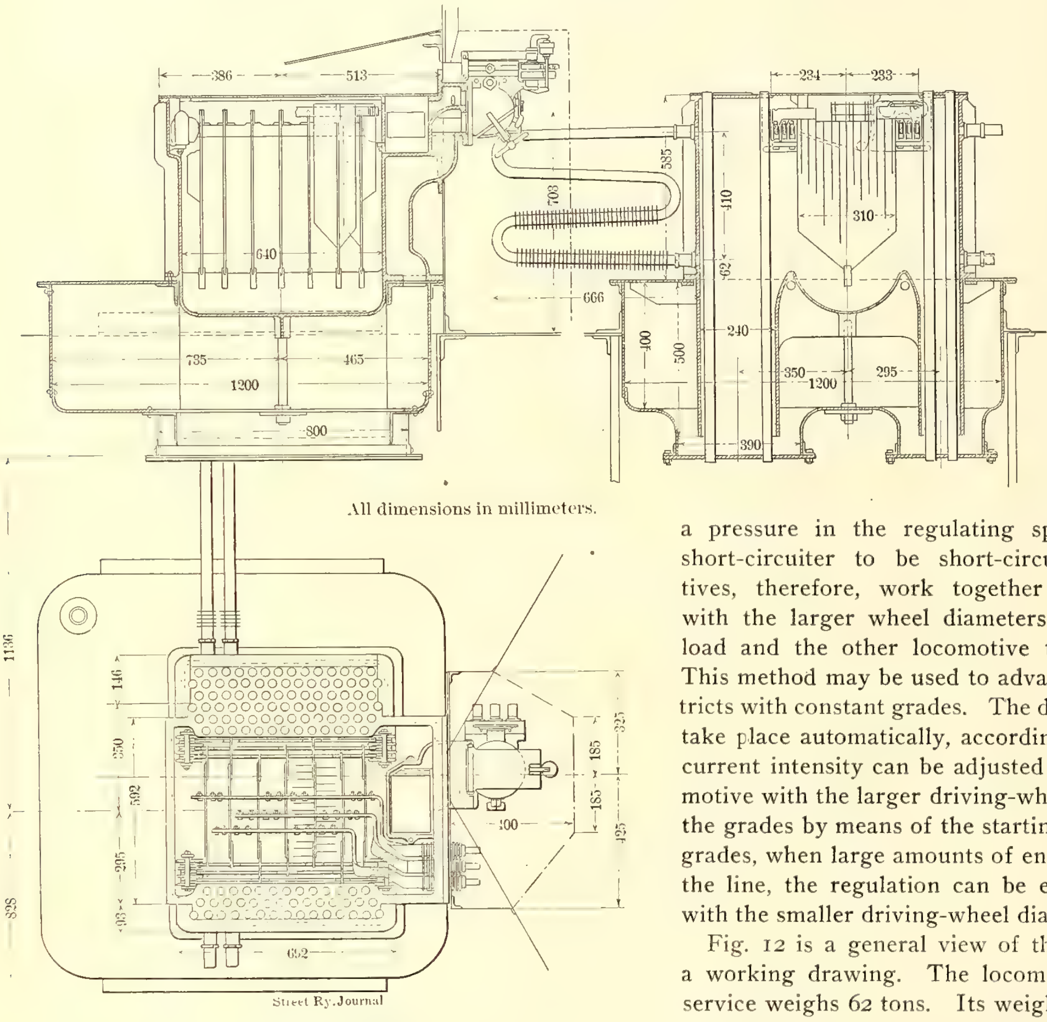


FIG. 11.—WATER RHEOSTAT

To remedy this defect a device has been used with success for the last three and a half years on the motor cars of the Valtellina Railway by which additional resistances provided with steps can be inserted in the rotors. In making up the trains the difference in the wheel-diameters is ascertained, and on the motor cars or locomotive whose wheel diameter is larger, a corresponding step of the additional resistance is inserted, so that at maximum load all motor cars or locomotives are about equally loaded. At other positions on the torque curve the load is not quite equally distributed but, as on all vehicles the load remains below the maximum, this is of no importance.

With the new locomotives, however, a very beautiful distribution of the loads can be secured on account of the use of one main water rheostate instead of the separate resistances. The height of the water in this rheostat depends upon the contraction between the air pressure and an electro-magnet in the regulating head. As many fine subdivisions as desired can be obtained, and so long as the short-circuiter does not short-circuit the secondary parts, every position of the starting lever corresponds to a constant current intensity in the motor and it is possible—by stopping the effect of the short-circuiter—to adjust at will the current consumption of the locomotive to accord with the larger driving-wheel diameters. For this purpose the water rheostate is provided with a smaller lever, shown at *a* in Fig. 10, by means of which the air inlet valve connecting the regulating space with the water space is lifted, so that there can never be such a pressure in the regulating space as would allow the short-circuiter to be short-circuited. The two locomotives, therefore, work together so that the locomotive with the larger wheel diameters is adjusted for constant load and the other locomotive takes the additional load. This method may be used to advantage in mountainous districts with constant grades. The distribution of load can also take place automatically, according to the profile, since the current intensity can be adjusted by the driver of the locomotive with the larger driving-wheel diameters according to the grades by means of the starting lever. On heavy downgrades, when large amounts of energy are being returned to the line, the regulation can be effected on the locomotive with the smaller driving-wheel diameters.

Fig. 12 is a general view of the locomotives and Fig. 9 a working drawing. The locomotive when ready for the service weighs 62 tons. Its weight on drivers is 42 tons, as with the previous locomotives.

A large dam and water power are projected at Hilldale, near Brattleboro, Vt., by the Connecticut River Power Company. The dam will be 26 ft. high with 800 ft. spillway, and it is expected 12,000 hp will be developed. Among those interested are Henry I. Harriman, of Hyde Park, Mass.; Malcom G. Chase, of Providence, R. I.; W. H. Vinton, C. A. Harris and C. W. Dunham, of Brattleboro.

The report of the Rio de Janiero Tramways, Light & Power Company for 1906, shows gross receipts of $5,605,000 and net receipts of $1,550,000. A considerable increase of business is expected as soon as the hydraulic station on the Lagos River is completed. The net receipts for 1907 are estimated at $2,133,000.

COPENHAGEN'S STREET RAILWAYS

Prior to eight years ago there were several street railway lines owned by separate and independent companies in Copenhagen. In 1898 a corporation was organized which combined the entire system, with slight exceptions. The capital stock of the corporation is $2,680,000, and bonds to the amount of $1,408,000, drawing 4½ per cent, were issued and sold. There is also a floating debt of about $884,400. As a condition to granting a franchise, the city government exacts the performance of the following duties:

First, that the fares to be collected should not exceed 10 ore (about 2½ cents), which also should include universal transfers. Second, that the company should pay to the city treasury 6 per cent of its gross receipts. Third, that it should pave and maintain between its tracks and about 2 ft. outside the rails. Fourth, the city reserved the privilege of providing the electric power at an agreed price, out of which the city is making a net profit of about 700,000 kroner ($187,600) per year. Fifth, that the charter should expire in forty years, at which time the entire property should be delivered to the city free of cost and encumbrance.

The lowest wages for motormen and conductors is about 4 kroner ($1.08) per day, a day being ten hours for the conductor and nine and a half for the motorman. After a period of service the pay is slightly increased, the amount for the year ranging from 1100 to 1500 kroner ($295 to $402). For the ordinary workman the pay is from 1100 ($295) to 1400 ($375) kroner per year.

In addition to this compensation the company provides the clothing for the motormen and conductors. They are allowed one day of rest in six without deduction of pay, and in addition six holidays during the year. Employees of the company remaining in the service twenty-five years are entitled to a pension in case at the end of that time they are unfit for further work. The pension amounts to two-thirds of the yearly wage of the person. In case of illness contracted outside of and not due to the service, full wages are continued for six weeks and half wages for the six weeks following, after which no duty rests upon the company; but the period of such illness is reckoned as a part of the service for the purpose of the pension. If the illness was contracted in the service, the employee receives full wages until recovered. In case of personal injury caused by an accident arising out of and in the course of the employment and incapacity for work results, the company continues full wages until the final consequence of the accident shall have been ascertained or until the employee recovers. In case the incapacity resulting from the accident proves to be permanent, the employee will receive a pension for life equal to about two-thirds of his average wage for the preceding five years. The provision for a widow's pension amounts to about one-eighth of the average wage of the husband for the preceding five years. In case an employee is injured and death results, the law provides that the widow, if there shall be a widow, shall receive 3200 kroner ($858) at once and in lieu of a pension. There are now 1420 employees.

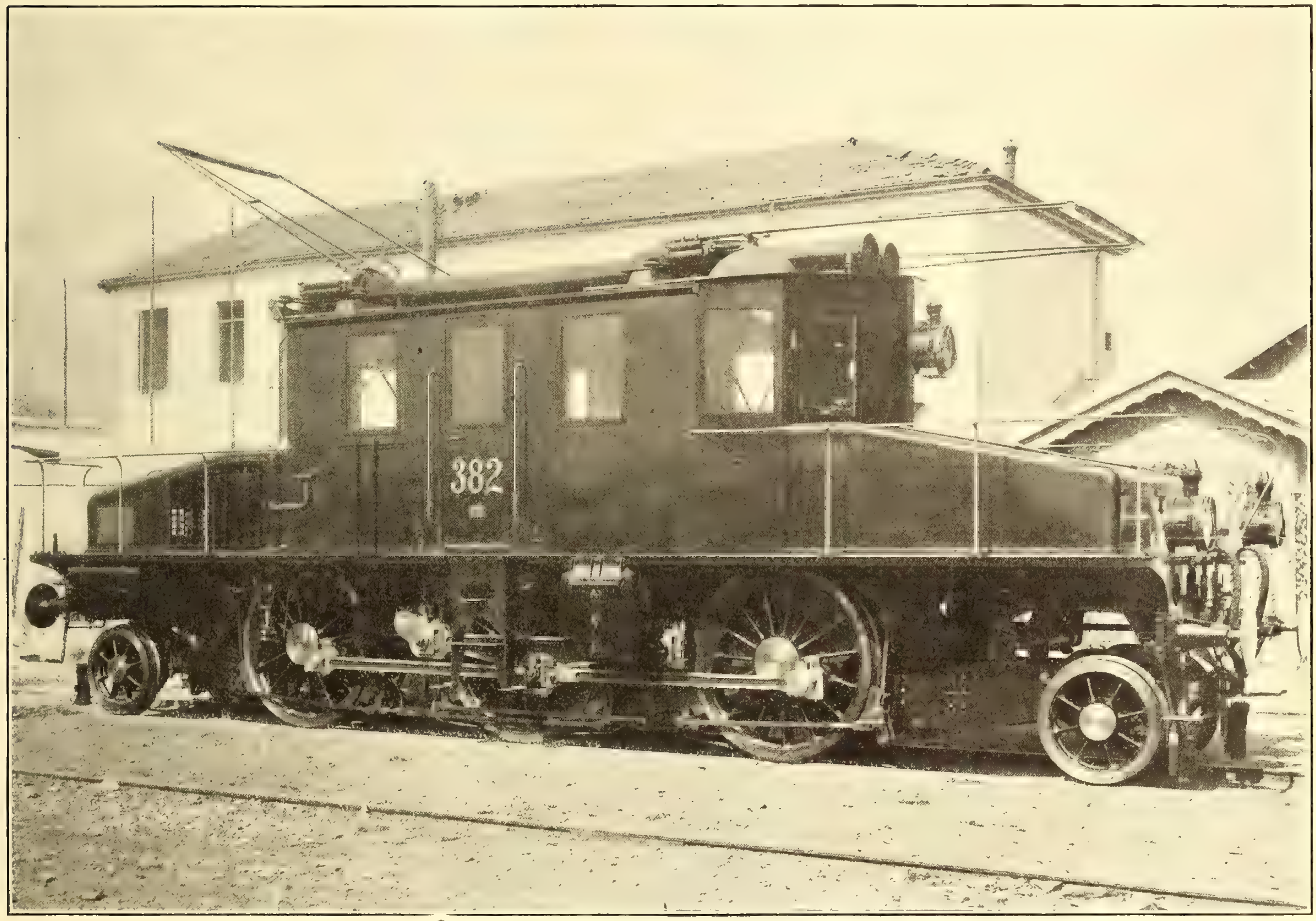


FIG. 12.—GENERAL APPEARANCE OF THREE-PHASE LOCOMOTIVE READY FOR SERVICE

The car-miles in 1898 were 3,797,413, and the income $719,831, while in 1906 the car-miles aggregated 9,771,827 and the income $1,562,492.

A premium is paid to motormen for reduced power used below a fixed standard, the sum of 5908 kroner ($1,583) having been paid to motormen under this arrangement in 1905. The company paid 6 per cent in dividends in 1905.

THE MULTIPLE CATENARY SUSPENSION FOR THE BLANKENESE-OHLSDORF RAILWAY, GERMANY

The Siemens-Schuckert Works, now building a single-phase railway from Blankenese to Ohlsdorf, Germany, have adopted for this line a new form of catenary suspension in which there are two carrier wires beside the trolley wire.

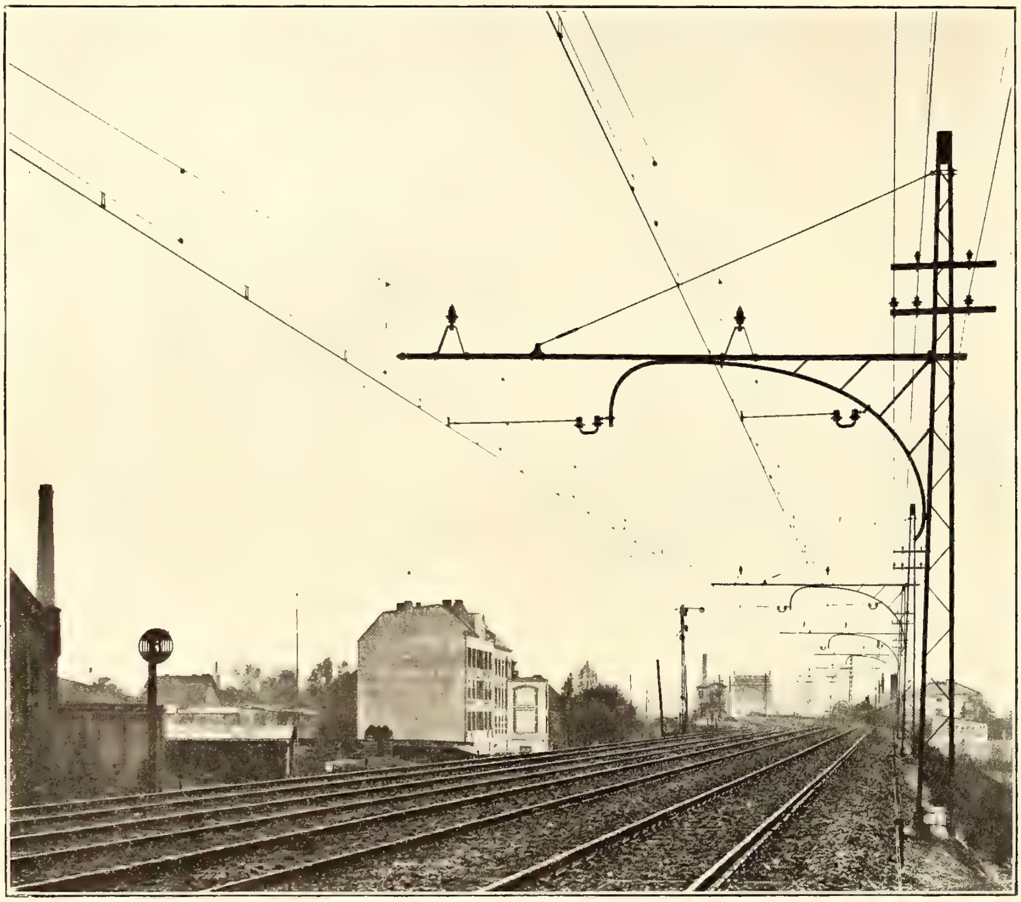


FIG. 1.—ARRANGEMENT OF MULTIPLE CATENARY SIDE-SPAN OVERHEAD CONSTRUCTION ON DOUBLE TRACK

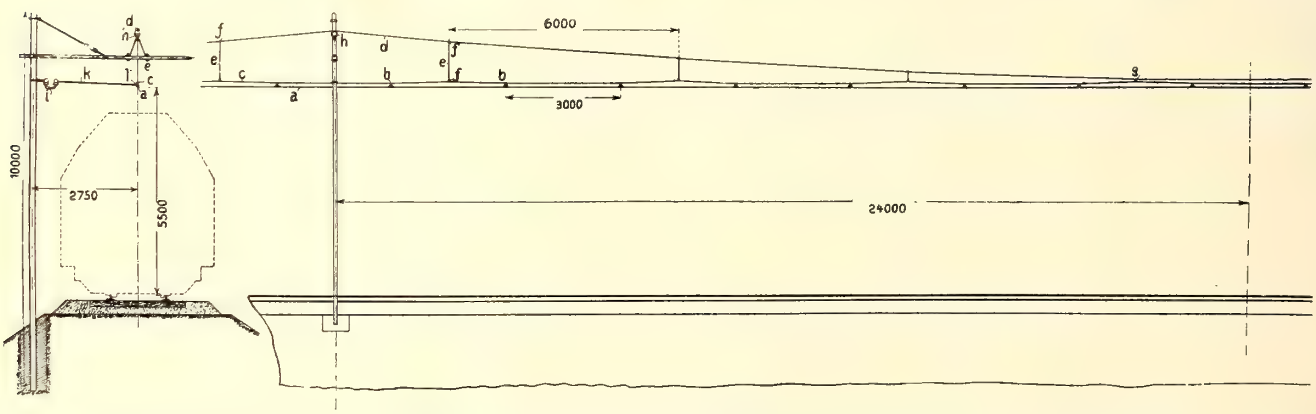


FIG. 2.—END AND SIDE ELEVATIONS OF MULTIPLE CATENARY (ALL DIMENSIONS IN MILLIMETERS)

It will be noted from Fig. 1 that in this case it is used with side poles and double track. The details of this type of catenary are indicated in Fig. 2. The trolley, *a*, is a hard copper wire of 100-sq.-mm section (No. 000) supported at intervals of 3 m (10 ft.) with mechanical clips, *b* (shown in detail in Fig. 3), which are fastened to an auxiliary carrier wire, *c*, placed above the trolley wire and practically parallel to it. The clips grip the trolley wire but have a longitudinal movement along the auxiliary carrier wire. These clips also allow for the upward movement of the trolley wire caused by the pressure of the current collectors, so a flexible suspension is secured which permits good contact between bow and wire. The auxiliary carrier wire, *c*, is of No. 3 wire or 6-mm diameter. It is suspended from the main carrier wire, *d*, at intervals of 6 m (20 ft.). This suspension is made through perpendicular hanger wires, *e*, which are connected with the main messenger cable as well as the auxiliary carrier wire by the special clamps illustrated in the right engraving in Fig. 4. In the middle of the span a different type of clamp, *g*, is used as shown in detail in the upper left part of Fig. 4.

The main messenger cable consists of seven strands of steel wire, giving a total section of 35 sq. mm, or that of about a No. 3 wire. As illustrated in Figs. 1 and 2, it is carried at the poles on an insulator, *h*, with a metal cap to which the hanger wire is screwed (see Fig. 6).

To prevent the side swinging of the trolley wire, the latter as well as the auxiliary carrier are secured by a double pull-off, *i*, of the type shown in Fig. 7, a piece of tubing, *k*, and clamp, *l*. The latter is so constructed that even at these points the trolley wire can rise with the bow pressure. At curves this arrangement is somewhat modified, as the wires are under tension only. Means are provided at definite intervals on all three wires to allow for the effect of changes in temperature.

The advantages claimed for the multiple catenary over the single catenary are as follows: The number of perpendicular supporting wires is only half of what it would otherwise be, affording considerable improvement in the appearance of the line and simpler and easier maintenance of the entire

overhead construction; the use of sliding clamps between the trolley wire and auxiliary carrier permits easy and auto-

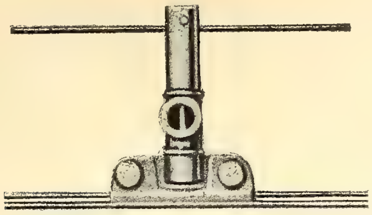


FIG. 3.—CLIP BETWEEN TROLLEY AND CARRIER WIRE

matic equalization of the tension on the former after the line has been installed, and hence less wear. This advantage

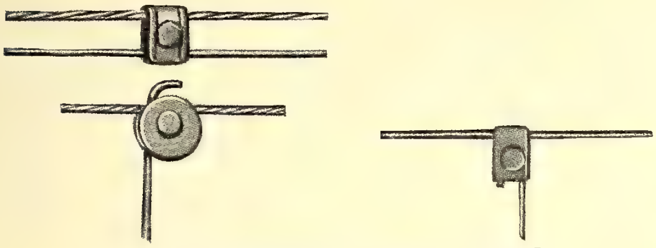
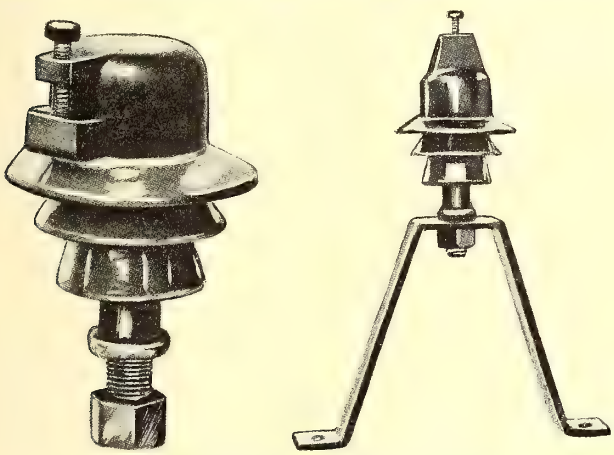


FIG. 4.—DIFFERENT TYPES OF CLAMPS

is claimed to be important on account of the differences in tension which will be caused by changes in temperature.



FIGS. 5 AND 6.—INSULATOR CARRIER FOR MAIN CABLE, AND DETAIL OF INSULATOR

Finally, in case of trolley wire breaks the supporting system is less apt to be affected on account of the sliding of

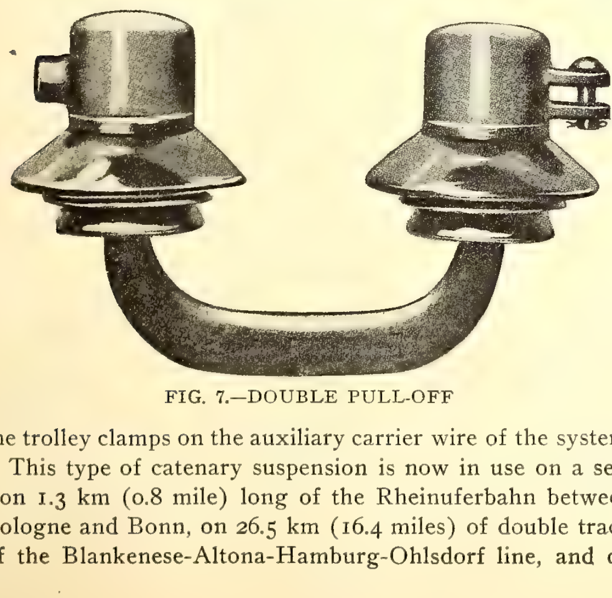


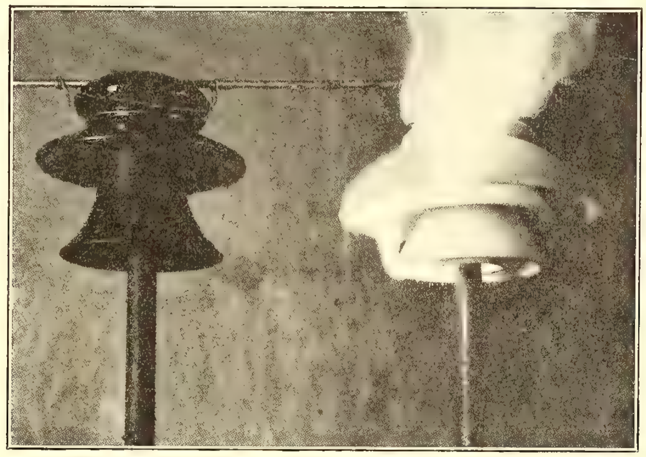
FIG. 7.—DOUBLE PULL-OFF

the trolley clamps on the auxiliary carrier wire of the system.

This type of catenary suspension is now in use on a section 1.3 km (0.8 mile) long of the Rheinuferbahn between Cologne and Bonn, on 26.5 km (16.4 miles) of double track of the Blankenese-Altona-Hamburg-Ohlsdorf line, and on 33 km (20.4 miles) double track belonging to the Rotterdam-Hague-Scheveningen Railway.

HIGH VOLTAGE TESTS ON DIFFERENT TYPES OF INSULATORS

Two articles have appeared in recent issues of this publication* relative to the testing and construction of the Kleinstuber type of Ambroin high-tension insulators made by the Vereinigte Isolatorenwerke Actiengesellschaft, of Berlin-Pankow, Germany. These insulators are not of the multiple-petticoat form commonly used for high-tension work. The ordinary insulator consists of a single bell of Ambroin molded at the top, in which a metal cap is screwed but for very high potentials there is also a disc of insulating material to separate the bell from the cap. To compare this construction with porcelain, the company submitted a number of its insulators for tests by the Reichsanstalt, the official research laboratory of the German Empire. The figures thus secured were then compared with the latest regarding porcelain insulators made in Germany.



AMBROIN AND PORCELAIN INSULATORS UNDER A 40,000-VOLT TEST

The following figures are taken from this comparison:

Porcelain Insulators.			Ambroin Insulators.		
Arcing Voltage in Dry Weather.	Arcing Voltage in Wet Weather.	Weight in Grams.	Arcing Voltage in Dry Weather.	Arcing Voltage in Wet Weather.	Weight in Grams.
60,000	29,000	700	56,000	29,000	610
75,000	37,000	1,460	69,000	46,000	740
91,000	44,000	1,850	77,000	54,000	810
93,000	49,000	2,125	83,000	66,000	1,200

The accompanying illustration shows what occurred during a laboratory test. The insulator on the left is of the Kleinsteuber type and the other a delta porcelain insulator. The latter had a maximum diameter of 177 mm., a height of 140 mm, a weight of 1950 grams, and was listed at 3.10 marks ($0.77). The former had a maximum diameter of only 135 mm, the same height, weighed 790 grams, and was listed at 1.65 marks ($0.41). Both insulators were mounted in parallel and connected by copper wire over the caps and between the supports. The test was made at 40,000 volts in an artificial shower. The arcing on the Ambroin insulator is barely noticeable, while the porcelain insulator is wrapped in flame.

*See Street Railway Journal, for August 11, 1906, and January 12 1907

NOTES ON THE JOHANNESBURG MUNICIPAL TRAMWAYS

Electric tramcars started running in Johannesburg, South Africa, on the first section of line completed (little more than a mile and a half in length) in February, 1906, and as fresh track was completed the service was extended, until at the end of the year practically the whole town and district

A SINGLE-TRACK SECTION

was served. The present length of the electrically-equipped routes is about 28 miles standard-gage track, and further extensions are already authorized.

Before starting upon its own electrical scheme the Johan-

LOOKING SOUTH IN THE HARRISON STREET SUBWAY

nesburg Council purchased the old horse tramways, which had a route length of about 12 miles. By adopting almost entirely different routes for the electric traction the Council was able to keep the horse service running until an equivalent electrical service was available. The last of the horse tramways ceased working during August, 1906.

The track is of the usual girder type for paved streets in the city limits, while T-rails are used on the suburban sections which are ballasted with rock. Overhead construction with double 0000 trolley wire is used throughout, and as shown in the illustrations is of both the span and side-bracket type.

A number of the poles were provided with an extra ornamental bracket for supporting arc lamps, while about 200 incandescent lamp posts were erected and 400 of the old gas lamps were converted into electric glow lamps.

The arc lamps and glow lamps are arranged in twenty

A BUSY DAY IN JOHANNESBURG

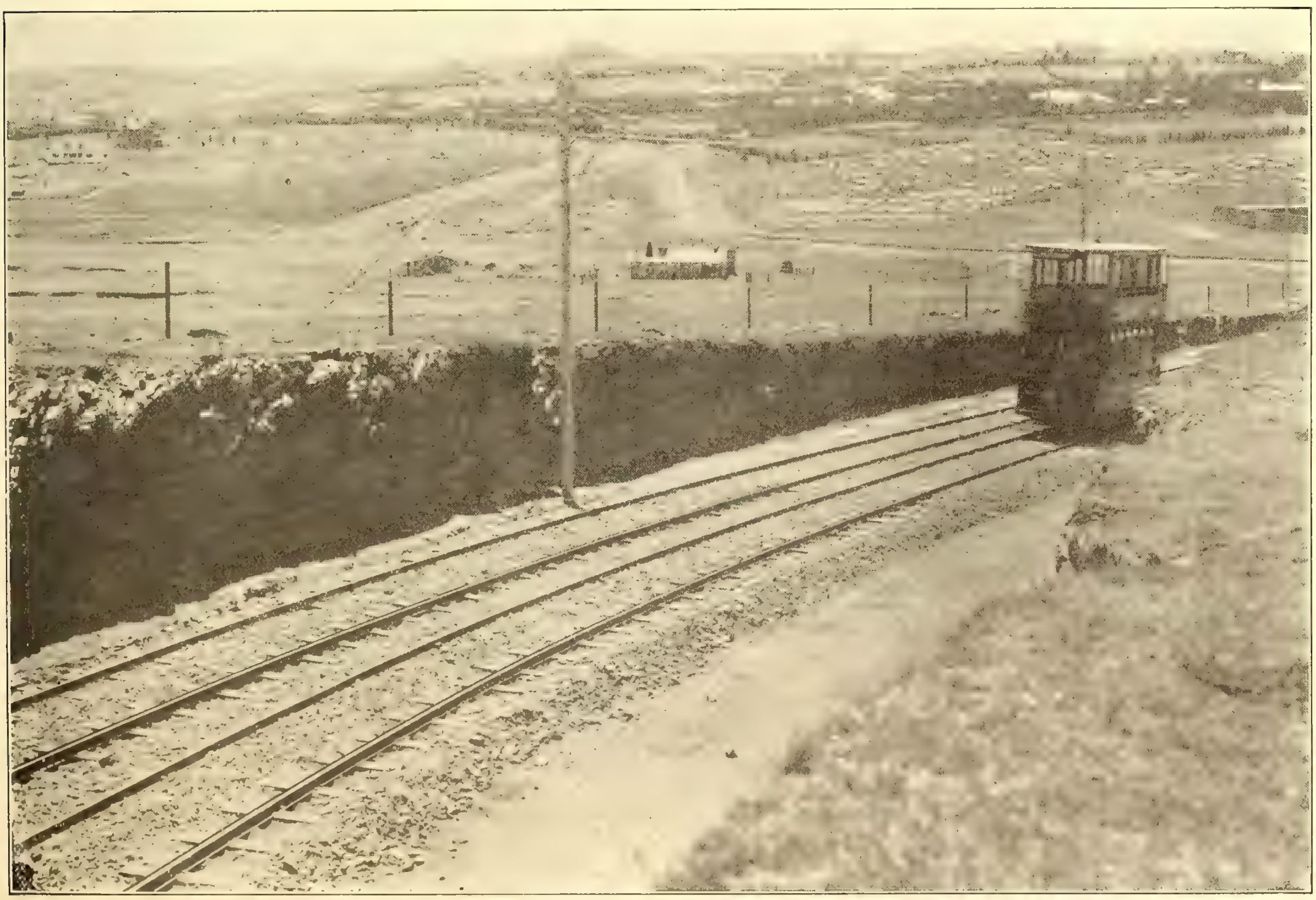
groups of nine in series across 460 direct-current mains and except in the case of two circuits each group of lamps is controlled by an automatic switch and fuse in the base of the first lamp post and a switch fuse in the last lamp post.

A VIEW IN THE OPEN CUT

The ears used are 18 ins. and 24 ins. long, and made of gun metal. The overhead switches are also of gun metal and are of the mechanical type, provided with an operating cord for working from the ground.

The span wire used for bow string suspensions for side bracket poles and span poles is of galvanized steel made up of seven strands of No. 14 and 12 S. W. G., respectively. The straight line hangers and double and single pull-off are of galvanized iron. For a certain length overhead bare

A VIEW ALONG THE MARKET SQUARE ROUTE OF THE JOHANNESBURG TRAMWAYS



A DOUBLE-TRACK ROCK-BALLASTED SECTION IN THE OUTSKIRTS OF JOHANNESBURG

feeders are run on brackets fixed to the poles. These are guarded by 7-16-in. strand wire erected on brackets above those carrying the feeders. Feeder and section pillars are erected at every one-half mile in accordance with the Board of Trade regulations, and the same are earthed to the rail as in English practice. Each feeder pillar is provided with a portable telephone and a twenty-seven-point switchboard for the main car house exchange.

The first contract for cars comprised 100 of the four-wheel type, of which 60 have cross seats inside and out, and the remaining 40 have the usual longitudinal seats inside and cross seats outside. Eighty out of the 100 cars have been fitted with top covers extending the whole length of the car. They are fitted with roller spring blinds at the sides as a protection against sun and rain, and end screens with doors and windows. Each car carries 24 passengers inside and 34 outside. The over-all width of the body is 7 ft. 3 ins., and the extreme width of the car 7 ft. 5 ins. The bodies are 16 ft. long inside, and the length over the platform is 26 ft. 6 ins. The inside seats are of rattan, while the top seats are of the usual garden pattern.

THE BRICK AND STEEL CAR HOUSE OF THE JOHANNESBURG TRAMWAY SYSTEM

With a view to insuring ample power and minimizing repairs on motors, each car has been fitted with two 35-hp motors, so that the maximum temperature rise in working is unusually low. The trucks are of the Brill type, and the wheels, which are 33 ins. in diameter, have especially thick steel tires.

The braking arrangements consist of magnetic track brakes combined with wheel shoes energized by the motors. A Peacock hand brake operates on the same wheel shoes as the magnetic brake. The cars are fitted also with the popular English trigger-type lifeguards and folding steps.

Ten double-truck cars have recently been shipped. They have longitudinal seats, top covers and electrical equipments similar in all respects to those on the four-wheel cars. Each of these will carry 30 passengers inside and 44 outside. They are intended for special traffic, such as for race meetings and at lunch time when the traffic demands are extremely heavy.

In addition to the 110 passenger cars, 5 watering and 3 freight cars have been supplied. The water cars are of the single-truck type, and have 1800-gal. tanks, with electrically-driven air compressors giving sufficient pressure to spray the water 25 ft. on each side of the track. The water cars and freight cars have electrical equipments identical with those on the passenger cars.

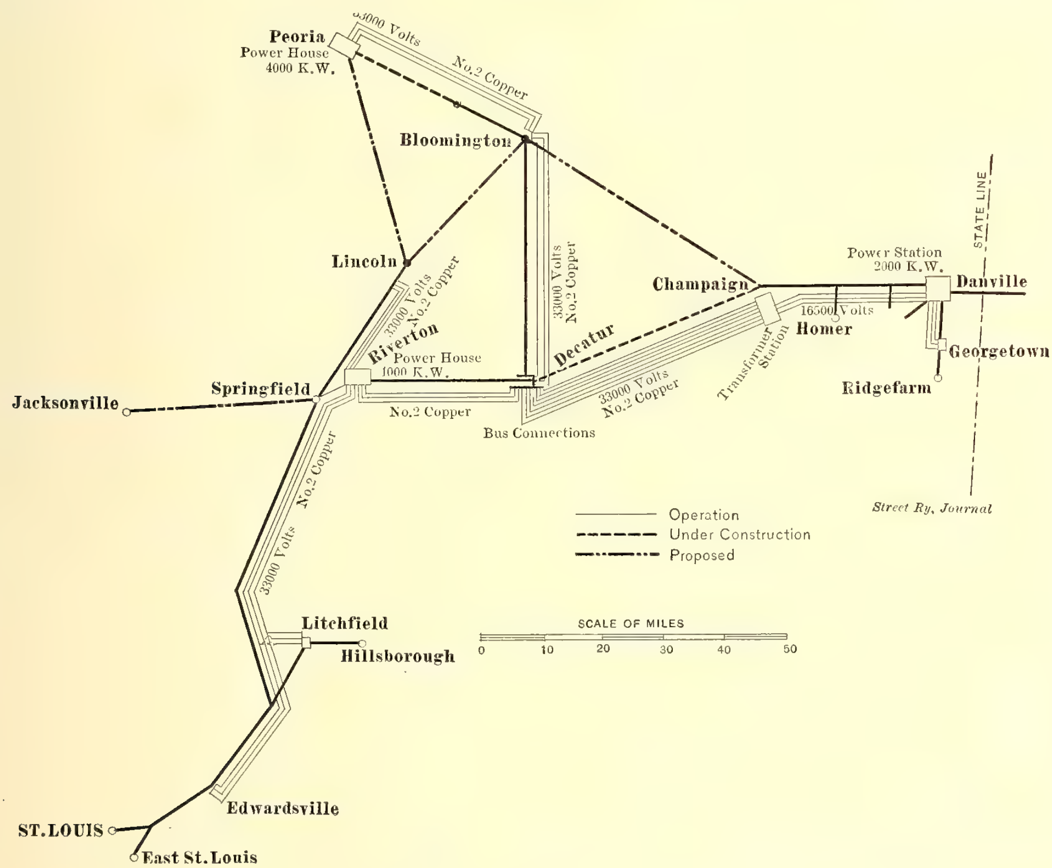
Excepting the bodies of the freight cars (which were made by the Gloucester Wagon Company), the whole of the cars and equipments have been supplied by Dick, Kerr & Company, and were manufactured by them—with the exception of the double trucks, which were made in America—to detail specifications prepared by Mordey & Dawbarn, the consulting engineers to the municipality of Johannesburg.

The overhead equipment was also erected by Dick, Kerr & Company, to the specifications of the consulting engineers. The poles and pole fittings were supplied by Messrs. Blackwell & Company under a separate contract.

The fact that the revenue from the tramways is over 30 cents per car-mile is an eloquent testimony to the appreciation of the tramway service by the public of Johannesburg.

THE ILLINOIS TRACTION SYSTEM—ITS GROWTH AND HIGH TENSION POWER DISTRIBUTION SYSTEM

The Illinois Traction System within the brief period of three years has attained a very prominent place among the interurban systems of the country. It is now operating over 300 miles of road in Central Illinois, and has in the course of construction about 80 miles of additional track. When the new line now partially completed between Champaign and Decatur is finished, the system will possess a through route from Danville to St. Louis, a distance of approximately 220 miles. There is at present a continuous road from Bloomington through Decatur and Springfield to the Missouri metropolis. A probable extension eastward from Danville to the Indiana State line will connect the system with the network of interurban lines covering Indiana and Ohio, from which it is now isolated.



HIGH-TENSION POWER DISTRIBUTION LINES OF THE ILLINOIS TRACTON SYSTEM

During the past year the Chicago, Bloomington & Decatur Railway has been put into operation between Decatur and Bloomington; the Springfield & Northeastern Railway Company began operating between Springfield and Lincoln, and the St. Louis, Decatur & Champaign Railway for a portion of the 41 miles between Decatur and Champaign. The balance of this latter line has been practically completed, and the Peoria, Bloomington & Champaign Traction Company's line connecting Peoria and Bloomington has been constructed.

Other extensions, including the line of the Illinois Western Railway from Springfield to Jacksonville, will doubtless be made during the approaching summer. To afford a satisfactory entrance into St. Louis, it is probable that a $,000,000 bridge will be built across the Mississippi River at St. Louis

The offices of the vice-president and general manager, L. E. Fischer, from which the entire system is managed, are located at Danville. In view, however, of the extensive operations farther west and the extensive territory in which the present development is being conducted, Mr. Fischer has temporarily removed to Springfield. A private car, plainly yet attractively equipped and furnished, serves as a movable office.

In addition to the interurban lines operated by the Illinois Traction System, the system embraces the city lines in Danville, Urbana, Champaign, Decatur, Bloomington, Jacksonville and Peoria; lighting and heating utilities in Danville, Champaign, Bloomington and Decatur, and lighting plants in Urbana, Jacksonville and Granite City.

POWER DEVELOPMENTS ON THE SYSTEM

Plans are being completed for the generation of power for the entire interurban system at three power houses, which will be interconnected by high-tension transmission lines in such a manner that they can be operated in multiple, notwithstanding the fact that some of the lines will carry a voltage of 16,500 and others a pressure of 33,000 volts.

A station containing two 2000-kw Curtis turbines is now being completed at Peoria. Additions are being made to the present plant at Riverton to give this station a rated capacity of 4000 kw. At Danville a 2000-kw generator which was exhibited at the World's Fair is being installed.

High-tension lines of No. 2 copper at 33,000 volts will leave the Peoria power house and, after supplying sub-stations en route will terminate in bus connections at Decatur. The lines from the Riverton power house and those extending east of Decatur to Champaign will also be brought to the same bus-bars at Decatur.

At Champaign will be located a transformer house in which will be installed three 400-kw transformers having a ratio of two to one. The low voltage coils of the transformers will be connected to the 16,500-volt high-tension line from the Danville power house, while the 33,000-volt lines from Champaign will be brought to the other side of the transformer. These transformers will serve simply as a means of tieing the lines together, and no power will be taken from them.

With the completion of the distribution system power generated in the Peoria power house may be used to operate the sub-station at Georgetown, about 125 miles distant. At the present time the Riverton power house supplies the Ed-

wardsville sub-station, about 90 miles distant, and this is probably the longest transmission of current generated in a steam plant in the country.

All of the lines north of Springfield, Decatur and Champaign will be single-phase roads. It is the present intention of H. C. Hoagland, electrical and mechanical engineer of the system, who is developing the transmission system, to operate each of three single-phase roads by one of the phases of a three-phase line from the Peoria power house. The sub-stations on the Peoria-Bloomington line will be connected to one phase, those of the Bloomington-Decatur line to another, and those of the line north of Springfield to Lincoln to another.

ACCOUNTING FOR TAXES

WM. H. FORSE, JR.

There is considerable diversity of opinion, among accountants, regarding the disposition of the item of taxes in preparing railway financial statements. All agree that taxes should be charged to operation during the year for which they are assessed, regardless of the dates when paid, but there is not the same unanimity as to whether taxes should be included in operating expenses or, with bond interest and analogous items, should be deducted from (net) income. The latter method seems to be the most popular, and in a recent published analysis of the Southern Railway Company's annual report a writer comments as follows: "The company lumps operating expenses and taxes together —the reason for this is not known. In some cases, like that of the Illinois Central, whose taxes consist of a 7 per cent tax on its gross earnings, these taxes might be considered as analogous to an operating expense. Usually, however, they are considered like interest on the funded debt, a fixed charge."

In the system of accounting prescribed by the Interstate Commerce Commission, taxes of every character, whether on earnings, valuation of property operated or securities owned, are shown as a deduction from income.

On the other hand, a firm of accountants of national reputation authorizes the inclusion of taxes in operating expenses, and in support of this action makes explanation as follows: "Taxes should be considered as a separate expense account under the heading of general expenses and not as a fixed charge. A fixed charge is properly a guaranteed return on invested capital, being specifically represented (1) by interest on mortgage bonds and (2) by guaranteed interest return on any other class of interest-bearing securities, said interest return being always in the nature of a fixed or guaranteed percentage, such as interest on debentures or interest on certain classes of preferred stock. In conclusion, a fixed charge is any guaranteed interest return on securities issued, which interest must be paid and deducted from net earnings, thereby leaving net profits, out of which net profits regular stock dividends can be paid."

Taxes may be separated, for the purpose of this discussion, into two general classes. The first of these may be, for convenience, termed property tax, consisting of taxes paid on all kinds of property owned, such as real estate used for right of way and other purposes, rolling stock, cash, securities, etc. Broadly speaking, the tax assessed upon property owned is not affected by the fluctuations in the volume of traffic, or, in other words, by the earnings of the property. In this respect it may be likened to the interest on funded debt, which remains constant, regardless of the fact that many trains may be taken off, or rates reduced under compulsion, and earnings thus show wide variations. It may happen, however, that taxes are largely increased this year over those of last year on the same amount of property by reason of an increased rate of taxation.

Operating expenses in detail, and the relation of their total to the gross earnings of a property, comprise tests of the efficiency of the operating staff through comparison with previous like periods; if operating expenses are cumbered with taxes, efficiency is apt to be lost sight of to some extent, when totals only are under consideration.

One accountant meets this theory with the objection that taxes can be influenced by the management in many cases. For example, at Smithtown the company rents a building and its grounds, valued at $5,000, for $40 a month, which is charged to operating expenses. The management decides to buy the property, does so, eliminates the rental payment, and henceforth pays a tax of $100 per year, which is grouped with other "fixed charges" as a deduction from income when it should properly be shown as part of the operating expense.

The writer does not accept this as a final settlement of the controversy for this reason. The company under consideration builds stations at many other places besides Smithtown, and in securing funds for the purpose puts out an issue of bonds, whose interest is thereafter a fixed charge of the company; the increased bond interest lessens operating expenses (rentals) as does the ownership of rolling stock and other property, but there is no thought of treating this additional bond interest as an operating expense.

Another kind of tax is that assessed upon earnings or volume of traffic. This is not materially affected by the method that has been used in financing the property, as is the tax assessed upon property owned, and whether the company owns or leases certain of its property, the amount of the tax is practically the same. In sharp contrast to property tax, earnings affect the amount assessed, and for this reason the tax is similar in some respects to those operating expenses which are sensitive to variation in traffic.

Frequently, however, the tax upon earnings takes a different form from that levied by municipalities and may be a charge per passenger for the use of tracks and stations at terminal points. In these instances, the gross earnings include the tax on terminal charge, which has been actually earned, and when paid as rental the amount is charged against operating expenses. Some accountants object to including this rental with earnings, especially in those States which assess a tax upon gross earnings. It is argued that the State would receive a tax twice upon the same earnings, once upon the earnings of the company owning the terminal and again upon the earnings of the company renting terminal facilities. It does not necessarily follow that the method of accounting shall be changed on that account. The writer is familiar with an instance which occurred in an Eastern State, illustrating the point. It was felt that good accounting required that the total amount earned be included in the gross earnings of the company using the terminal facilities, but for tax purposes the amount paid per passenger for trackage was set out in reports to the State board as a deduction from gross earnings, and as the companies owning and renting the tracks were agreed upon this method of reporting, the State officials allowed the deduction.

POWER STATION COSTS IN LONDON

The London "Engineer" recently published some interesting statistics on cost and output of the Neasden power station which supplies electric power to the trains of the Metropolitan Railway in London. This station was described in the Street Railway Journal for Aug. 29, 1903. Briefly, the generating equipment consists of four 3500-kw Westinghouse-Parsons turbines operating at 1000 r. p. m. The steam consumption is 17 lbs. per kilowatt-hour at full load and 20¼ lbs. at half load. The vacuum maintained is about 1¼ lb. per square inch absolute. The variations in load are naturally heavy, during the daytime running from about 35 per cent to 175 per cent of normal, and after 7 p. m. from little over 20 per cent up to 100 per cent of normal. The consumption of lubricating oil in the whole station for the four turbo-generators, the exciters, alternator for coal conveyor work, pumps, etc., is under 100 gals per month.

The four turbo-generator sets at present installed are served by fourteen water-tube boilers designed for 200 lbs. pressure and worked at 180 lbs. to 185 lbs., with 180 degs. F. superheat. They were hydraulically tested to 300 lbs. per square inch for one hour. Each has 260 tubes, 18 ft. long by 4 ins. diameter, and two drums, 23½ ft. long by 4½ ft. diameter. This gives each boiler 5730 sq. ft. of heating surface, and its grate area is 100 sq. ft. Their guaranteed evaporative power is 20,000 lbs. per hour each, with 25 per cent. overload capacity; this corresponding to 3½-4⅜ lb. per square foot heating surface. The superheater of each boiler contains 128 tubes, 1½ ins. in diameter, giving 894 sq. ft. of external heating surface. Four banks of economizers serve the fourteen boilers, with a total of 1760 tubes. These deliver the feed at an average temperature of about 275 degs. F. The feed is brought to them from the hot well through feed heaters, which raise the temperature about 100 degs. F., by two compound vertical double-acting steam pumps, each of which is equal to supplying three turbines at full load.

Each turbine is served by a separate barometric condenser, the rising exhaust main being 54 ins. in diameter and 34 ft. in height. Each is designed to condense normally 66,500 lbs. of steam per hour, and will deal satisfactorily with about 60 per cent. in excess of this. The remainder steam, that is to say, the steam that is not carried away as condensed water with the circulating water, and the air are drawn off by a steam-driven "vacuum pump," its two pump barrels being 24 ins. in diameter by 24 ins. stroke, while the one steam cylinder is 10 ins. diameter by 24 ins. stroke, all three being arranged tandem. This pump runs at 100 double strokes per minute, and consumes 55 hp. No auxiliary jet ejector condensers are employed. The circulating pumps are centrifugal, one 18-in. pump to each turbine, delivering 250,000 gallons per hour, or not much short of forty times the weight of steam to be condensed. There is also a 16-in hot-water pump in each turbine.

There are three duplex cooling towers, each essentially composed of an immense number of timber slats, which baffle and spray the water as it falls through a height of about 20 ft. Each can cool 400,000 gallons per hour down to at least 85 degs. F.

The alternators are three-phase, with 11,000 volts in each phase on a non-inductive load. The normal speed of 1000 r. p. m. gives a frequency of 33 1-3 cycles per second, the machines being four-poled. There are three 100-kw exciters installed. A small 100-kw alternator is run to supply power to various small motors and for lighting the station and yards.

There are in all nine sub-stations. Most of these have in each three 800-kw rotary converters; but two of them have each three 1200-kw, and one of them four 1200-kw rotaries. In all there are twenty-eight sub-station rotaries, of a total normal capacity 25,200 kw. These run at 375 r. p. m., and with 550-600 volts between the outgoing terminals. Each rotary converter is served by three static transformers reducing from 11,000 to about 440 volts.

The conductor rails are of soft steel of a conductivity equal to one-seventh that of copper. They are 100 lbs. per yard in weight, or 10 sq. ins. in sections. They are copper-bonded, with 1½-sq.-in. copper section. The insulators are placed 9 ft. apart.

The present rolling stock comprises twenty-eight trains, each of a total weight of 180 tons plus the passenger load, the passenger seated capacity being 350. The motor cars weigh 40 tons, and the trailers 25 tons each. Each full train consists of two motor coaches and four trailers. The motors are rated at 150 hp, and there are four of these on each motor coach, giving 1200 hp to the full train. This yields an acceleration of 1½ ft. per second per second. There are in addition ten trains of a total weight of 185 tons each, the motor equipment being somewhat heavier in these. The Westinghouse unit switch system of train control is used. Besides these, there are ten locomotives of 1000 rated horse-power each with four motors. These locomotives weigh from 45 to 50 tons, and are capable of drawing 250 tons up a grade of 1 in 40 at 10 m. p. h.

In November last complete systematic tests of the whole generating plant were made. It is unnecessary to give here all the details of these tests. The "Engineer" mentions the following results: The boiler test lasted six hours, the gage pressure being 188 lbs. per square in. and the superheat 150 degs. F. The feed reached the economizers at 160 degs. F., and left them at 253 degs. F. The water actually evaporated was 3¼ lbs. per hour per square foot of heating surface, the coal consumed being 23½ lbs. per hour per square foot grate area. This corresponds to a steaming power of 7.94 lbs. actual superheated steam per pound of coal burnt. Apart from the action of the feed heater and the economizer, which together raise the feed to 253 degs. F., the boiler proper and its superheater have, therefore, an evaporative efficiency of 9.0 lbs. water from and at 212 deg. F. per pound of coal burnt ($7.94 \times \frac{1095.6}{965.7} = 9.0$). Taking the boiler along with the feed heater and economizer, the whole plant has a heating efficiency of $\frac{1263.6}{965.7} \times 7.94 = 10.4$ lbs. from and at 212 degs. F. per lb. of coal. This means 84½ per cent efficiency, since the coal used had 11,980 as its calorific value. The percentage efficiency of the boiler and superheater separately is 73. Deducting 12 per cent of moisture contained in the fuel, the consumption of dry coal per kilowatt-hour was 2.4 lbs. Considering that there was 8½ per cent of ash as well as 12 per cent of moisture in the fuel these results are very good.

The turbo-alternator test was carried out with 184½ lbs. steam gage pressure and 150 degs. F. superheat, the average vacuum pressure being 1¼ lb. per square inch absolute. During a six hours' "full-load" run the actual variation of load was from 1200 to 6000 kw, and averaged 3850 kw. During a subsequent two hours' "half-load" run it varied

from 800 to 3400 kw, and averaged 2175 kw. The actual steam consumption per kilowatt-hour was 18.3 lbs. at full, and 22.2 lbs. at half power; but with the allowance made on account of the above large variation and for other reasons, the full-load consumption is within the guaranteed 17 lbs. per kilowatt-hour. If 85 per cent be taken as the mechanical and electrical efficiency of the combined turbine and alternator, this figure of 17 means 14½ lbs. per kilowatt-hour, or 10.8 lbs. per horse-power-hour of mechanical work done by the steam on the turbine blades.

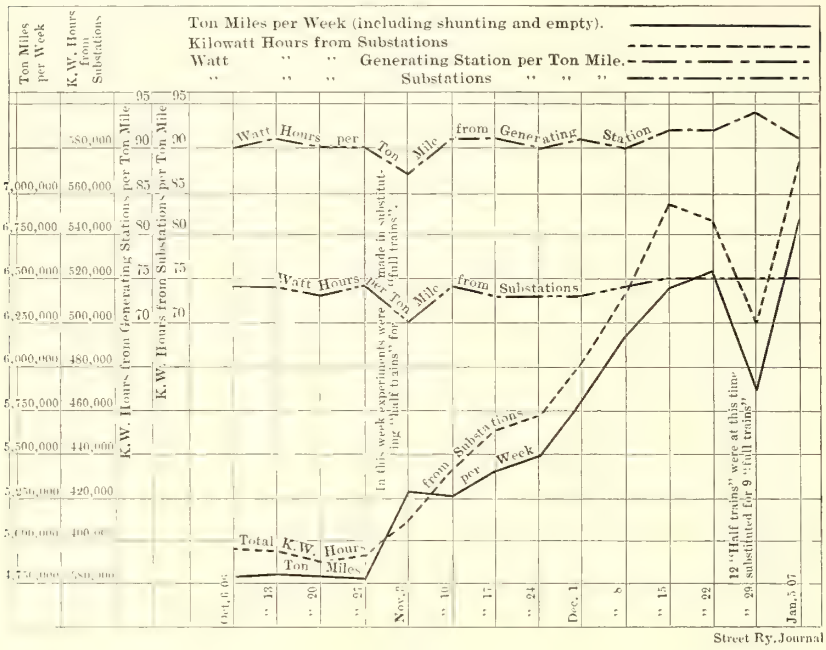


FIG. 1

The principal statistics of the last four months of 1906 are presented in the accompanying four diagrams. For the purpose of obtaining a definite figure for train-miles all the trains have been reduced to equivalent trains of 170 tons' weight, although many of the trains are three-car or "half" trains, and also the real weight of a full train approximates more nearly to 180 tons than to 170 tons. In calculating the ton-mileage the passenger load has been neglected. The seating capacity gives a full passenger load of about 20 tons, but as during certain hours there is a considerable standing load, 10 tons of passengers per full train is probably an under estimate of the average. This is 6 per cent of 170 tons, and this ought to be remembered in considering the other figures of the diagrams. For instance, the average energy from sub-stations per ton-mile is 74 watt-hours, but reducing this by 6 per cent, the real figure, taking into account passenger load, is only 70 watt-hours.

The coal consumption includes all banking-up time and losses on economically small loads. The output from the sub-stations is between 82 and 83 per cent of that generated. Of this latter output between 9 and 10 per cent is spent on lighting, machine driving, etc. Thus about 75 per cent of the power generated is used for actual traction work upon the track. It is this last consumption that is given in Fig. 1 as "Consumption per train-mile and per ton-mile from sub-stations." Per train-mile of 170-ton trains the average is 12,800, and per ton-mile 74 watt-hours. Per ton-mile ⅜ lb. of coal is used, costing .0046 cents. The cost in coal consumed varies very uniformly in proportion to the output, while the other costs in this station are low, being only about .016 cent for labor and .001 cent for lubricant and supplies. The total cost thus comes to only .063 cent on the average per ton-mile. Per kilowatt-hour generated the average figures are: 4¼ lbs. coal, costing 0.5 cent; wages, 0.2 cent; supplies, .01 cent; total, 0.71 cent. This figure includes no depreciation or repairs, nor does it cover interest on capital outlay.

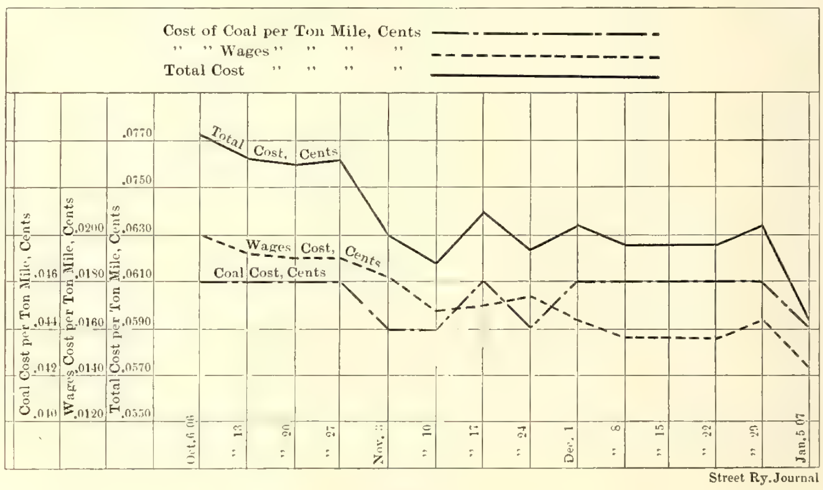


FIG. 2

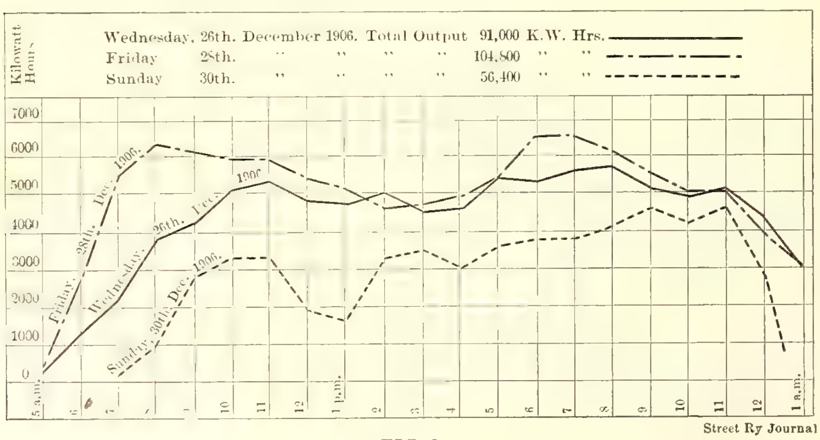


FIG. 3

The installation is fortunate in the fact that the morning and evening demand peaks are not nearly so pronounced as they are on very many electric traction systems. This is shown in Fig. 3, which gives the hourly output throughout three typical days. The Metropolitan Railway is used as a means of business communication right through all the mid-day hours. Also for at least four hours at night there are no passenger trains running, and for three out of every twenty-four hours none of the big turbo-generators is at work. The load factor is thus 42 per cent, reckoned on the normal capacity of the four units installed.

The staff works in three shifts, and over its eight hours

each shift has a low load factor of employment. The three shifts all told of high and low degree number 42 persons, or .0030 of an individual per rated kilowatt. The total

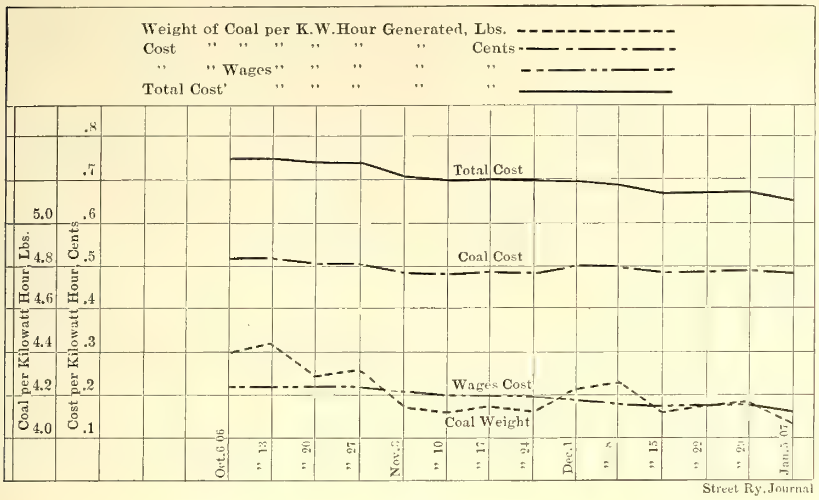


FIG. 4

number of stokers is 14 to take charge of boilers whose normal duty to evaporate and superheat 280,000 lbs. or 125 tons of water per hour.

A CLAIM AGENT'S VIEW OF STANDARDIZATION

The following address on the standardization of street railway equipment from the standpoint of a claim agent was delivered at the March 13 banquet of the Massachusetts Street Railway Association in Boston by Edward O'Callaghan, claim agent of the Boston & Northern Street Railway. It was afterward the subject of a general discussion among the street railway men present, a large majority favoring standardization along the lines advocated by the speaker.

STANDARDIZATION FROM THE STANDPOINT OF A CLAIM AGENT

The adoption of a standard for the construction of car bodies, trucks and electrical equipment has been a subject for deep thought and discussion in this and kindred associations for a long time, and judging by the numerous and ever varying types we see on different roads, the results up to date are not encouraging to its advocates. In taking up this subject, the principal points to be considered are the practicability, the advantages, if any, and the cost. If we are satisfied on the first two, we should not be "phased" by the question of cost, unless we find it disproportionately great. This question, like a great many others of importance in railroading, is largely a local one, as the type which may be very satisfactory in our new Western cities, with wide streets, would be out of the question with us in the East; but taking it as a general proposition, I think it unwise, with few exceptions, to adopt a standard. We want the best, and in this age of progress, when invention and improvement follow one another in rapid succession, we should allow the widest possible latitude in style and dimensions of parts and then choose the most suitable for certain localities.

Considering the subject from the standpoint of the claim agent, the standardization that counts is that which enters into the operation of the car by the conductor and motorman, that which makes their work as uniform as possible, and eliminates every foreseen possibility of confusion or mistake on account of the difference in location or manipulation of the different parts by the men. No matter who built the cars, the location of the controller, air brake, hand brake, gong pin, sand pin, scraper lever, door and step levers, overhead switches, bell cords and register cords, could and should remain uniform, so that a man stepping from one car to another could manipulate the different parts as mechanically as a touch typewritist does the keyboard of the machine.

A great many accidents have happened through lack of this uniformity; for instance, a controller and brake are a certain distance apart, so that a short man can turn both at once. On the next car they are several inches apart and he must operate one at a time, often becoming confused with dire results to the company and himself. The location of the overhead switch, if the controller sticks, is important, and when he wants it he is liable to find it in front, where he can reach it easily and almost instantly, or out of reach overhead so he has to take one of the handles to strike off the connection. Again, when he is approaching a team and it pulls in front suddenly or some careless pedestrian steps in front, he wishes to make an emergency stop. He puts his foot out to operate the sand box and at the same time sets his brake or reverses. He then is liable to discover that the sand pin is differently located than on the other car. The difference in width of cars is sometimes forgotten, so that the side of a truck, part of a load, a temporary fence by day or a warning light by night may be struck, with several claims for damages as a result.

Another trouble which unnerves the motorman when cars are in danger of collision either head-on or rear-end, is the frequency with which one car overrides the other and smashes in the vestibules, owing to the difference in height of platforms and bumpers. With his own life in danger, he is liable to become confused and forget to do the proper thing if he does not actually do the wrong one.

This brings us to the most important part of the whole equipment to standardize; either have the platforms at a standard height, so the ordinary bumpers will surely meet or adopt a standard bumper which will prevent the highest platform from over-riding, and also the lowest from passing underneath. For any company using cars of different heights of platforms, this absence of uniformity is a costly matter. The cost of repairing cars alone is a big item, but back of that, we have the broken legs and bruised spines when passengers are caught, and going still further we have the exaggerated claims for trifling injuries and fake claims where there are no injuries at all. All this is principally on the strength of the damage to the cars, whereas if they had collided with even greater force and no apparent damage was done because the bumpers met squarely, the passengers would not consider it much of an accident; and if any did go into court they could not play on the feelings of the jury by describing the damage done and gaging the force of the blow thereby. Many thousands of dollars have been voted away by juries where the injuries were trifling, simply because of the blood-curdling description of the accident, the smashing, crashing and rending of glass, iron and timbers. I firmly believe that enough money goes in repairs and settlements in one year to standardize the platforms and bumpers of every car in the State.

The absence of uniformity is still more annoying to the conductor, and is a very liberal contributor to the accident column. The location of bell cords and register cords is something that never seems to trouble the car builders,—any old place seems good enough for them, but it is of great importance to conductors not over the average height when the aisles and platforms are packed and when they have all they can do to reach them even when the car is empty. Many a time the failure to ring a quick bell or three bells to prevent an accident is due to the bad location of the bell cord. In some cars they are set so far back that a short conductor actually walks on the feet of the passengers while endeavoring to reach them, and frequently disturbs passengers' hats in the same manner. This applies with greater force to the register cords, as they are more in use. Again, both cords are sometimes so near together and sag so much between pulleys that the conductor has to puzzle over them for some time before he knows which is which. Some cars have the bell cord above and some below the register cord. We can readily understand that quick, business-like work is out of the question under such difficulties. All this wastes time and keeps the conductor inside the car, when he should be on the rear platform safeguarding his passengers and the company's treasury.

These things are very annoying, and although trifling in themselves they often lead to trouble of a more or less serious nature on account of the extra bother and sometimes the twitting of the passengers. If he happens to be sensitive or not over level-headed, the conductor becomes impatient, nervous and snappy; he gives the wrong change, does not punch transfers right, carries passengers by their destination, or starts his car too quickly. Each mistake adds to his discomfiture, until he is unfit to handle a car.

We will now assume that we have a standard equipment and it is of the utmost importance that it be maintained as such. This is not always as easy as it seems; some employees are careless, and some are actually destructive and abuse everything they handle. The motorman will strain his brakes until they are unfit for use, will mix gong and sand pins, blister the controller fingers by delaying between points, and the conductor will sometimes in an ugly fit deliberately break his bell and register cords. To correct by discipline is difficult, however, for reasons well understood, and the greatest care should be taken to see that all parts are in perfect working order at all times. For instance, the length, width and shape of gong pins and sand pins should be uniform, not everything from a 6-in. square-headed lag screw which stands 1½ ins. over the floor with a sticky thread and so slim that it runs down beside the tapper to a flat-headed 2½-in. pin which is so close to the floor that a little sand will prevent it from working. In the latter case the motorman has to stoop down, pick it up and clean it, during which time he may have an accident. The brake chain should be so adjusted that it will not require three turns where the last car had only required one.

Another injurious result of the absence of uniformity is the effect it has in shaping public opinion. Regular patrons often ride on the platforms, and become more or less familiar with the working of a car and are quick to notice defects and to criticise the management. Often, owing to statements of dishonest employees, they become imbued with the notion that the management and not the employee is to blame for a good many accidents, and even where the employee may be clearly to blame he will lay the blame to some defect which does not exist. The passenger, owing to certain things he had noticed at different times, believes him, hence we find that passenger to prove a poor witness for the company and his neighbor a poor juror.

Carelessness and poor judgment on the part of employees insure a certain number of accidents, and everything possible should be done to confine them to this class by adopting and maintaining uniformity wherever possible in everything that counts in the operation of a car. These standards should apply not merely to local conditions. If general, they would result in a great saving by stopping the destruction of property, the maiming of passengers, and preventing a number of minor accidents by removing "as far as lies in the power of the management" so many contributing causes.

MEETING OF THE UNDERWRITERS' NATIONAL ELECTRIC ASSOCIATION

The annual meeting of the Electrical Committee of the Underwriters' National Electric Association to consider changes in the national electrical code was held March 27-28 at the rooms of the New York Board of Fire Underwriters, 32 Nassau Street, New York. The suggestions of the sub-committee on wiring and equipment of street railway property, including rolling stock, were published on page 451 of the STREET RAILWAY JOURNAL for March 16, 1907.

Rule 28, Section b: The committee proposed to amend this section by the use of the following words: "Must not be used when the difference of potential between the two wires under normal conditions is over 300 volts." It was decided not to adopt this amendment, but to add a note in fine print to the code exempting railway circuits from Section b of Rule 28.

Rule 33, Sections c and d: The object sought by the amendment suggested by the committee was approved. A change was made in the wording of each amendment, however, by substituting the word "may" in each case instead of "can." It was thought that the former word expressed permission better than the word "can." The last clause of the amendment to Section c in its original draft read: "The current must be cut out of the building whenever the latter is not in use or the road is not in operation." It was not the intention of the sub-committee to require that the circuits should be cut off when there is an inspector in the building, and it was decided to reword this sentence so as to permit the use of current in the building under these circumstances.

Rule 33, Section e: Clauses 1 and 3 were united so that they read as follows: "Cut-outs and switches must be placed between non-grounded side and lights or motors they are to protect."

The wording of the proposed clause 4 of Rule 33, Section c, was also referred to a committee for rewording. As expressed in the amendment proposed by the committee it would seem to dictate the use of a No. 00 B. & S. gage wire for connecting the lighting circuits to the rail return, whether there is one light or more on the circuit. It was decided to change this wording so as to permit the lighting circuits to be wired under the usual rules and simply grounded to the No. 00 main to the rail return.

On the morning of March 29 a short conference of the association was held as to the advisability of drawing up a code for high-voltage single-phase trolley wire installations, such as those from 3300 volts to 11,000 volts. It was the opinion of the association, however, that it was too early in the art yet to make rulings of this kind.

TRANSPORTATION AT THE JAMESTOWN EXPOSITION

BY E. C. HATHAWAY

General Manager, Norfolk & Portsmouth Traction Company

The problem of handling the millions of people who are expected to attend the Jamestown Exposition, to be held at Sewell's Point on Hampton Roads, Va., this coming summer, is one which will doubtless be of interest to the readers of the STREET RAILWAY JOURNAL, and I shall endeavor to give as concisely as possible our plans for doing this.

There are two trolley lines, both double-tracked, which will operate between Norfolk and the Exposition grounds, viz.: the Norfolk & Atlantic Terminal Company and the Ocean View division of the Norfolk & Portsmouth Traction Company.

The Norfolk & Atlantic Terminal Company, recently acquired by the Norfolk & Portsmouth Traction Company, is a double-track trolley line of standard gage which operates between Norfolk and what is known as "Pine Beach," a summer resort operated by the same company at Sewell's Point, and on from the latter place by ferry to Newport News.

On this line a single-track viaduct across the Norfolk & Western Railway necessitates a wait when two cars have to pass at this point. To avoid this when we are running the frequent schedule which will be necessary during the Exposition, we have gotten from the city a temporary permit to lay certain track connecting the lines of this company with those of the Norfolk & Ocean View Railway Company (formerly the Bay Shore Terminal Company), which was also recently acquired by this company. This latter line also crosses the Norfolk & Western at another point by a single-track viaduct, and it is proposed to run all cars of both companies out of the city and across the Norfolk & Western via the lines of the Bay Shore and return via the lines of the Norfolk & Atlantic Terminal Company. The cars of each company will then return to their own tracks on the other side of the railroad, thus making a loop through which all cars will operate in one direction. This will facilitate the operation of a fast schedule and do away with all chance of accidents at the viaducts.

The Ocean View division of the Norfolk & Portsmouth Traction Company runs from Norfolk to Ocean View and Willoughby Spit and from there by ferry to Old Point Comfort. We have extended this line from a point just below Ocean View, known as the Government Reservation, across the country on the shores of Willoughby Bay to the Exposition grounds, a distance of about 3½ miles. This road is a double-track line with a 5-ft. 2-in. gage.

The use of these two lines makes practically a four-track line, and as the terminals in Norfolk are at different points, the crowd will be divided in loading.

We have purchased about forty Brill semi-convertible cars and forty open trailers, and these, with the cars we already own, will enable us to run a motor car and trailer over each line every 2½ minutes, and during rush hours every three-quarters of a minute. Counting 250 passengers to the train, this would mean a capacity of 12,000 an hour in each direction.

The terminals at the Exposition grounds are shown on

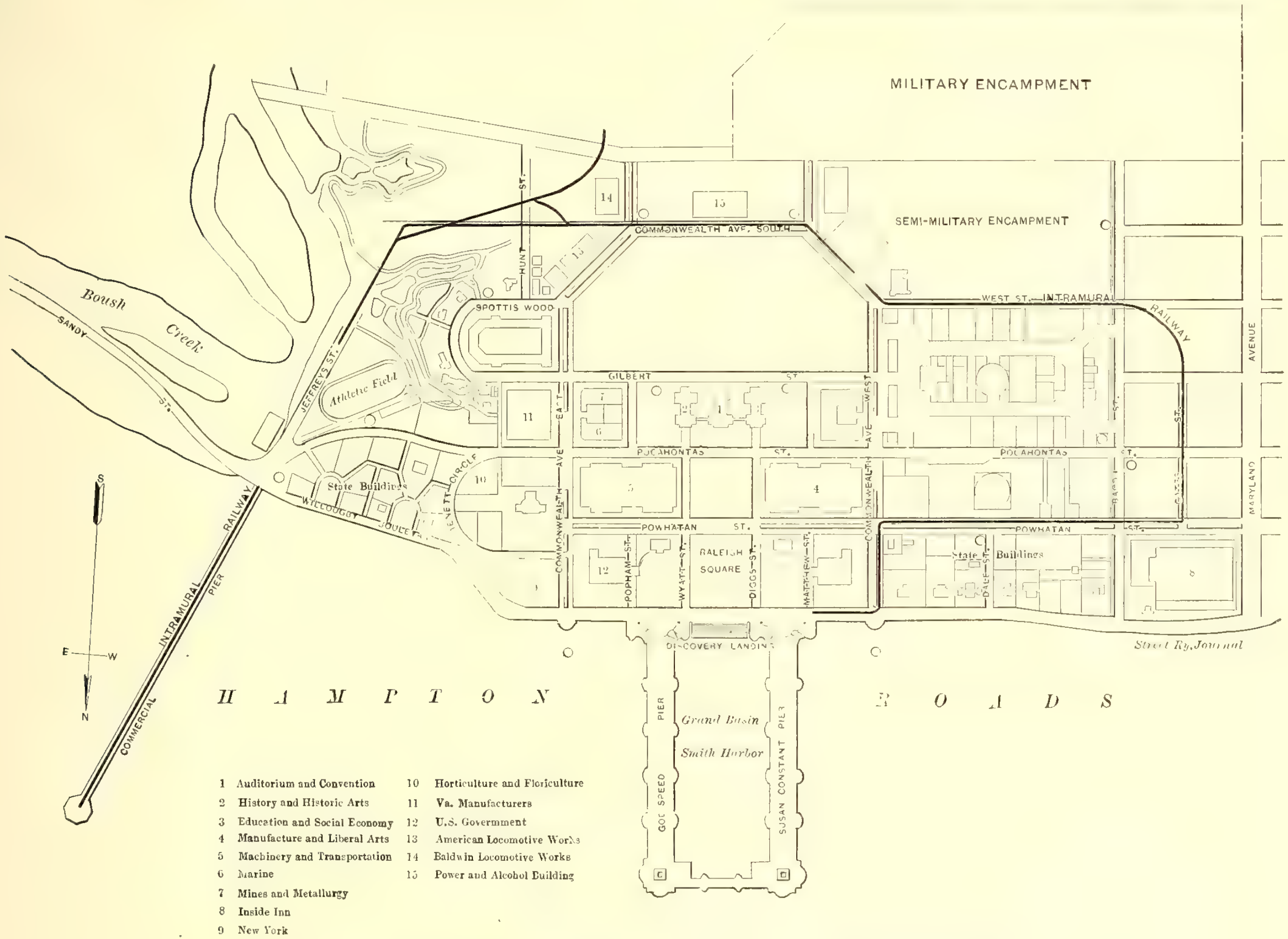


FIG. 1.—PLAN OF JAMESTOWN EXPOSITION, ON HAMPTON ROADS

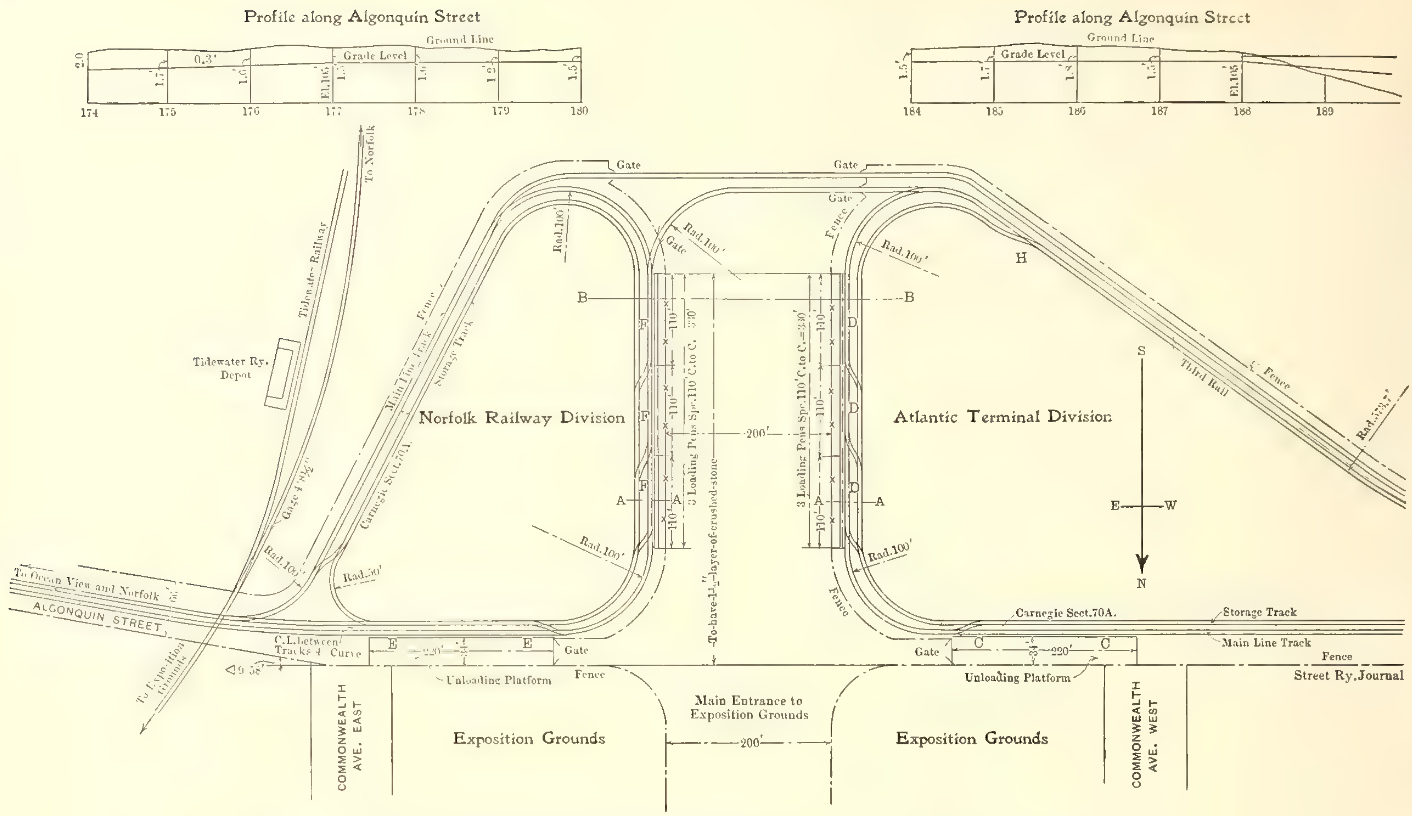


FIG. 2.—PLAN OF TERMINALS AND APPROACH OF ATLANTIC TERMINAL DIVISION

the accompanying map, Fig. 2. The difference in the gage of the two lines necessitates two separate stations.

The Atlantic Terminal cars will come in and unload passengers at the point *C*, continue around to the point *D*, where they will load, go on around the loop and return to Norfolk. The Ocean View division cars will come in on the other side, unload at the point *E* and proceed to the point *F*, where they will load and return around the loop to Norfolk, via Ocean View. As shown on the map there are three cross-overs in front of the loading platforms on each side and frequent cross-overs at other points, to facilitate switching cars for loading and unloading.

On each side are three loading pens each 110 ft. long. Each pen is provided with two gates at about the points marked *x*, and each gate has a turnstile and a ticket-chopper, one man to operate each ticket-chopper and one man to operate each turnstile. Six cars at a time can be loaded at each terminal, and with one gate for each car and

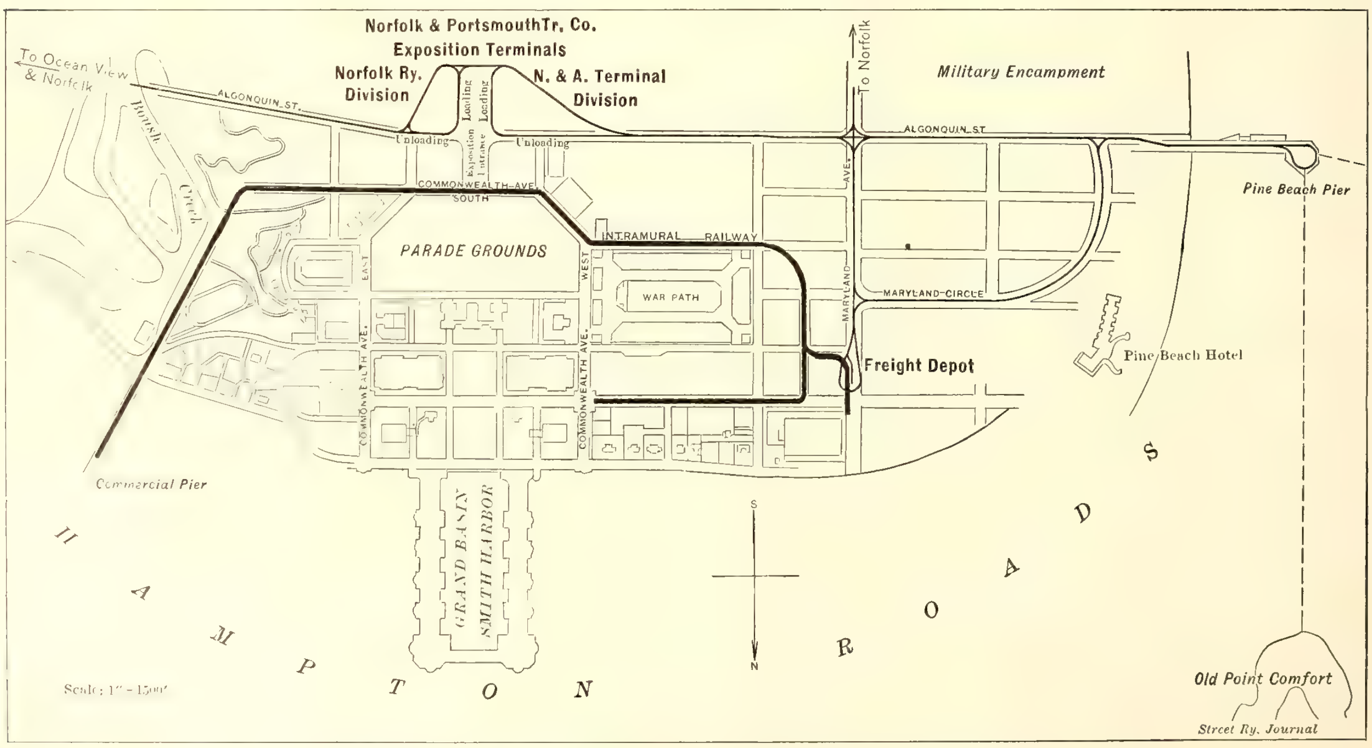


FIG. 3.—GENERAL PLAN, SHOWING TERMINALS, GROUNDS AND INTRAMURAL RAILWAY

the divisions between the pens, there will be little danger of accident in loading cars. It will also be seen from the map that the storage track on the terminal side extends from

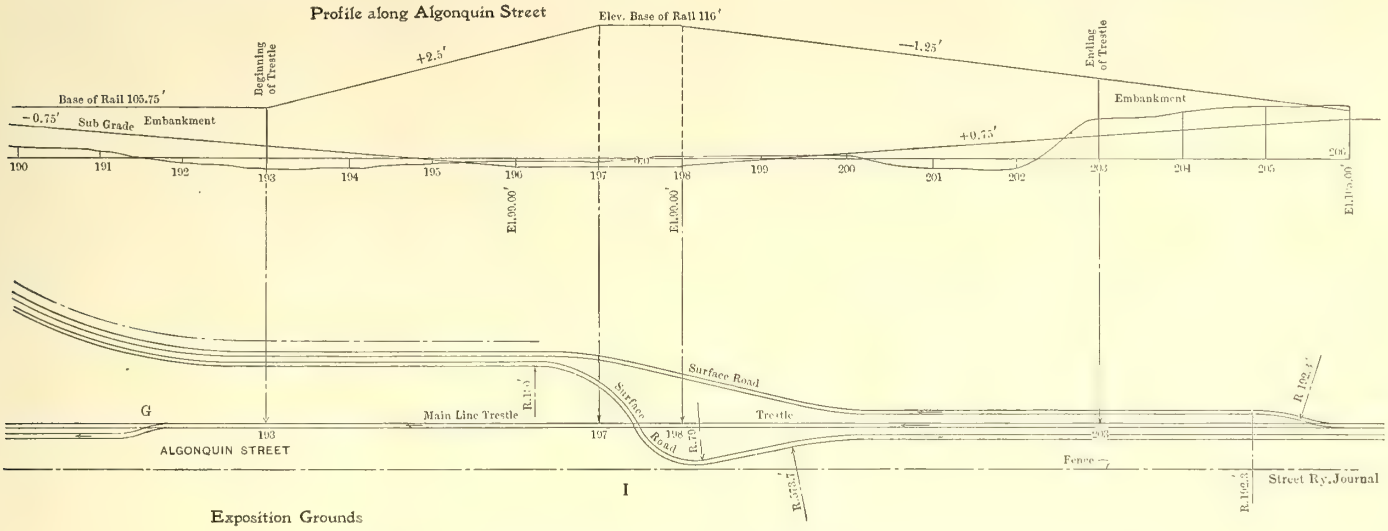


FIG. 2 (CONTINUED).—PLAN OF TERMINALS AND ATLANTIC TERMINAL DIVISION

the point G around to the point H, a distance of over 1400 ft., and on the Traction side the entire inside track around the loop is available for storage for about the same distance.

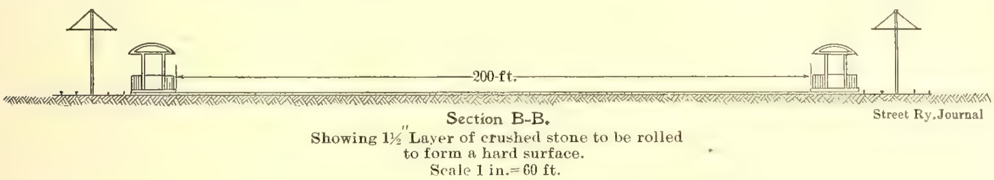


FIG. 5.—SECTION BB OF FIG. 2

Where the tracks cross at the point I, one track passes over the other, thus doing away with the danger and delay incident to a grade crossing.

In the space just outside the Exposition gates will be erected booths from which tickets will be sold. It has not been fully decided whether the plaza between the terminals will be paved or covered with crushed stone.

The third rail from the point where the Traction Company's tracks join the Terminal tracks is for the purpose of enabling the cars of the Traction Company to reach the freight station shown on map Fig. 3 and in detail on map Fig. 6.

A smaller terminal station will be located opposite the

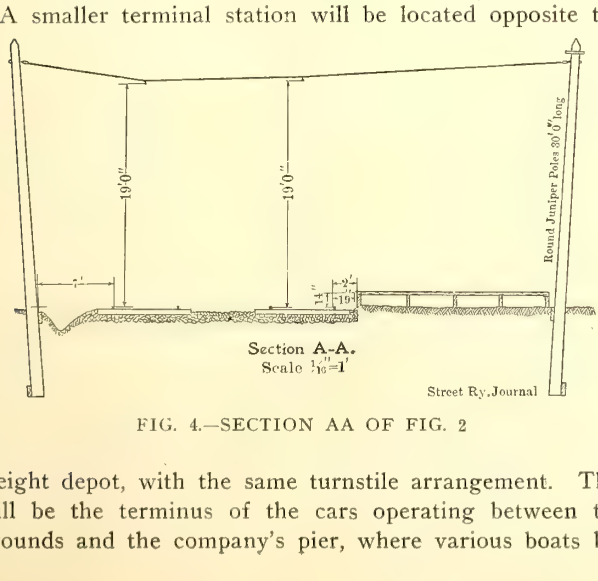


FIG. 4.—SECTION AA OF FIG. 2

freight depot, with the same turnstile arrangement. This will be the terminus of the cars operating between the grounds and the company's pier, where various boats besides our own will land, bringing people from Newport News, Old Point Comfort, Hampton and Norfolk.

There will be a cashier's office at the Terminal station and the surplus money taken by the conductors will be turned in at stated intervals during the day. All receipts will be deposited in drop safes at this end and will be taken care of by the treasurer and his staff at the close of each day.

The fare between Norfolk and the Exposition grounds will be 10 cents or two tickets over the Norfolk & Atlantic Terminal division, six tickets for a quarter being sold on

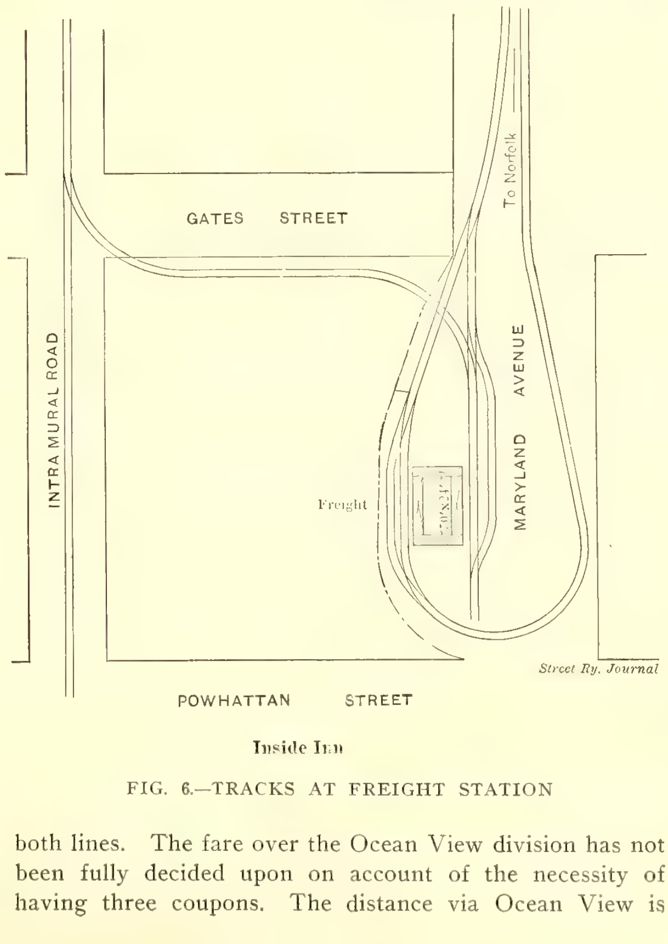


FIG. 6.—TRACKS AT FREIGHT STATION

both lines. The fare over the Ocean View division has not been fully decided upon on account of the necessity of having three coupons. The distance via Ocean View is

9 miles and will consume approximately 40 minutes. The distance via the Atlantic Terminal is about 6 miles and consumes 30 minutes.

At the Norfolk end the cars of both companies operate around loops, so that there will be no delays in switching and turning cars.

We have studied every phase of the situation and feel that we have a very complete plan, and with the various steamboat lines which will be operating between Norfolk and the Exposition grounds we shall have no difficulty in handling the crowds.

THE DAYTON MEETING OF THE CENTRAL ELECTRIC RAILWAY ASSOCIATION

The March meeting of the Central Electric Railway Association was held at the Algonquin Hotel, Dayton, Ohio, March 28. It was well attended and the discussion of the papers presented was animated and exceedingly interesting. The morning session was opened by President Nicholl at 11:30. Retiring President Spring took the occasion to welcome his successor, President Nicholl, to the chair and to extend to him the best wishes of the association, and as a token of the esteem in which he was held presented him a bouquet of roses. In a few appropriate remarks President Nicholl thanked the association for the honor conferred upon him and stated that he regretted very much his inability to be at the Indianapolis meeting, at which he was elected. He urged all to attend the meetings and to come fully prepared. He believed none could spend one day every two months to a better advantage than by attending the meetings.

After the minutes of the last meeting had been approved the following paper on "Track Bonding" was presented by Thomas B. McMath, civil engineer of the Indianapolis Traction & Terminal Company:

TRACK BONDING

The earliest track bonding noticed by the writer was the bonding of the old tram rail on wooden stringers. This was done by drilling a ⅜-in. hole in the tram near the end of the rail. The bond consisted of a No. 4 galvanized iron wire; a rivet was started in the hole, about two turns of the wire were taken around the rivet and then the rivet was set. In speaking of this work, some time ago, a statement was made that no pains were taken to get good contact. This is the general opinion of present critics, but it probably was never the case. Frantic efforts were made to pour solder on the wraps of wire around the head of the rivets. The head of the rivet was under the rail and the space required for clearance was obtained by notching the stringer. The end of a rail only was raised during the work of installing the bond so as not to interfere with the service of mule cars which passed over the road every ten minutes. Both the contempt of the mule driver for the new methods of propulsion and the conceit of the expert applying bonds often found ready expression in plain but vivid language.

The next method of bonding, so far as the writer knows, still retained the use of the galvanized iron wire, but the supplementary wire was carried the full length of the track and was connected with each joint bond. Even in this type of bonding an effort was made for good contact, as all wire splices were soldered.

Failure of the bonding during these periods was not hard to explain. The entire track construction was so weak that the impossibility of securing a proper return was chargeable largely to the track as well as the lack in capacity of the bond. At this time, while the tram rail was still in use the 4½-in. girder rail was considered standard construction for horse-car work and was expected to be sufficient for electric cars if it were only bonded.

The channel pin was generally used with wire bonds and was the first efficient terminal. It was first used with galvanized iron wire up to No. 0000.

This type of bonding held its own in popularity and efficiency till driven out by bonds concealed under the angle plates. Its popularity was largely due to the possibility of using old scrap wire from feeders and trolleys as bonds. Its efficiency was due to its easy application by unskilled workmen. Its failure was caused by the ease with which the copper was stolen on exposed track.

With the 6-in. girder rail, however, a much better bond, known as the Chicago bond, was used. Those employed by the writer had a solid No. 0 wire with a large base at the terminal end, and the terminal was threaded. After the terminal was put through the rail a brass nut was put on and pulled tight. The surface of the rail around the hole was milled with a special tool, and a large area of contact was provided by the boss on the terminal which pressed against the milled surface. Special pains were taken for contact, as a strip of solder was introduced under this boss and after heating it with a torch the nut was given an extra turn. Finally the end of the thread was riveted to prevent the nut becoming loose.

The next bond coming under the writer's notice was the No. 00 Atkinson "horseshoe," about 2½ ins. long. This bond was designed to be applied with a single screw compressor, but in reality a large majority were driven in and riveted with a hammer. This bond gave good results on account of its increase in capacity when used on good firm joints. On loose joints, however, its shortness and lack of flexibility soon resulted in the contacts being destroyed. The No. 000 and No. 0000 Washburn & Moen bond known as the Crown bond was next. This bond had a hollow terminal which was expanded after its insertion in the rail by a tapered steel plug driven into the hollow terminal. These bonds proved to be good. The point of failure was generally in drilling a hole of the exact size needed for the terminal, and the limited expansion the plug would give. The result was loose terminals. There are bonds of this description in track at Indianapolis that test fair now after six and seven years use.

The standard bond in use in Indianapolis is a No. 0000 10-in. flexible bond with ⅞-in. compressed terminal. With this type of bond the chief difficulty is the connection of the flexible strand or ribbon wire with the terminal. Each manufacturer claims that his process is the best. But all bonds are subject to the personal errors of the workman in manufacture. Certain heat conditions, together with proper manipulation at the exact moment, are essential to the construction of a good bond. Individual wires which are badly burned or practically cut through in the process of forging are frequently found in all these bonds. I know of no practical test that can be applied to ascertain the conditions at the point where the strands merge into the terminal. If the terminals are sawed open with a hack saw, the condition of the surfaces exposed is no proof of their original condition, as the drag of the saw teeth in a material which flows as readily as soft copper will cover and smooth over irregularities. If the terminal is cut in quar-

ters by a hack-saw down to the flat and these quarters are spread and flattened back by sharp, heavy blows with a hammer, such a test may demonstrate the ductility and hardness of the material and may show some measure of the contact between the ribbon wire and the head in cases where the head was originally a separate piece. For testing the union of ribbon or strand wire with the terminal, the following is suggested: Hold the head of the bond firmly in a vice, then after cutting the strands some 2 or 3 ins. from the head, bend them back against the terminal. Then take the individual wires and separate them from the head by a strong, sharp jerk. This will show, relatively, any reduction in area, brittleness and possible defect at their junction.

Manufacturers do not pay sufficient attention to smooth terminals. Frequently terminals are so rough that an appreciable flow of material under compression will be required to bring cavities into contact.

A serious difficulty in bonding is the drilling of holes in the rail. New twist drills will bore an exact hole, but if they are ground by hand the holes which they bore will not be true. A tool grinder is therefore essential. A Yankee tool grinder in the shop, or one of the portable tool grinders now obtainable, should be used exclusively for bitts. A portable grinder costs about $15 and can be fastened on a hand car, wagon bed or even on a block of wood. In the latter case the grinder is convenient to carry, and when nailed to a pole or a tie, grinding can easily be accomplished.

In one case, after carefully bonding some 3 miles of track the writer found at the end of three months that 15 per cent of the bonds were faulty, and is convinced that defectively ground bitts were entirely responsible for this condition. The original holes were drilled with a Ludlow electric track drill after the track was laid, and the holes drilled dry so that no oil or dust could prevent contact. The bonds were immediately applied with good compression. It was decided that one of the bitts used, due to defective grinding, must have drilled a hole nearly one-eighth of an inch large. The only defective bonds were consecutive along one side of the track, and the holes were all found to be too large.

It is necessary to insist on the use of the tool grinder, as men claim they can grind better by hand. Investigation has shown that all claims of better grinding by hand were due to a wire edge left by the tool grinder which prevents good cutting. The wire edge can easily be removed by the back of a knife blade.

If one man is made responsible for the field grinding he will soon learn the necessary kinks and take pride in doing the work well.

The writer has never personally used a plastic bond. His experience with solders of low melting temperature, and which contain bismuth and mercury, indicate to him that such alloys will granulate and disintegrate in time.

Soldered bonds are a succcess where carefully applied. They give good contact, and are hard to remove. Good track with firm joints are necessary for the success of a soldered bond.

The use of a bond brazed to the rails by means of an electric brazing device gives the best contact that can be obtained. This process of brazing, however, includes the merging of the ribbon wires into a solid mass for a terminal, which is the most delicate part of bond manufacture. The forging of a bond can be entrusted only to a workman of the highest skill. Railway companies will find it difficult to do work themselves with such a machine, unless able to find and keep an operator with the requisite skill.

In Indianapolis there are 40 miles of track with cast-weld joints. These joints have been tested several times for electrical contact, and show well in this respect. Only 1 per cent of open joints have had to be rebonded after five and six years of service.

It is frequently impossible to bond all joints in special work, as the compressor cannot be applied. Long bonds must be used to connect all pieces that would leave open joints. In addition it is best with complicated layouts to use long bonds to jump the entire job of special work. The size and number of such long jump bonds depend on the amount of return current to be carried. Long bonds can be made with terminals spliced and soldered to the wire or cable.

Manufacturers charge more for two terminal ends than for a 30-in. cable bond, which cut in two will provide the desired terminals. The reason for this is a secret of the manufacturer.

The general rule for cross-bonding is to use a cross-bond every 500 ft. and at both ends of all special work. Double track should be bonded across at least every 1000 ft. A bond made 66 ins. long will suffice for both track and devil strip cross-bonding.

Bond testing can be done with very simple instruments. The double voltmeter is sufficient. This is wired to knife-edge terminals. One reading is taken through the joint, the other reading through a similar length of rail. A comparison of the drops shown by each meter will give the relative conductivity of joint and rail. A joint showing three times the resistance of an equal length of solid rail is frequently permitted. Greater resistance indicates that the bond should be renewed. The expense of removing and replacing the pavement, however, frequently prevents proper attention to poor bonds.

It is a slow and tedious job to go over any length of track with a bond tester. Enough attention is, however, not given to the condition of bonding. A bond supervisor should be employed on all roads and he should have no other duties which will prevent his making proper inspection. A good bond supervisor will undoubtedly be termed a crank by construction gangs; if so, this proves his efficiency. A test car for general inspection of bonding would be a good investment for roads of considerable length of track. Such a car has made trips over Indiana and Ohio roads. The car gave the general conditions, but registered more open joints than actually existed, as any break in contact between the wheel of the car and the rails would also register as an open joint. In spite of any local defect missed or non-existing defect registered, the car would show the conditions of bonding for less expenditure per mile than any other method.

DISCUSSION ON TRACK BONDING

The discussion following Mr. McMath's paper was largely confined to the method of drilling holes and to the use of brazed bonds. Mr. Mason, of the Electric Service Supplies Company, thought that oil used in drilling holes got into the steel and was hard to remove. Mr. McMath replied that he had forbidden the use of either water or oil in drilling holes.

G. H. Kelsey, electrical engineer of the Indiana Union Traction Company, said that one bondmaker insisted on using gasoline to remove oil. He believed oil formed a coating of insulation and increased the resistance of the bond.

W. H. Evans, master mechanic of the Indianapolis Traction & Terminal Company, said that there was no question

but that oil was detrimental. He added that the later developments in the production of high-carbon or high-speed steel would permit drilling without the use of oil or water.

Mr. Kelsey wanted some information concerning the brazed bond. He said he had heard that one objection to this bond was that in fusing the terminals the meshes were weakened. He thought this was probably due to improper fusing, but he wanted to know some practical results from brazed bonds.

C. N. Wilcoxson, general superintendent of the Cleveland, Southwestern & Columbus Railway, said that about fifteen months ago he had two short divisions of his road bonded with these bonds. The bonds were installed at a season of the year when wet weather and other conditions prevented the installation of soldered bonds. A recent inspection of the bonds on the different divisions after they had been on fourteen months showed that out of 1200 bonds there were seven defective. Of the seven, five were defective on account of broken strands. The terminals of these bonds were intact and in good order. Two bonds had one terminal loose. He considered the showing a remarkable one. At a later date 500 bonds were placed in brick pavement. The track was in bad condition and it was practically impossible to keep joints tight. Of these 500 bonds an inspection showed 27 defective ones. He thought this a very good showing, considering the condition of the track. He said he would use many more brazed bonds this year. In two years, he added, he had used about 10,000 soldered bonds. His data were not sufficiently accurate to give definite results, but he did not think the failures excessive.

George H. Whysall, of the Columbus, Delaware & Marion Railway, in speaking of the expense of installation of bonds, said that in installing 2000 twin terminal bonds the expense of installation was from 8 to 10 cents. The number that could be installed per day depended somewhat on the temperature. During the installation of the first 1000 bonds considerable trouble was experienced by the breaking of drills. The drills broken were usually those used to bore the two inner holes or the holes next to the end of the drill. He removed the oil used in drilling the holes by the use of a cheese-cloth swab and gasoline. He took exception to Mr. McMath's statements that the drills should be machine-ground. In all his work the drills were hand-ground, and he thought they could be ground more accurately by hand than with a machine. He added that trouble with bonds was usually because the company expected to get the work of bonding done by a section hand rather than by a mechanic.

The next paper on the program, "Car Wheels for Interurban Service," was presented by C. Skinner, master mechanic of the Scioto Valley Traction Company, Columbus, Ohio.

CAR WHEELS FOR INTERURBAN AND CITY SERVICE

I have interpreted this subject to mean, "Wheels for heavy interurban cars, operated over both interurban and city tracks," and in the treatment of the matter at this time I have in mind only the operation of high-speed equipment weighing 40 tons or over per car. I am fully satisfied that in the selection of wheels for this class of service the specifications of the Master Car Builders' Association should be adhered to as nearly as possible. It may be, and in our case was, necessary to reduce the size of the wheel flanges somewhat to operate over city streets. I believe the flange dimensions may be safely reduced to 1⅛ ins. or 1 in. in depth and to 1¼ ins. or 1⅛ ins. through the throat, but I am firmly of the opinion that the 4-in. tread is essential to safe tracking and to obtain proper efficiency in braking with heavy equipment.

Since the introduction of the rolled-steel wheel is comparatively recent, I will not enter into a discussion of the relative merits of this type as compared with the steel-tired wheels which we have in use on all of our motor equipment.

My experience has been that the flangeless brake-shoe is best for service in which heavy cars are operated over grooved rail in city streets, for the reason that the flange wear, always excessive, should not be increased by the use of a flanged shoe. We have demonstrated by practical tests that the wear on the wheel flange by a brake-shoe adhering to the flange of the wheel reduces the possible length of time between tire turnings by nearly 30 per cent. Therefore, in the operation of heavy equipment at high speed with flangeless brake-shoes, we need a fairly wide tread to obtain sufficient braking power.

The question of safety in tracking is an extremely important one. I believe all will agree that no system of inspection, no matter how thorough, can be depended upon to detect a wheel loose and working at the axle fit at just the time it occurs. Therefore, why reduce the factor of safety from this not unusual trouble, especially when we have to meet a condition in operating over city tracks that greatly increases the liability of wheels to loosen on the axle fit? Recognizing the desire and expediency of interurban companies to operate their cars over the tracks of city companies within the limits of municipalities, I believe that in the operation of this same heavy equipment at high speeds outside of city limits, safety must be the first consideration.

Asking your further indulgence, I will give you a brief resumé of the experience of the Scioto Valley Traction Company with the wheel question. This company commenced operation in July, 1904, and until about Dec. 1, 1904, it operated on its own T-rail tracks exclusively, not entering Columbus over the city tracks until the latter date. The records from which data were obtained for this report cover ten 60-ft. passenger cars of this company, weighing 42 tons each and equipped with 36-in. steel-tired wheels, having M. C. B. tread with flange 1 in. deep by 1 1-16 ins. thick through the throat. (This was found to be the maximum size of flange which could be operated over the groove-rail tracks in the city of Columbus.)

The accompanying drawings submitted herewith show the exact wear on flanges of a pair of wheels removed from one of the cars on March 22, 1907; this pair of wheels having been placed under the car Nov. 8, 1906, with tires newly turned to the dimensions mentioned above. The mileage made by this pair of wheels during this interval was 28,000 miles. This wear was, however, somewhat abnormal, as we average about eight months between turnings, or about 48,000 miles.

The first five months of our operation, you will recall, was over T-rail, and I would call particular attention to the fact that during that time our wheel flanges showed no perceptible wear. Since Dec. 1, 1904, or during a period of about twenty-seven months, we have been obliged to remove and turn ninety-three pairs of wheels for no other cause than worn flanges. The distance covered in going in and out of the city of Columbus is 7 miles, about one-half of which is grooved rail with 1¼-in. groove.

In looking at the print you will observe the excessive wear on the inside of the flange. This wear, coming at the

angle it does, shows a very severe wedging tendency, which finds its weakest point at the wheel and axle fit. The inertia from the swaying of the heavy car and climbing the inside of groove where the track is out of alignment makes it very difficult to maintain an immovable wheel at this fit. In less than two months after commencing operation over the city tracks we had a large number of loose wheels, that is, they had moved out of gage on the axles, notwithstanding that it afterward took from 45 to 60 tons hydraulic pressure to move the same wheels in the shops. We replaced these wheels at from 90 to 125 tons pressure, and have been fairly successful in keeping them tight.

Judging from our experience, I should say that wheels for this class of service should be pressed on at about 90 tons, with a minimum of 70 tons. I have handled wheels of the same design on steam railroads for a number of years, using 40 tons as a maximum pressure, with no trouble from loosening.

Although over half of the wheels under the cars covered in this report have been refitted on account of becoming loose, we find it necessary to maintain the most rigid inspection of our wheels. We keep a trained inspector whose principal duty it is to gage each pair of wheels each day a car is in the shops, that is, every alternate day. The spread is measured by a solid immovable gage and a written record is made of the position of the wheels on the axle. This report is turned in to my office, where it is carefully checked with the former records. It is not unusual even now to find a wheel loosened, notwithstanding the enormous pressure at which we put them on.

Some idea of the excessive wear of flanges due to the cause mentioned may be shown by comparison with the life of the same wheel under equipment of equal weight on steam railroads, it being not unusual to obtain a mileage on steam roads of about 200,000 miles between turnings, while our average is 48,000 miles.

DISCUSSION ON CAR WHEELS

Mr. Whysall thought that the wedging action caused by the wheels riding on the inside of the groove of the rails in city streets was undoubtedly the cause of the loose axle fits experienced by Mr. Skinner. He wanted to know whether or not Mr. Skinner had found any difference in the wear on the flanges of the wheels on the gear side and of the mate wheels.

Mr. Skinner said that he had found the wear about equal. He added that his troubles were increased by the fact that the gage of the city track over which his cars ran varied from 4 ft. 8¼ ins. to 4 ft. 9 ins.

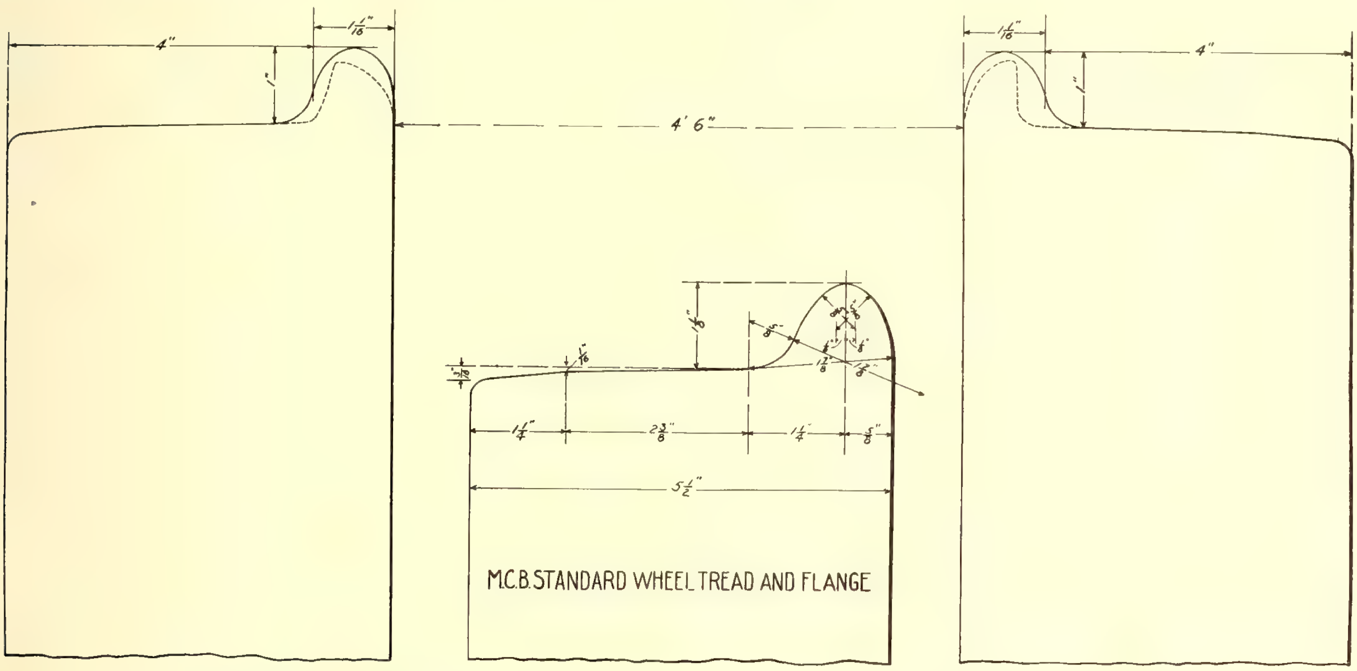
Mr. Whysall said that his experience had been that the greatest flange wear was on the leading wheel nearest the gear. At first he thought this was due to the sanding devices, but the sanders had been changed and the same results had since been obtained.

F. A. Bundy, master mechanic of the Lima & Toledo Traction Company, said that he was not able to get 50,000 miles out of a pair of wheels because of the rapid wear of the wheel adjoining the gear. Recently he had not been turning a full flange on worn wheels. Instead, the sharp flange is partially turned out of the wheel worst worn, and the wheel is then put on the rear axle and on the side opposite the gear. He is now turning the wheels on the gear side of the forward truck a little larger, so as to offset the tendency to wear. He did not know whether his trouble was due to the condition of the track or to the fact that his cars were operated in one direction only. The trouble was experienced with two styles of truck.

Mr. Skinner said that his cars were operated in both directions. He got from 160,000 to 170,000 miles out of 2½-in. tires.

Mr. Kelsey said he believed one cause for the wearing of wheels was the condition of the side bearings. He said there is no question but that a roller center bearing would help matters.

Mr. Evans thought Mr. Bundy's wheel troubles were due to the type of rail and largely owing to too close gage on curves. He said that the importance of mating wheels was not fully appreciated. Often the mating of wheels was given over to men who did not take sufficient care. He said that wheel-makers sometimes employed boys 10 or 12



WEAR ON INTERURBAN STEEL-TIRED WHEELS CAUSED BY RUNNING OVER GROOVED RAIL IN COLUMBUS, OHIO

years of age to do the taping. He thought that a difference of one-eighth of an inch in the tape measurements in taking the circumference of wheels should be the limit in mating them. He urged the use of a tape rather than calipers in getting the diameter of wheels, saying that he knew nothing better for taking measurements than the M. C. B. standard tape. He had followed the plan of making the wheel having a thin flange a little larger to throw the strain on the mated wheel. He said it was important that the wheels should be mounted at equal distances from the center of the axle. This place could be located by a punch mark at the center of the axle. It was unfortunate, he said, that the traction companies had not agreed on a rail which would tend to reduce the wheel wear.

Mr. Skinner, in reply to a question by Mr. Bundy, said that his wheels were not key-seated on the axles.

At the conclusion of the discussion, on a motion by Harrie P. Clegg, president of the Dayton & Troy Electric Railway, a vote of thanks was extended to those presenting the papers and to those taking part in the discussion.

AFTERNOON SESSION

At the opening of the afternoon session the president announced the appointment of several committees, after which the following paper on "Trolley Wheels" was read by M. M. Baxter, electrical engineer of the Western Ohio Railway Company, Lima, Ohio:

TROLLEY WHEELS

We have many trolley wheels to-day to test out on our many different roads, for each style of road must have its particular wheel. At this time we will consider the wheel for the interurban car. Much time and expense can be saved by a railroad company by using a wheel built for its particular service; hence, it pays to test them thoroughly.

When testing a new wheel we should not only keep the car-mile record of wheel, spindle and bushing, but a record of complaints from the conductors. We should learn if the wheel held to the wire and if it ran quietly. We should examine the wheel when it came off test and learn whether it met with accident or if it was entirely worn out. Examine the spindle, lubricant, bushing and flange of wheel. See if the wheel wore true. It also pays to keep a complete record of every wheel used. This can be done with little cost by the car house man who looks after the trolleys. Let him stamp each wheel and keep a record of the date when it went in and out of service, giving the number of the car on which it was placed. This record can be completed by the man who takes care of the car mileage. If a record of all wheels is kept we will not allow some of them to lie along the right of way for boys to pick up and sell; we will get them to our own scrap pile. Very often where an extra pole and wheel are carried on a car the train crew in their haste make quick repairs and get their car back on time after a trolley wheel accident, will throw the old pole and wheel on the ground, expecting the work-car crew to pick it up some day. If this record is kept we will know if the wheel manufacturer is keeping his product up to standard. If we learn of some other road giving the same service as our own who claim good results from a trolley-wheel test, we will know if we care to try their wheel. Many delays on the road from trolley-wheel trouble can be done away with by having a good man to inspect wheels. This inspection should be done every day or after every 500-mile run. Much attention should be paid to the contacts and collecting springs of wheels. These contacts and springs should be kept clean and in good shape so that the current will not depend upon the spindle for a path to the trolley pole. If it does the lubricant will soon dry out and the spindle or hub will be ruined. Oftentimes a wheel is condemned when the real cause of trouble may not be in the wheel. This cause may be in the trolley stand or the adjustment of the wheel in the harp. To have the life of a wheel increased where a double trolley is used and where the wheel has a tendency to wear only on one side instead of in the center, adjust the trolley stand so that it will swing freely, but not too freely, for the high-speed road cannot make time with a too sensitive trolley stand. The pressure of the wheel on wire should be watched closely.

DISCUSSION ON TROLLEY WHEELS AND CLINCH EARS

The discussion following this paper developed into a comparison of wheels of different makes and the care taken of them. General Manager Whysall, of the Columbus, Delaware & Marion, said that the average run of the Kalamazoo wheel, with graphite bearing, one lubrication a day, had been 2200 miles on that road, but with two lubrications a day they had run as high as 6500 miles. However, he thought the time and trouble in lubricating a second time is worth more than the cost of the wheels. The Hensley wheel, he said, averaged from 3000 to 3500 miles. The poles carried a tension of 40 to 45 lbs., with trolley 19 ft. above the rail. During the past winter considerable trouble had been encountered by the wire breaking and the tension was reduced to between 35 and 40 lbs. Since this has been done the trolley does not keep to the wire.

Mr. Mason, of the Electric Service Supplies Company, stated that the trouble with the wheels was that they were not properly lubricated, and he thought that particular attention to this point would result in better service.

The new Holland wheels, used on the Western Ohio, Mr. Baxter said, had worn on one side, but when supplied with a roller bearing stand this objection disappeared. Other members stated that this appliance would increase the life of any wheel now in use.

F. A. Bundy, master mechanic of the Lima & Toledo, made the statement that oil in graphite bushings destroyed the qualities of the graphite and defeated the purpose for which the bushing was intended. This idea was endorsed by a number of other members who had experimented with them. He also said the average life of trolley wheels on his road had been 3200 or 3300 miles for the past six months, but before that time he could not get even 3000 miles out of them. Mr. Bundy thought that the electric railway men should become educated to the bow trolley or some other appliance that would do away with wheels. He suggested that a shoe with a contact of at least 6 ins. be used. If aluminum could be utilized for this purpose, Mr. Bundy said, he thought such a scheme would be successful, as the metal is light and greater contact could be secured than with a heavier metal. Regarding the tension of trolley poles, Mr. Bundy suggested that a pressure of from 40 to 50 pounds is sufficient to break the retriever or damage some other portion of the mechanism. He said that from 30 to 35 lbs. with a roller-bearing base is sufficient to hold the trolley wheel to the wire and will be found more satisfactory than a greater tension.

There was some discussion on the clinch ear and the liability of the wire breaking at the ear. One member stated that on a road 65 miles long this style of trolley had been used and no breaks had occurred at the ear, but in all cases they occurred 10 or 12 ft. away. Another speaker took just

the opposite view, and said his experience with trolley lines erected with the small clinch ears showed practically all breaks at the ears.

E. C. Spring stated that the alignment of the wire has much to do with the wear of the trolley wheel. The Hensley wheel, he said, had given good service on his road, as is attested by the fact that he had just placed an order for the second dozen poles in the past five years. He had had no breaks in the wire, except at the sleeve, soldered sleeves being used. Mr. Whysall replied that keeping the track in alignment is as important as the wire, and that he was afraid that many failed in this respect. Usually a track is either out of surface or alignment. A deviation of ⅜ in. at the track means much more at the wire 19 ft. above.

Mr. Kelsey, of the Union Traction Company, said that he had had some experience with the No. 18 Kalamazoo wheel with graphite bushing. He thought many engineers make the mistake of using wheels that are too heavy. Poles and wheels should be as light as consistent with the use to which they are subjected. He favored the graphite over a solid bushing, because the pounding of a worn graphite wheel is less marked than with the solid brass. Mr. Kelsey made a good point in stating that many trolley wheels are burned out by forcing the current through the bushing which is covered with oil. The oil acts as an insulator and forms an arc which soon destroys the wheel. Some of the faults that are placed upon the wheels may be due to this instead of defects in the wheel or its manufacture. Mr. Kelsey said he hoped the bow trolley would soon show itself on the roads in this section. The only danger that he could see in the adoption of that plan is in the wear on the trolley wire. The speaker discussed the Clark splice for trolley wires and said that the only trouble he had ever had with them is in their turning out of their position when some distance from a support.

R. C. Taylor stated that he had been using the Holland trolley wheel and had also purchased a supply of the Hensley wheels. Some of them had shown a mileage of 5000. In this connection Mr. Whysall said he had tried a sliding bow for a trolley, but that all the appliances he had used would melt like ice in the sun.

On the Rushville line in Indiana, A. A. Anderson stated that they had been getting 5000 miles out of a bow trolley with an aluminum contact. The results, he thought, would be better in voltages up to 6600 and 11,000. This type of trolley has not proved successful on d. c. systems, because of the wear at the point of contact. To prevent wear on the bow, grooves were cut lengthwise in it to hold the oil. There is no perceptible wear on the wire.

F. W. Shelton stated that there are 20 miles of catenary construction on the Fort Wayne & Springfield line and that the bow trolley will be used as soon as the track is in condition, the ordinary trolley being now used. The difference in expansion in the messenger and trolley wires should be given close attention in order to get the latter tight enough.

George S. Davis described a malleable-iron wheel which had given 11,000 to 12,000 miles on a Pennsylvania road. It was 6 ins. in diameter and had a copper bushing lubricated by rawhide strips which carried the oil from a reservoir. Mr. Bundy said that he had gotten 8000 miles service from a cast-iron wheel, operating with four 90-hp motors, and that the wheels did not wear out at the hub. He believed that if unbalanced wheels were cast in metal molds they would all be absolutely alike and would answer the purpose better than a milled wheel, and save machining.

After this discussion, the chairman announced the following paper on "Car Inspection," by Lee M. Jacques, master mechanic of the Fort Wayne & Wabash Valley Traction Company, Fort Wayne:

CAR INSPECTION

Car inspection, as applied to street railway and interurban service, is to be considered as one of the most important points with which the electric railway men have to contend. It should be considered from several different standpoints, viz.: safety to the public, maintenance of proper schedules and economy in maintenance of equipment. Proper inspection is the greatest insurance, both to ourselves and the public, and the only way in which a satisfactory degree of safety can be assured.

As regards maintenance of proper schedules, inspection greatly reduces the liability of cars failing while in service and lessens the chances for the public to express opinions regarding the poor service that electric railways maintain for the different city and interurban lines. This also has a tendency to make the public, in general, think that electricity is not as reliable as steam when used for the purpose of transportation.

When inspection is considered from an economical standpoint, as regards the maintenance of equipment, the old adage that "a stitch in time saves nine" is expressly applicable to the maintenance of electrical apparatus. Inspection of electric cars should be carried on like that of locomotives on steam lines and not as a railroad car or coach, because each individual car has its own motive power, a small defect in which may cause serious trouble and much expense and delay. Accidents, such as burning out of controllers and derailments caused by broken flanges, etc., with proper and thorough inspection at frequent intervals can generally be avoided.

At the present time, especially in the East and Middle West, electric lines handle daily many more people than the steam railroads; therefore we should be equal, or superior, to them as regards inspection and maintenance of equipment and have facilities by which each car could have thorough inspection at frequent intervals.

On many of the city lines cars are allowed to run several days without complete inspection. This generally is owing to the crowded condition of shops and pit rooms, as many of the older city lines are still using the same shops, or portions of them, that were used in horse-car days. As these shops are centrally located in a majority of cases, floor space and pit rooms cannot be obtained owing to the excessive price of adjoining grounds; consequently, the cars cannot all be run over the pit each night but have to be divided to permit alternate inspection, several nights or days sometimes elapsing before all the cars have been inspected. This explains, to a large extent, why so many cars fail while in service, interrupting schedules and giving great dissatisfaction both to the management and public.

Another point to be considered is that most of this work has to be done at night when it is necessary to use torches or extension lights while inspecting all parts under the cars, and an inspector is much more liable to miss defective parts than he would in daylight. Most street railways as well as other industries do not think night work can be carried on as economically as in daytime. This is true to a great extent, but, with only the few extra cars and limited room that most city lines have, an additional night force with a competent and wide-awake foreman and inspector seems to be the only remedy.

We believe the inspector should be jointly responsible with the foreman for the condition of the equipment and the proper manner in which repairs are made. He should be thoroughly familiar with the different types of equipment he is required to inspect, and it should be his duty to examine carefully each car underneath as soon as it arrives over the pit. If conditions warrant he should complete the inspection of the controllers and car bodies afterward to allow pit room for the next car. After completing his work he should report on a blank form furnished for this purpose. He should also know that the work has been done before the car is allowed to enter service and promptly report to his foreman any errors made in repairs.

Shop conditions should also be carefully considered. When building new shops is it not well to remember the fact that, although not so centrally located, considerable advantage would be gained by having plenty of room for storage, repairs and inspection?

Another important fact quite likely to be overlooked is the facilities for complete inspection. This would mean that the cars would pass over the pit each night and be allowed time enough for the inspector to go over them thoroughly. Both inspection and repairs would be greatly facilitated if one or two pits are so located that cars can be passed over them; those found in good condition being taken to a place for storage and those needing attention to a pit room for repairs. This arrangement would also save much time in shifting defective cars to where they can be repaired.

Interurban shops and car houses are generally located in small towns where land is not so expensive, but unless the shops are very modern conditions are much the same as with cities, as the buildings in most cases are too small to accommodate the increase in equipment that the business now demands. In other words, the present large equipment now used for interurban service has outgrown the shop facilities. However, as these cars are less in number and not so closely scheduled, there is much better chance to give them necessary inspection.

At the present time, with the high speed that is required of these cars, their frequent and careful inspection is of the greatest importance as there are many defects that would not only delay schedules but might result in serious accident and loss of life. Inspection of interurban cars should be carried on in the same manner as with the smaller equipment, only, of course, more time would be required.

In addition to shop inspection each night, I would suggest that the motorman could be of great service if given the proper schooling by being put through a practical shop course and knowing where he would be likely to find the defects and the best manner to correct them. On most interurban lines the schedule allows considerable time to lay over at the end of each trip, and if the motorman was required to inspect and do light repairs he would soon become quite proficient in this respect. He, of course, should provide himself, or be provided, with suitable overclothes and tools for this work. Work of this kind might be the saving of many delays and avoid possibly serious accidents caused by broken or sharp flanges, loose tires, etc., which can readily be detected in daylight. If motormen were placed on the same level, trained and held as responsible as locomotive engineers are in steam railroad service, there would be many less accidents and schedule failures than there are now. This inspection should be the motorman's duty as well as the handling of his car; however, his defect report to the shop men should in no way interfere with their inspection.

Many roads contend that it is not necessary for motormen to know too much about electrical equipment, but simply to teach them to cut out motors, replace fuses and brushes and do other minor repairs. There are some good arguments in favor of this, especially in city service, as they are quite likely to attempt to make repairs of which they have little knowledge and thus both delay schedules and damage equipment; but in interurban service more time could be given to their training and more shop experience so that they could soon be able to detect many small defects that are now overlooked. At the end of the run, providing the schedules permitted a lay-over, as most of them do, he could make a thorough inspection of all parts of his car that can be easily reached without having it over the pit. Many times a motor brush will stick in the brush-holder, break, loosen, etc., all of which can be easily detected. The damage to commutators, brush-holders, etc., thus avoided, would greatly reduce repair bills in many cases. There are also many other light repairs, such as tightening loose bolts on the trucks or brake rigging easily accomplished. Frequently the loss of a cotter pin in certain parts of the brake rigging will cause the loss of a pin and the result is that the car has no brake. This is generally found out at a point where a stop is very essential, and the newspapers do not fail to publish a detailed account of the "failure" of the air brakes.

By using a thorough system of car inspection each time the car comes to the shop, and having motormen thoroughly competent to inspect and make light repairs at the end of each trip, the cars would not be liable to get in an unsafe or dangerous condition. On the contrary, we would have the best possible safeguard against any liability of accident, either to the public or equipment, thereby saving the claim and mechanical department financially to a great extent. In other words, the more frequent and thorough the inspection by thorough and competent men, the less the liability to damage suits and the more economical the service.

DISCUSSION ON CAR INSPECTION

During the discussion on Mr. Jacques' paper, Mr. Bundy remarked that when the cars did not get far from the car houses he did not believe it well for the motorman to know too much; but motormen on interurban cars should have enough ability to get the car into the shops in an ordinary case of breakdown. Some motormen, he said, would take more interest in making repairs on the road if it were not for soiling their uniforms, which they are compelled to pay for. There would be a different tendency if the men were provided with overalls. He was a strong advocate of overalls for motormen, saying that with them the men would be dressed more in accordance with their work.

E. C. Spring, in discussing this paper, said he did not believe that it is necessary to have the motormen trained to make repairs, thus scattering the shop all along the line. Motormen, he said, should be dressed in a proper manner, and they are usually not prepared to do this work, even if they know how. Under his system the conductors make a report of all troubles and complaints every morning to the general superintendent. These reports are handed in, no matter whether there is anything to say or not, and the men are thus trained to make it a part of their duty, so they will not forget or neglect it. The monthly report of the superintendent of motive power shows the condition of every car on the road and acts as a check upon all other reports that are made during the month. Another thing, he said, motormen, by working on a car, may disarrange some experiment which the shop foreman is trying, or may act in some other way to undo what has already been done.

Difficulty in securing experienced men, Mr. Spring said, had induced him to employ bright farm hands. They are placed in the shop for a few weeks and learn all about the cars and how to handle them. When they go out on their first run they are able to keep full control of the car under all circumstances. Because they have received their instructions from men who have the interest of the property at heart they learn the business well. The experiment had proved a success and they have a number of good men from the farm on the line now. Mr. Spring said that they now had a class, consisting of the foreman and fourteen men, taking a course in the Electrical Institute of Chicago, and that they were making good progress in the studies.

J. L. Adams, manager of the Indiana, Columbus & Eastern, said that the men who make reports should have a good knowledge of the cars on which they report. His conductors and motormen are required to make a report to the foreman each day and this report goes to the manager.

That it is necessary to educate the men who do the work on the road was the opinion of Mr. Evans, of Indianapolis. Motormen should come up through the ranks, he said. Farmers may run a car in a few days, but they know little more than to turn on the current and set the air. As to dress, motormen may be respectably clothed in washable suits that make a better appearance than some of the shabby uniforms occasionally seen. In Indianapolis men are scarce and the companies are almost compelled to take any laboring men that can be had. They are given a drill of a few days in the shop before they are allowed to have anything to do with the cars. The question of inspection, Mr. Evans said, is becoming more and more important all the time. Men, to make competent inspectors, must go through a course of preparation that will fit them for the position.

Mr. Whysall objected to the idea of requiring motormen to wear overall suits so that they may do repair work about the cars. A motorman's job is not a dirty one, he said, and the men should keep themselves clean and neat. If they keep themselves looking that way, their cars will have the same appearance. The management in most cases is responsible for the appearance of its trainmen, and careful attention should be paid to it. Mr. Whysall thought that the men should be able to look after their cars, and if they are not, they should have a little shop training. They may carry overalls or clothing of some kind to use in case they must do work of that kind. The cars of the Columbus, Delaware & Marion run 360 miles a day and the men do not have much time for inspection.

After a man has been in the service for some time and then brings a car into the shops without knowing what is the matter with it, there is something wrong, said C. B. Clegg. The training of motormen depends largely upon the willingness of the car-house foremen to give information. They would often become well informed if all troubles were explained to them. Some foremen hold themselves above instructing the men, while others drill them in such a manner that they are able to handle many troubles that come up on their runs. Mr. Clegg said he liked the rule that prohibited passengers from riding in the vestibule, but that it is often necessary to allow them to do so or leave them on the road when the cars have heavy runs.

Mr. Evans was of the opinion that it is about time that clothes cease to cut the figure they do in the maintenance of electric roads. Interurban trainmen, he said, may keep themselves very neat in washable garments, but he would not apply the same ideas to the men who operate city cars.

Mr. Skinner stated that in the three years the Scioto Valley Traction Company has had its road in operation they had never had an armature on the pole pieces. The men inspect the cars at each end of the line, more for safety to passengers than anything else. The men look after the wheels, as well as other parts of the car, and if they do not understand what to do in case they find anything wrong they telephone the shop for instructions. The company operates seventeen motor cars which average 450 miles a day. Only experienced steam railroad men are employed, and they are required to ride over the road for two or three weeks to learn the track thoroughly. Then they are put into the shops to learn all they can about the cars. As an examination, a car or motor is taken to pieces and the men are required to put it together. If they fail, further training is given them. They are taught all about resistance points and how to prevent rough acceleration on the road. Mr. Skinner was asked a number of questions as to how he could secure railroad men at the salary electric railway companies are able to pay. He said that they were able to get men who preferred the work to steam railroading, even if the salaries are less, and some are taken who have for one reason or other been dropped by the railroads, but their records are always carefully scanned before they are employed. They do not employ men who have been discharged for criminal negligence or anything else that would make them undesirable.

REPORT AND DISCUSSION ON EXPRESS COMPANIES

Chairman Anderson, of the committee on express companies, said that the members had not been able to make sufficient investigations of the question to render a report at this time, and asked that the matter either be referred to another committee or further time granted. The association instructed the committee to continue its investigation and report at the meeting in May.

Manager Whysall, of the Columbus, Delaware & Marion, gave the members some information regarding the operation of the Wells-Fargo Express Company over its lines. He said that the company had not been able to get into Columbus directly over the steam lines, and made a contract with the electric road with that end in view, as well as for the purpose of handling local express matter. The business is handled on the tonnage basis by the railway company, but in estimating the tonnage the value of the goods is also taken into consideration. He did not feel at liberty to go into detail regarding this feature of the contract, with the exception of stating that the more valuable goods counted as greater tonnage than the ordinary run of shipments. On local business the railway company receives one and one-half times the local freight rate on express shipments and on foreign business, that is, business originating on other roads the rate is the same as the local freight rate. The operatives of cars used exclusively for express business are paid by the Wells-Fargo Company, but where a car is used jointly by the railroad and express companies, each pays half the expenses of operating it. He considered the tonnage basis the more satisfactory way of handling the express business, as the remittances are received in from thirty to sixty days. On a commission basis, it might take six months at times to get the accounts made up and receive remittances. The clerical work would be greater and the expenses would be higher than on the plan the company is now doing the business. The valuation of all articles is trusted to the express company, under the plan now in use, and the management has had no cause to feel that everything is not done in a fair manner.

Chairman Taylor, of the committee on car lighting, asked and was granted further time to make a report. President H. A. Nicholl asked the members to be prompt in responding to all inquiries made by the committees, as this is the only way in which they will be able to secure information upon which to base their reports.

MISCELLANEOUS MATTERS

The following report of J. C. Staats, chairman of the committee on insurance, was adopted by a unanimous vote:

During the past two years extensive investigations have been made, relative to the best plans for promoting the interests of traction companies and electric light and power companies, along lines of insurance. As a result of these investigations, the American Railway Insurance Company, of Cleveland, Ohio, has been incorporated and organized with a capital and surplus of $500,000. The officers and directors of the company are composed of men representing railway, light and power companies, and the business of the company will be confined exclusively to these interests. In addition to the American Railway Insurance Company, there have been incorporated the Traction Mutual Insurance Company and the Electric Mutual Insurance Company. These companies will co-operate with the American Railway Insurance Company. In the opinion of your committee, all of the members of the Central Electric Railway Association may be profitably consolidated into one organization to the extent, at least, of the insurance of their properties against destruction or damage by fire. We approve the plan of insurance adopted by the above named companies and recommend the earnest co-operation of every road connected with the Central Electric Railway Association.

(Signed) HENRY N. STAATS, Chairman,
HARRIE P. CLEGG,
H. J. DAVIES.

Chairman Evans, of the committee on standards, said that particular attention to this matter would be given this year and many subjects recommended by the national association would be taken up.

The next meeting will be held in Indianapolis at the usual time in May.

CORRESPONDENCE

CAR HEATING AND VENTILATION

CEDAR RAPIDS, IA., March 22, 1907.

Editors STREET RAILWAY JOURNAL:

In designing a system of heating and ventilating for cars, one of the most important points to consider is the proper circulation of the heated air and its subsequent removal. Heating and ventilation are closely connected, and should be planned at the same time. Indirect radiation must be used, in part at least. In cold weather the fresh air must be warmed to a higher degree of temperature than that at which we wish to maintain the temperature at the breathing line.

Efficiency and economy of car heating and ventilation depend upon the proper location of the inlets and outlets. If a large volume of air is brought into a car and allowed to escape without proper circulation, as will be the case in upward ventilation, but very little benefit will be derived. The fresh air should be taken in above the top of the car through an intake duct, carried down to the bottom of the car, thence upward through the heating coils and into the compartment at or near the ceiling. Here it will spread out and as it cools will gradually descend. The foul air should be removed at the floor into a duct and taken up to the atmosphere. The intake pipe should always be open toward the fresh air currents, and the outlet should open in the opposite direction. The intake and outlet should be automatic and adjust themselves to conform to the different air currents, thus insuring against fluctuation and strong drafts in the car. This would give a combination of the exhaust and pressure system, acknowledged to be the best method in use. When the car is standing it would be a gravity system and there would be some ventilation, varying with the difference of the temperature outside and inside of the car.

It is not practical to remove the foul air through grates in the floor. The tendency of warm air is to rise, and as the outside air is colder, the foul air will not pass downward. An opening can be made in the vent pipe to be used in warm weather, but should always be closed in cold weather. One inlet and one outlet will suffice for a car containing fifty to sixty people. In figuring the amount of air required, it is the number of people and not the size of the compartment that must be taken into consideration. Twenty-two cubic feet per person per minute will maintain a standard purity of 10 parts CO_2 in 10,000.

The car should be made as tight as possible. Double windows are of advantage and will soon save their cost in the fuel or electricity used for heating the car. The windows should always be kept closed, and the doors as far as possible. A fan would be of benefit only when the car stopped, or when running slow. It would be of no advantage when the car was running at a reasonable speed.

Cars will never be properly ventilated until the apparatus is automatically controlled. Hand regulation of monitor sash is bound to be intermittent. Moreover, it is inseparabe from cold drafts down on the passengers and the volume of air fluctuates according to the cross winds, the number and size of the openings. Perfect ventilation of cars can be accomplished automatically when 31 ins. x 31 ins. of floor space is allowed for the apparatus, and not before. In the early days of ventilating school buildings, it was thought that the room required by the heating and ventilating flues, could not be afforded. That idea has passed away. The modern architect is perfectly willing to allow the space required, and car owners should be willing to do the same.

It is no more difficult to ventilate a car than to ventilate a building. In fact, a car would be the easier of the two, and the expense would be much less in proportion.

E. R. SWAN.

THE MECHANICS OF HIGH-SPEED CARS ON CURVES

NEW YORK, April 2, 1907.

Editors STREET RAILWAY JOURNAL:

For a number of years the writer has had occasion to board a railway train at a station located upon a curve. In striking this curve even at the reduced speed required to come to a full stop, it has been observed that on icy mornings the presence of a film of ice between the ties and the rails permitted the outer rail to shift bodily outward as the forward wheel of each truck encountered it. By this action the spikes were gradually bent backward into the wood and loosened. The same action has since been observed during rainy weather when a film of moisture supplied the necessary lubricant.

Several prominent steam railway engineers, in reply to my letter on the subject in the "Engineering News," some weeks ago, have written that they have observed similar action with hard wood ties in dry weather, since the ham-

mering of the rail on the ties had produced a slippery surface upon the wood.

It is thus evident that the elaborate calculations made recently by several able engineers are clearly incorrect in the assumption of a certain amount of friction between the rail and tie at different elevations. This friction, instead of being a constant at each speed and elevation, is a variable under weather conditions, and is affected by the polish of the wooden surface; and this variable may at times be reduced to practically zero, leaving the entire stress to be exerted in shearing the spike heads. It is, therefore, evident that at high speed public safety demands the use of a tie-plate with projecting webs parallel with the rail on its upper and lower surfaces, engaging respectively the wood of the tie and the outer edge of the rail base. In these days of unreasonable anti-railway sentiment and legislation it would be a wise action on the part of railway engineers to adopt this simple but effective protection at all main-line curves.

Another matter of very great importance on curves of high-speed electric roads has been entirely overlooked by the engineers, as far as is shown by their published calculations. This is the fact that the rapidly rotating armature of an electric motor tends to maintain itself in its line of motion and resists very strongly any attempt to swerve it in any direction from that line. Any one who used an electric pen, whose armature weighed less than 2 oz., will remember that when running at full speed the pen would force itself out of any hand which attempted to swing it rapidly with the elbow as a center. The amount of force due to the gyroscopic action of this light armature would amount to several pounds when swung rapidly. This scheme has been successfully used recently for steadying gunboats in a heavy sea.

It is evident that the speed of rotation, weight of armature and speed of forward advancement are the factors which determine the amount of this gyroscopic action. The bodily displacement of both rails and ties at curves on high-speed electric roads which has recently been observed is accounted for by this action.

In one case it was reported that with a 96-ton electric locomotive on a curve of 2 degrees 30 minutes at a speed of 75 m. p. h., with an elevation of outer rail calculated for 60 m. p. h., the entire track with ties shifted perceptibly on the gravel ballast, while at practically the same speed no such effect was produced by a steam locomotive of about the same weight.

The writer feels that it is the duty of engineers in charge of high-speed electric roads to determine definitely the value of this factor so that it may thereafter be accurately taken into account in all curve calculations. This can easily be done by allowing ample end play of the armature shaft and adjusting a dynamometer to take the thrust towards the outer side of the curve, thus registering the gyroscopic action of the armature at various speeds and various amounts of super-elevation of outside rail.

It would also be interesting to apply a dynamometer on the outer rail at or near the entrance to a curve, moving outward a few of the spikes so that the rail could move, say, ⅛ in. against the dynamometer, which could be set so as to register the amount of tangential force exerted at different rates of speed and of super-elevation. This would give a basis of absolute fact for use in subsequent calculations, where now an assumed factor is used whose value is shown by recent events to be an unknown quantity.

Harold P. Brown.

LIGHTNING PHENOMENA AND LIGHTNING ARRESTERS

The regular March meeting of the American Institute of Electrical Engineers, held March 29, 1907, was devoted to lightning phenomena and the protection against lightning. Lightning phenomena in electric circuits was discussed by Dr. C. P. Steinmetz. Protection against lightning and the multi-gap lightning arrester were treated in a paper by D. B. Rushmore and D. Dubois; while Prof. E. E. F. Creighton described some new principles in the design of lightning arresters.

Messrs. Rushmore and Dubois believed that from the standpoint of protection of the system from static disturbances, whether external or internal, the grounded star transformer connection with overhead ground wire offers the best conditions and is in general to be recommended where the choice is not determined by other conditions. Due to its apparent simplicity, the horn lightning arrester has of late received considerable attention. It is in reality an emergency device and serves as a weak point in the system which is the first to rupture when the voltage increases to a dangerous value. In general the discharge of horn arresters without resistance will throw synchronous apparatus out of step and necessitates starting up the system again. A flaming arc in air, such as occurs on the horn arrester discharges, is a possible source of disturbance much worse than the original one. Practically complete protection can be obtained for wood pole transmission lines by the use of an overhead ground wire in connection with a lightning rod and horns for protecting the insulators. What is known as the water-jet arrester has been used abroad to some considerable extent and it has apparently obtained in certain localities a reputation which is difficult to justify. Its only function can be that of a high resistance connected permanently to the line, and in this case it has the advantage of being self-repairing if ruptured by discharge.

A considerable portion of the paper by Messrs. Rushmore and Dubois was devoted to the multi-gap lightning arrester. As is well known, the essential elements of this arrester consist in a number of cylinders between line and ground and line and line, small air-gaps being left between the cylinders. When voltage is impressed across the arrester the potential gradient is not uniform along the cylinders because the charging current which passes between the adjacent cylinders depends not only upon the electrostatic capacity between the cylinders, but also upon the capacity to ground. Thus the potential gradient is considerably steeper at the high-voltage end of the arrester. At a certain voltage across the arrester the potential gradient between the first and second cylinders is sufficient to break down the dielectric between them, the potential of the second cylinder, being connected to the first by an arc, then rises and a breakdown occurs to the third cylinder and so on until the arc has passed entirely across the arrester. The line current then flows across and the potential is distributed uniformly along the cylinders; the maximum potential difference is less than in the case of the initial breakdown, so that the arc may become ruptured. In the actual lightning arresters much depends upon the choice of the alloys used for the cylinders. The current is carried across the gap by a stream of metal vapor coming from the cathode. If the metal vapor forms at a low temperature the temperature of the arc will be low. Unfortunately the metals, having low boiling temperatures, do not hold their form well under the electric arc. It is necessary, therefore, to use alloys rich in these metals. The metals of higher boiling

points cannot evaporize while those of low boiling point are present, and thus the cylinders retain their form without affecting the temperature of the arc. By properly designing the resistance used in series with the arrester, the arrester can be made to protect equally well at any frequency.

The paper by Prof. Creighton described a new form of liquid electrode lightning arrester.

The discussion was opened by Dr. F. A. C. Perrine, who disagreed with the presentation of the case of the horn arrester. The proper use for this arrester is as an extra precaution against surges which would probably destroy any other type of arrester and leave the apparatus without protection during the continuance of the storm. Experience has shown that where horn arresters are used in parallel with multi-gap arresters the high frequency disturbances discharge harmlessly over the multi-gap arresters; while the low periodicity surges pass over the horn arresters. He stated, as his opinion, that in the present state of the art, leaving out of consideration the recently described electrolytic arrester, the best protection is found in a combination of the horn and multi-gap arresters. In the electrolytic arrester there is found a new type of protective apparatus. The formation of an actual arc in the electrolyte seems very important indeed to its proper performance. The electrolyte arrester seems to be objectionable in that the arc formed within the arrester would probably rapidly evaporate the electrolyte and the cells would require considerable watching.

Farley Osgood related some actual experiences with 60 miles of 30,000-volt transmission circuits feeding power to three sub-stations in which 60-cycle rotary converters are used. Resistances in series with the gaps of multi-gap arresters were tried but discarded, and subsequently resistances were placed in shunt with the gaps. After some experimentation the proper value was found for the shunted resistance and the arresters have proved successful. Light discharges pass across them without any difficulty whatsoever; moderate discharges pass with very little difficulty, while very severe discharges cause the cylinders of the arresters to weld together, which, of course, puts the arresters out of service. It has been found that discharges occur more frequently from line to line than from line to ground. The record for 1906 shows that there has been no interruption of service, although twenty discharges have been noted. Choke coils have been found very effective. A twenty-turn coil seems to answer all purposes very well. The worst operation condition which has been met has been due to short circuits to ground. More apparatus is destroyed during short circuits to ground than at any other time. The liquid arrester seems to be well suited to protect the system against trouble due to grounding of the line.

P. H. Thomas stated that the multi-gap arrester with shunt resistance, leaving out of account the electrolytic arrester for the present, seems to be the most promising protective device now available. He expressed the opinion that the art of protection against lightning is now so far advanced that it is unnecessary to be annoyed by the shutting down of the plant, such as is occasioned when a horn arrester discharges. In discussing the tests reported by Prof. Creighton, Mr. Thomas called attention to the fact that it is important to consider the source of power. It is not safe to draw any conclusions as to the general non-arcing quality of an arrester when oscillographs taken during the tests showed that 200 amps. drawn through the arrester decreased the electro-motive force from 2000 to 200 volts.

V. G. Converse called attention to the fact that when fuses are used in series with the horn arrester, a single stroke does not leave the system unprotected, because it is possible to employ repeating fuses so arranged that when one fuse blows a switch drops and connects in a second fuse, a third, fuse, a fourth fuse, and so on. The Ontario Power Company during the whole of last season observed only one discharge from the generators at the power station, but there were numerous discharges from the lines across the insulators. Experience has shown that a lightning disturbance seldom travels more than four or five line spans before it will pass to ground by way of a tower.

D. Dubois explained that multi-gap arresters are so designed that when a discharge occurs the current from the generator is limited by the higher series resistance to about one-sixteenth of an ampere, which causes such a drop in the resistance rod that there remains a drop of only about 80 volts across each gap. This voltage is so low that the arc is promptly ruptured.

William McClellan reported the results of some observations made upon multi-gap lightning arrester equipments used on 11,000-volt trolley circuits, which tended to show that such arresters are destroyed when the disturbances are heavy and frequent. The electrolytic arrester possesses most excellent characteristics in that it acts exactly like a safety valve. When the station supplying the power is equipped with large generator capacity, so that a short circuit sustained for a considerable time will not cause a shut-down, horn arresters can be used to advantage. When extra insulation is placed on the end turns of transformers and powerful insulators are used on the line, the equipment is designed to take care of a certain increase in voltage, and it does not seem necessary to adjust the lightning arresters to discharge every time the voltage rises a small amount above the normal.

Ray P. Jackson explained that in the type of electrolytic arrester used by him he did not consider the current on discharge to be limited by the counter-e. m. f. effect. There seems to exist a dielectric film, which after it has been punctured is capable of resealing itself when the voltage drops below a certain value. It acts like a valve with a spring behind it. Concerning the horn arrester, it may be stated that its virtues consist chiefly in its mechanical characteristics. It is comparatively simple and cheap and can be placed out of doors. It will prove an excellent device for use in series with an electrolytic arrester for limiting the dynamo current to a small value.

H. C. Wirt remarked that the only disadvantage possessed by the electrolytic arrester resides in the liquid. It seems, however, to represent the solution of the lightning arrester problem. He submitted some data regarding the operation of the shunt resistance type of multi-gap arrester on a 33,000-volt system installed at Joplin, Mo. Although much trouble was experienced with the series-resistance type of arrester, almost perfect results have been obtained with the shunt resistance arrester subsequently used.

Dr. C. P. Steinmetz, in replying to the objection raised against the employment of a fuse in a shunted resistance arrester, stated that when the fuse blows the system remains protected equally as much as though the fuse had initially not been installed. The use of the fuse provides a closer protection for most of the time and under most of the conditions than would be permissible if the fuse were not there. The conditions are in no respect analogous to those existing when a fuse is inserted in series with the horn type of arrester.

PENNSYLVANIA RAILROAD COMMISSION REPORTS UNFAVORABLY ON ROAD MOTOR CARS AS AN AUXILIARY IN AMERICAN PASSENGER SERVICE—ALSO REPORTS ON RAIL MOTOR CARS

Last fall the Pennsylvania Railroad appointed a committee of officials, composed of C. M. Sheaffer, superintendent of passenger transportation; R. N. Durborow, superintendent of motive power, and A. E. Buchanan, chief clerk to the general passenger agent, to visit Europe for studying general railroad conditions, and the operation of road and rail motors, especially with reference to the possible adaptability of the American use of road motor cars as auxiliary to the regular passenger service. This committee has just submitted its reports to the general manager.

The road motor report says:

"The road motors for passenger service are simply automobile omnibuses of various types, the cost varying from $3,000 to $5,000, some of them having double decks, and in many cases small compartments for the accommodation of luggage and parcels. Machines of this character have been introduced to a greater of less extent by the following railways: London & Northwestern Railway Company, Great Western Railway Company, London & South Western Railway Company, Great Eastern Railway Company, Caledonian Railway Company.

"Frequent road motor service has been established at points where there are villages not located on the railways, but with sufficient population to warrant the service, also from stations on the main line, as well as from the terminus of one branch line to that of another. These motors are operated on advertised schedules, at a maximum speed of 15 m. p. h. The routes covered range from 3 to 20 miles in length, and the tariff rates for passengers, luggage and parcels are published, no distinction being made as to class. A storekeeper in each village is employed as the agent for the company.

"The established schedules are maintained with a fair degree of regularity; the service is well patronized, and is appreciated by those depending upon it. However, your committee failed to find, at any of the places visited, very much enthusiasm expressed in regard to the road motor proposition from a railroad standpoint, some of the railway officials stating that they did not consider this character of service a proper function of a steam railway company. In some cases negotiations were under way with independent automobile omnibus companies to take over and operate the road motor service; and, further, we failed to find any road motors in operation or contemplated in connection with any of the Continental railways.

"The Great Western Railway of England, on account of the numerous small towns and villages adjacent to its lines, is the largest user of road motors, owning eighty-four machines and operating them on forty-four established lines. We inspected the service between Slough and Stoke-Poges, a distance of 10 miles the round trip. The car used was equipped with a four-cylinder gasoline engine of the Milnes-Daimler type, and had a carrying capacity of twenty persons. Steam road motors have been tried on this line, but were unsuccessful on account of boiler troubles, and they have been abandoned. The London & South Western Railway has four steam road motors of the Clarkson type, which are considered quite unsatisfactory.

"The Great Eastern Railway has eighteen motors—four Daimler, two Wolsely, two Thornycroft, and ten built by themselves. The cars have double decks and each seats thirty-eight persons. The Caledonian Railway of Scotland has two road motors in service a few miles from Glasgow, between Clarkson and Eaglesham, a distance of 8 miles. It was noted that wherever steam has been used for the operation of road motors they have proven unsatisfactory, and that gasoline machines are the most successfully operated, those of the Milnes-Daimler type predominating.

"From our personal observation and the information obtained as to the conditions existing under which road motor service has been established and operated in Great Britain, and with our knowledge of the general condition existing in the territory traversed by our line, it is the opinion of your committee that the establishment of this character of service as an adjunct to our railway passenger business is not worthy of any serious consideration at this time, and it is our judgment that the same cannot be successfully or profitably operated, on account of the general bad condition of the roads, severe climate and the territory not at present covered by trolley lines being so sparsely settled as to make such service unnecessary and unwarranted."

The report on self-propelled railway cars says:

"Rail motors, costing from $8,000 to $10,000 each, have been introduced to a greater or less extent by all principal railways of England; also by several on the Continent, as follows: Great Western Railway; London & North Western Railway; London, Brighton & South Coast Railway; London & South Western Railway; Great Central Railway of England; German Government Railways (Saxony); Italian State Railways; Paris, Lyons & Mediterranean Railway; Paris & Orleans Railway Company.

"In some cases these rail motors have entirely displaced the steam passenger service on branch lines, but are generally being used for supplementary service in connection with other trains.

"The rail motor car is in charge of a guard, who issues tickets and collects fares, besides performing necessary duties in connection with the handling of luggage and parcels. He also keeps the necessary train records. The car is equipped with a small compartment on the rear platform in which is placed a throttle connection with the boiler, the necessary brake apparatus and whistle, which permits it to be operated from either end, making it unnecessary at any time to turn the car. The design and construction of the car is such as to make it unsuitable for shifting purposes. On lines where motor cars are operated the freight train service is performed by a regular locomotive.

"It appears that where rail motor service has been established travel has increased to a considerable extent. Within itself, the service is not remunerative, but the expense would seem to be warranted when its value as a feeder in creating additional long-distance travel from the main line steam trains is considered.

"Operating officials of roads on which this character of service has been established were rather enthusiastic as to its possibilities. The mechanical officials, however, were not favorable to it. It was admitted that there is a slight saving in fuel, but it is claimed that this is more than offset by the increased cost of maintenance and the loss of service while undergoing repairs.

"On the Continent, while this service is in actual operation to a limited extent in Germany, France and Italy, railway officials still consider it to be in an experimental stage.

"We inspected the Great Western Railway motor service from Southall to Ealing, both stations being suburban to London. The speed ranged from 20 to 45 miles an hour. The driver said the car was capable of 50 m. p. h. The car

ran smoothly, without noticeable vibration, and had been in successful operation for three years. The London & North Western Railway operates a rail motor line on its Oxford branch from Bicester to Oxford. The London, Brighton & South Coast Railway has two gasoline motors in service at Brighton. Each car is equipped with two 30-hp Daimler motors suspended from the frame. Noise and vibration were noticeable while these cars were standing with the motors running. There was also a very disagreeable odor from the gasoline.

"The London, Brighton & South Coast Railway has small detachable steam locomotives at Brighton, which are attached to trailers. Local officials said this service was more satisfactory than by the gasoline cars. The London & South Western Railway has fourteen steam rail motors from its Marylebone Station, London.

"German railways, under government management, have been experimenting with rail motors two years, using for purposes of comparison a Serpollet car (steam, with coal fuel), a Milnes-Daimler car (gasoline), and an accumulator car (storage battery), also a small locomotive and coach. We were told that the experiment so far showed the steam locomotive and coach to be the most economical and successful.

"With the benefit of this experience the committee is of opinion that the installation of self-contained motor cars for passenger service on certain branch lines largely depends upon the gradients, the possibilities for increased travel and the possible saving from a reduction in the train crews. A small tank locomotive and car, equipped for operation in either direction without turning, commends itself as the most elastic adaptation of the rail motor which came under our observation and appears to be in the line of future development abroad."

In connection with the foregoing reports it is interesting to add that the Nov. 5, 1904, issue of the Street Railway Journal contained a comprehensive article by Philip Dawson on "The Use of Independent Motor Cars on Railways" which described quite fully some of the cars mentioned in the report. Since then other articles have been published in this journal on prominent types of European motor cars. The auto-bus subject from a commercial standpoint was discussed in an article in the Nov. 17, 1906, issue by H. Vellguth on "The Operating Costs of the Modern Auto-Bus."

ELECTRICITY IN OTTOMAN ASIA

On Feb. 7, in the presence of the governor-general of the province and the general in command of the fifth army corps, besides other civil and military officials, notables of the city, and foreign consuls, the new electric street car and street lighting service in Damascus were formally handled over by representatives of the Ottoman government who had come from Constantinople for that express purpose to the Societé Ottomaine Impériale des Tramways et d'Eclairage Electriques de Damas. At first the street car service will cover only the distance from Salhyeh to the Meidan, some 5 miles through the city from suburb to suburb. Cars were to commence running on March 14, on which day the Ottoman fiscal year begins. Electric lights have been installed, and Damascus is now being lighted by 1000 electric street lamps, for which the municipality pays an annual rental of 3000 Turkish liras ($13,200). Besides these, the company has put in more powerful lights in the Grand Mosque, in the public squares, and in the Serail. Private electric lights will soon be introduced in shops and residences. The installing company is Belgian. Some of the electrical supplies and apparatus have been imported from Germany, France and England, but all cars, motors, dynamos, etc., have been bought in Belgium. American manufacturers have apparently paid no attention to this opportunity of securing preliminary vantage ground. Concessions for electric light and street railway undertakings have been granted corporations in Damascus, Beirut, Aleppo, Smyrna and Salonica.

ACCIDENTS IN GERMANY

The following interesting classification of the accidents occurring during January, 1906 and 1907, on the street railway lines belonging to the German Street and Interurban Railway Association has been prepared by the secretary of the association. This association includes practically all of the electric railway companies in Germany:

Character of Accident.	1907.	1906.
Fatalities	2	2
Accidents involving disability for more than 13 weeks	75	15
Accidents involving disability for less than 13 weeks	314	274
Total	391	327

DAY OF ACCIDENT.

	1907.	1906.		1907.	1906.
Sunday	29	22	Thursday	49	58
Monday	69	38	Friday	61	53
Tuesday	69	48	Saturday	62	52
Wednesday	54	51	Not recorded	8	5

TIME OF ACCIDENT.	1907.	1906.
Between 12 midnight and 6 a.m.	29	30
Between 6 a.m. and 12 noon	145	112
Between 12 noon and 6 p.m.	118	117
Between 6 p.m. and 12 midnight	89	62
Not recorded	10	6

NEW PUMP COMPANY

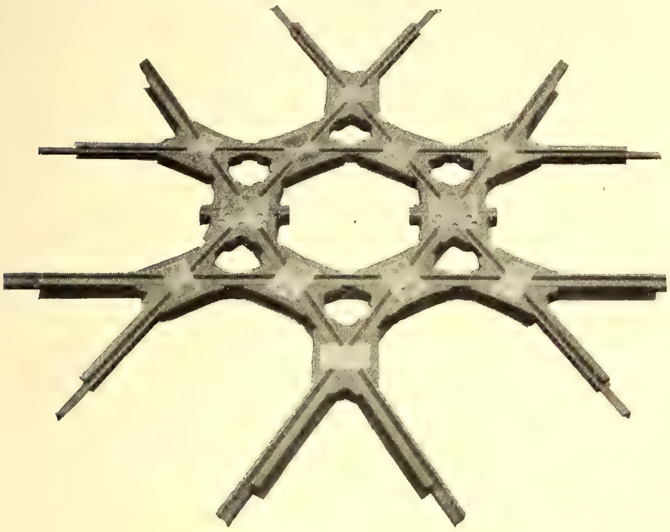
The Alberger Pump Company, of New York, has been organized to manufacture and sell centrifugal turbine pump machinery of all capacities and for operation against any head, either steam power or electrically-driven. The steam turbine has taught the great principle of dealing directly with rotary motion, and the managers of the Alberger Pump Company are convinced that future progress in pumping lies along this line.

The officers, management and works of the new company are identical with those of the Alberger Condenser Company, and in order to provide for this business a large addition to the Alberger shops is now in progress. The equipment will consist of special tools for this particular class of work, together with elaborate testing apparatus.

The Indiana, Columbus & Eastern has purchased a handsome parlor car, with observation vestibules and buffet, built by the Cincinnati Car Company, and it will be put into the limited service on the Columbus, Newark and Zanesville division.

THE HOBOKEN TURNTABLE

In connection with the large turntable at the Hoboken terminal of the Public Service Corporation of New Jersey, described by Martin Schreiber in the Street Railway Journal for March 23, it may be interesting to add some further points furnished by the New York Switch & Crossing Company, the builder of this turntable. It was impracticable to build the table crossing in one piece on account of its great size and the danger of breakage during transportation. As shown in the accompanying view, it was necessary to make the joints through the hard centers, because the latter are so numerous that there was not room to fish-plate without doing this. The hard centers are made of hammered steel and are held in place with six 1-in. vertical bolts through each center, with the heads countersunk. Babbitt was then poured into the counter-sunk holes to finish, as shown.



THE SPECIAL WORK FOR THE TURNTABLE

As mentioned in Mr. Schreiber's article, the table was installed because there was not room enough at the ferry slip to allow loop operation. A compromise was effected by putting in the table and so arranging the tracks that cars need only be turned through an angle of 120 degs. Continued operation has demonstrated this turntable to be far more successful than was anticipated under the disadvantageous conditions at this terminal.

SEMI-CONVERTIBLE CARS FOR CONESTOGA TRACTION COMPANY

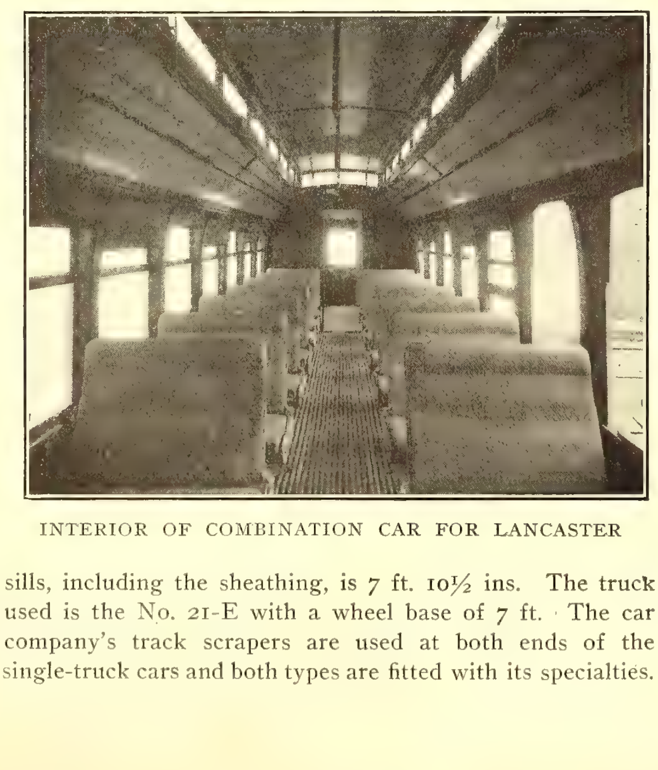
The Conestoga Traction Company, of Lancaster, Pa., which is a very large user of the grooveless-post semi-convertible cars, has just received a number of Brill combination passenger and baggage cars for use on an interurban branch of the system and four single-truck cars for city service. In addition, the company will shortly receive from the same builders five 40-ft. baggage and express cars. The semi-convertible feature in these interurban cars permits a greater width of aisle and seating space, coupled with the inviting high-back seats with head roll with adjacent arm rests. The interiors, which are of cherry, are stained a mahogany color and harmonize nicely with the robin's egg blue tint of the ceilings. A single sliding door separates the two compartments. The baggage compartment is fitted with the usual accessories, including seats which can be folded up when not in use. The truck used is the 27-G1 with a wheel base of 4 ft. 6 ins., which is the standard double-truck for the road; each of the cars carries four motors. The length of

EXTERIOR OF SINGLE-TRUCK CAR FOR LANCASTER

car over end panels is 31 ft. 8 ins.; over crown pieces, 41 ft.; length of baggage compartment, 9 ft. 2 ins.; width over sills, including sheathing, 7 ft. 10½ ins.; over posts at belt, 8 ft. 2 ins. Readers of this paper are familiar with the single-truck type of grooveless-post semi-convertible referred to. The treatment of the interiors in the last lot

EXTERIOR OF PASSENGER AND BAGGAGE CAR FOR LANCASTER

ordered is similar to that adopted in the combination cars, and the seats, while not having high backs, are also of Brill make. The cars measure 20 ft. 8 ins. over the end panels and 30 ft. 1 in. over the vestibules. The width over the

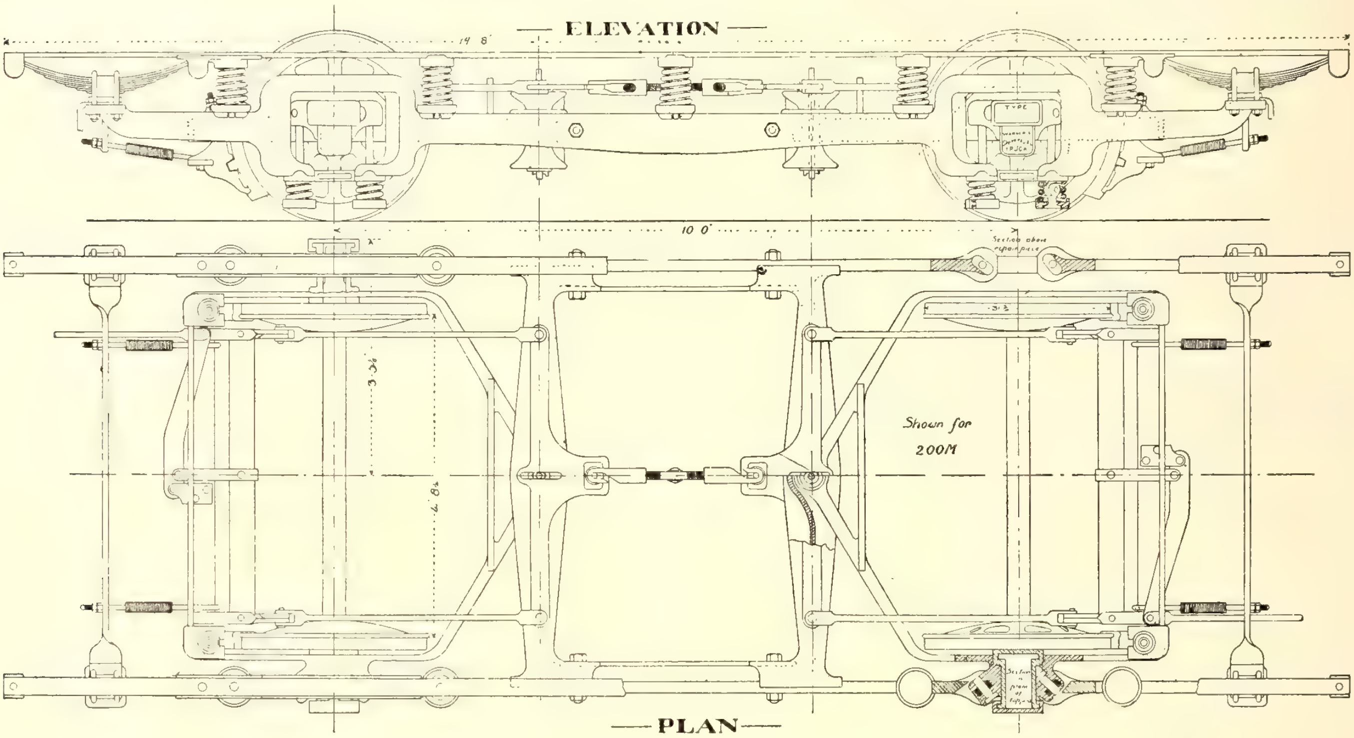


INTERIOR OF COMBINATION CAR FOR LANCASTER

sills, including the sheathing, is 7 ft. 10½ ins. The truck used is the No. 21-E with a wheel base of 7 ft. The car company's track scrapers are used at both ends of the single-truck cars and both types are fitted with its specialties.

A NEW RADIAL TRUCK

As noted previously in these columns, the subject of radial trucks is one which has received much attention abroad. Of the countless attempts that have been made during the past sixty years to produce a perfect steering control for railway wheels, one of the latest is the method devised by J. S. Warner, of Westminster, Eng., as the outcome of his experience with American truck makers. The term used by German engineers, "single axle bogie," or by the French, "pivotal axle," is preferred by Mr. Warner to the term "radial truck," at least for four-wheel cars since perfect radial action with four-wheel cars is a remote possibility.



PLAN AND ELEVATION OF RADIAL TRUCK

As will be seen by reference to the plan, Fig. 1, the motors are pivoted at points between the axles. The whole car then hangs on links each about 1 ft. in length, there being two to each axle box. The result of this arrangement is a peculiar movement illustrated by Fig. 2, the upper view representing what would be seen by a person on the inside of the curve.

Through the enterprise and courtesy of H. E. Blain, of the West Ham Tramways, England, some twelve months' regular service has been run with the Warner method applied to one end. The result of this trial is claimed to show that even without the control of alignment springs no overswing results, while on straight track the car body preserves an unusually comfortable dead straight riding. An important claim for this truck is that the traction is reduced not only by the absence of oscillation obtained by the longer wheel base, but about 5 to 10 per cent less tractive resistance is secured than with any other truck by the extremely delicate accommodation to the track sinuosity. Fig. 3 is a view of the actual gear.

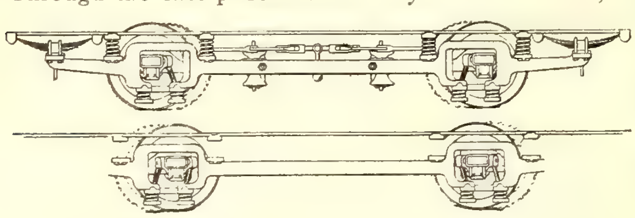


FIG. 2.—VIEWS ILLUSTRATING THE RADIAL MOTION OF THE TRUCK

Links have been used with a purely transverse swing giving an approximation to this result, but the steering effect given by the Warner truck around the slightest irregularity gives a valuable freedom from flange friction reducing it probably by one-half. Since flange friction for straight tramway track and single trucks is never equivalent to less than 30 per cent of total traction current, the claim that 5 per cent less current is used seems a modest one. It is said that the riding of the car is absolutely free from side-to-side jolting and that a reduction in flange wear is observed which must mean at least an equal reduction in rail wear. A double truck on the same principle is now being designed by the same maker.

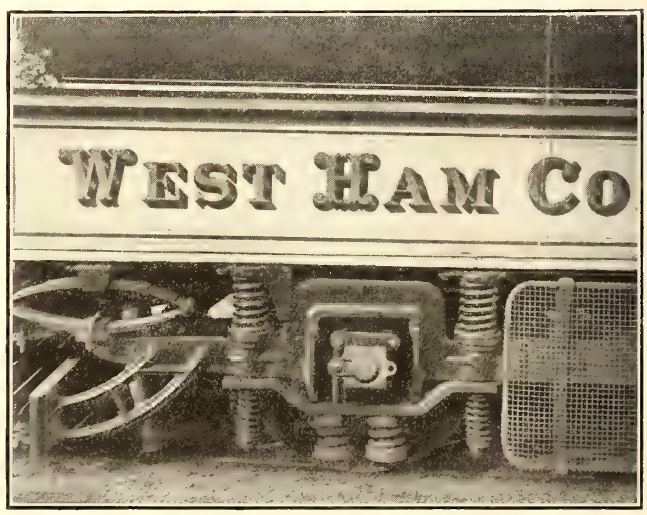


FIG. 3.—RADIAL TRUCK GEAR USED ON WEST HAM TRAMWAYS

One of the double-decked cars mounted on this truck is of 10-ft. wheel base with a 22-ft. body and an over-all length over the fenders of 35 ft. This size of car has hitherto been mounted on two maximum traction trucks. In this case not only is there appreciable economy in traction resistance, but the simplification of brake mechanism with the absence of four pilot wheels, axle boxes and two axles will greatly reduce maintenance charges, while the traction will be the maximum available from the given weight of car.

Twelve months' running has shown that the wheels give 30 per cent greater wear; that is, a steel-tired wheel running 60,000 miles ordinarily will do 90,000 miles with this radial truck.

GASOLINE-ELECTRIC SYSTEM FOR COMMERCIAL VEHICLES

The British Thomson-Houston Company, of Rugby, England, has developed a gasoline-electric mechanism for propelling vehicles in which the transmission is entirely electrical. Differential gears are eliminated by using two motors, which also allow the speed to be varied by the series-parallel method. The generating equipment consists of an automatic regulating d. c. generator directly coupled to a gasoline engine. The generator is designed to maintain a constant load on the equipment at a constant speed of the engine, irrespective of the varying load demands of the vehicle. In other words, the product of volts and amperes of the output is at all times constant, for as the amperes load demand increases the volts correspondingly decrease, so that the load and, therefore, the speed of the engine remain unaltered. This result is obtained automatically by a suitable arrangement and design of the windings, and without the use of moving contacts. The generator is coupled to a 35-hp engine and is normally rated at 15 kw, 850 r. p. m., 65 to 130 volts, but is capable of withstanding heavy overloads. It has removable aluminum covers, which completely protect it from dirt and water.

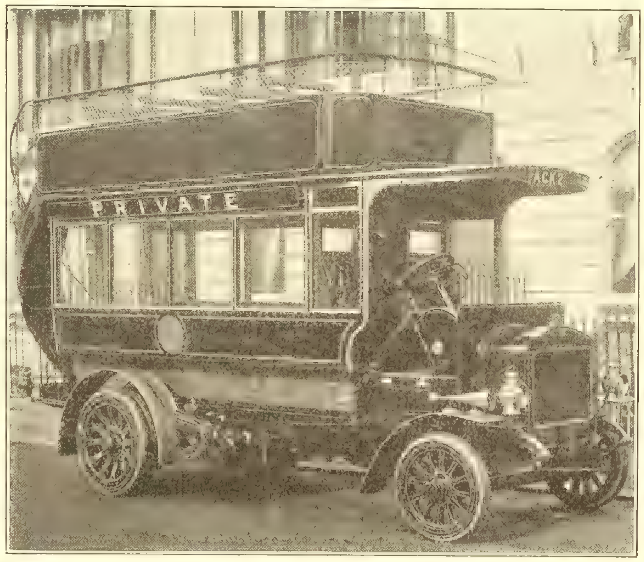


FIG. 1.—GASOLINE MOTOR CARS

FIG. 3.—INTERIOR OF CONTROLLER

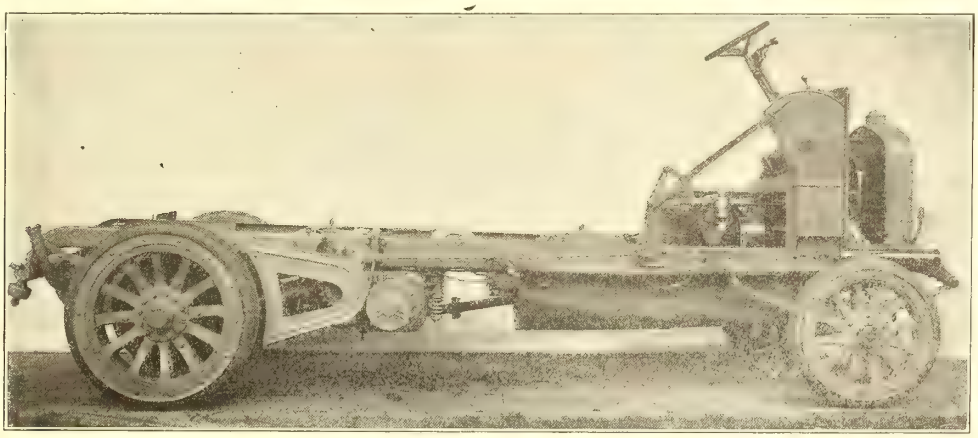


FIG. 2.—CHASSIS OF GASOLINE ELECTRIC VEHICLE

Each motor is designed for a constant input of 7.5 kw at from 500 to 1400 r. p. m.; the e. m. f. varying from 65 to 130 volts; it is a series-wound machine. The two motors are capable of propelling a vehicle having a gross weight of 7 tons up grades exceeding 14 per cent.

The system of control is extremely simple. To the right of the driver, in the position usually occupied by the change-speed lever on a gear-driven vehicle, the "operating box" is mounted. This is coupled through a chain to the controller proper. The latter is located close to the motors and generators to reduce the length of the connecting cables to a minimum. The controller provides two forward speed points corresponding to the series and the parallel connection of the motors, and one reverse speed point with the motors in series.

In the operating box is mounted a small resistance and control switch, electrically connected in circuit with the generator field coils. A pedal is coupled to both the engine, governor and to the control switch, so when the pedal is fully depressed the engine is governed to run at 400 r. p. m. and at the same time the switch is moved to insert in the generator field circuit a resistance sufficient to reduce the main volts to practically zero. No current, therefore, flows through the motors and the vehicle is stopped. On releasing the pedal the first movement cuts the resistance out of the generator field circuit, causing sufficient current to flow to the motors to start the vehicle, which will continue to run slowly, the engine remaining governed at 400 r. p. m. On entirely releasing the pedal the governor is "held up," allowing the engine speed at once to increase to 850 r. p. m., and the vehicle will accelerate to its full speed. The engine speed is prevented from exceeding 850 r. p. m. by the restraining influence of the generator, which exerts for all conditions of load a limited but definite load demand.

That the motors may exert the necessary additional torque in ascending a grade, the generator automatically supplies the required increase of current, but at a proportionately lower voltage. Thus the torque on the engine, and therefore its speed, remains unaffected whatever the grade may be, and this is brought about without any hand regulation by the driver.

It should be observed that no main resistances are used to regulate the vehicle speed; there is, therefore, no power wasted in such resistances. The extra field circuit resistance mentioned is quite small, and under no condition absorbs more than 25 per cent of the power of the engine, and during normal running is cut out of circuit altogether. An additional feature of the control is the stopping and restarting of the vehicle without operating the controller, and therefore without breaking the main circuit, thereby eliminating any possibility of sparking at the controller contacts. The vehicle is started with the motors in parallel, that is, with full speed connection.

The controller is operated only for reversing and in climbing grades exceeding 5 per cent, when better results may be obtained by running on the first forward series position. On the other hand, however, no damage can occur to the equipment if the driver neglects to change the speed.

A feature in the control which tends to economy in fuel is the arrangement whereby the driver is obliged to reduce the speed of the engine to 400 r. p. m. when the vehicle is standing, thus preventing the practice of racing the engine with the vehicle stationary. For cases where it is necessary to travel long distances at reduced but constant speeds, and it is not convenient to regulate by the pedal, a hand lever is provided which independently controls the engine speed and allows the pedal to be released.

Under certain circumstances, as for example, when climbing steep grades, it is desirable to accelerate the engine speed for short periods to obtain the maximum power. This is provided for by running the hand lever to the field circuit switch in correct sequence, so that, after the hand lever has been moved to a position corresponding to a normal engine speed of, say, 850 r. p. m., a further movement inserts a portion of the field rheostat, which changes the load demand

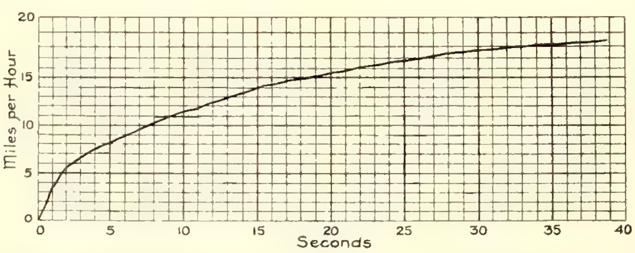


FIG. 4.—ACCELERATION CURVE ON A LEVEL MACADAM ROAD

of the generator and permits the engine to increase in speed, thereby delivering to the generator, and thus through the motors to the road wheels, its maximum available power. By this means full advantage can be taken of the additional power that may be obtained by running the gasoline engine for short periods above normal speed.

In the control system here described, the acceleration is both smooth and rapid; it is also automatic and does not depend on the skill of the driver, as is the case when a clutch and gear-box are used. A driver who has been taught to steer can immediately drive a vehicle fitted with this system as efficiently and economically as one who has had long training and experience.

On referring to the description of the control it will be seen that to stop the vehicle the generator volts are reduced to zero. Conversely, it follows, that in restarting, the volts start from zero and increase to their maximum in regular progression as the vehicle accelerates. This insures a perfectly smooth starting effort, and no shock can result at starting due to a careless or inexperienced driver releasing the pedal too suddenly. The action of releasing the starting pedal fully opens the engine throttle valve, and the engine at once attains its normal speed of, say, 850 r. p. m. The generator load prevents the engine exceeding this speed; the latter is, therefore, developing its full power, which is converted by the generator and delivered to the motors in the correct proportion of volts and amperes corresponding to the speed of the vehicle at that particular moment. As the vehicle continues to accelerate, this proportion continually varies automatically, the amperes decreasing and the volts increasing, the product of the two resulting in a constant quantity representing the full power of the engine. The engine is, therefore, developing its full power at a constant speed during the whole of the acceleration period, and the resultant rate of acceleration is limited solely by the power of the engine, and not by the skill of the driver. As soon as the starting pedal is released, the acceleration becomes automatic, and the maximum available power is delivered to the road wheels without any loss due to the slipping of the clutch or reduced engine speed. Fig. 4 shows an acceleration curve taken from a record made by a Boyer speed recorder on a 24-hp vehicle fitted with the above-described system, weighing 6 tons with its load. The maintenance of the electrical equipment is practically limited to brush renewals, which form a very small item. The general maintenance of electrical machinery is well known to be small, and the design of these equipments has been carefully considered with a view to reducing maintenance to a minimum. The smooth starting effort will effect a considerable saving in maintenance on tires, chains and transmission gear generally. It is impossible to subject the engine to sudden shocks, and these, therefore, cannot result in broken crank shafts, as is often the case with the clutch and gear-box drive.

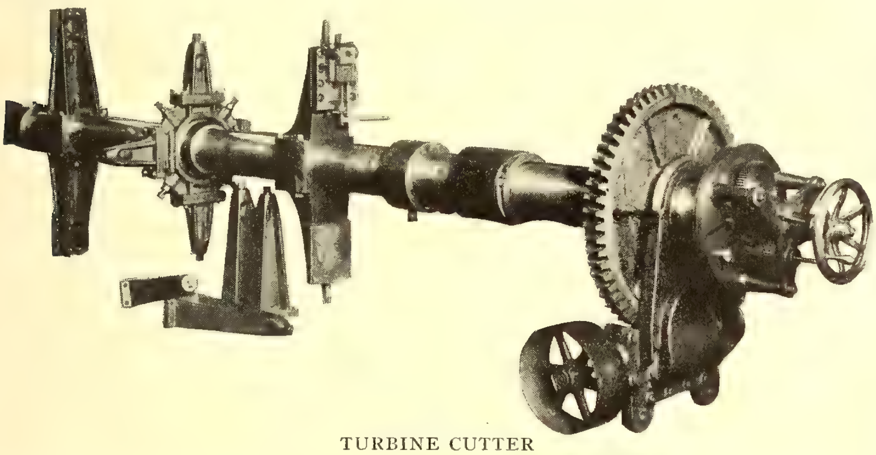
The efficiency of the equipment has been demonstrated by comparative tests with gear-driven vehicles. From the results of these tests it is claimed that a higher average speed can be maintained on a given route, with a given number of stops, and with less fuel consumption than with a gear-driven vehicle of similar type and of equal power and weight. This is due in the first place to a more efficient transmission and, secondly, to the absence of a definite relation between the engine speed and the speed of the vehicle, which renders it possible when running on a good, level road to run the engine at a comparatively low speed and yet maintain a comparatively high vehicle speed.

BORING MACHINE FOR TURBINE CYLINDERS

The illustration on the next page shows a portable boring bar, 10 ins. in diameter and 27 ft. long, recently brought out by H. B. Underwood & Co., of Philadelphia, for the boring of turbine engine cylinders, for cutting the grooves in each cylinder for blades, and when the latter are inserted for truing them up. If the blades need grinding, it can be done while the bar is in place. The bar is made of a good quality of solid steel, "forged." The driving gearing is an accurately cut worm and screw of the Albro Hindley type. The feed attaches on the end of the bar and has three different feeds. To change from one to the other, a sliding shaft is

used. The large hand wheel shown is for feeding by hand when starting cuts and for changing the position of the cutterheads quickly. When feeding this hand wheel is held stationary by blocking or any convenient way of holding.

The boring bar is fitted with three cutter heads. The larger ones are made in halves to enable them to be placed on the inside of the cylinder, the spider or steady rest having different lengths of arms with adjusting screws also made in halves for the same reason. The small one is placed in the cylinder and the bar is slipped through it. The feed screw is in one side of the bar; on this screw is placed the feed nut that does nothing but feed the tools into the cut. On the opposite side of the bar is a proportionate keyway that carries the key for receiving the side thrust of the cut. As it is long and of sufficient size it makes an easy guide and receives the strain on the feed nut. The thrust for taking car of the thrust of the screw while driving the cut into the metal is of high grade hard bronze with many grooves into it. These grooves fit into corresponding grooves in the screw, making a very substantial bearing and



TURBINE CUTTER

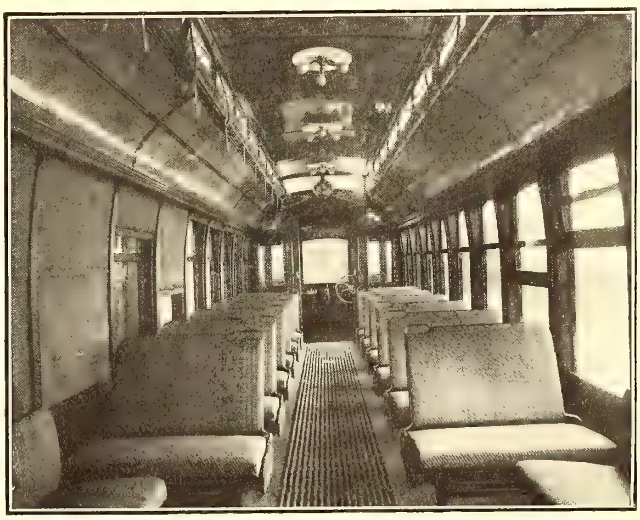
thrust for the heavy duty required in deep and heavy cutting.

The reason for making two arm cutterheads in two pieces is the duty for which the machine was designed; that is, the turbine cylinders are cast in sections of various diameters,—the two end ones have the engine shaft bearings. They are machined before putting together, rough bored, and the flanges faced; then bolted together, making a long cylinder of different diameters. In one of the cylinders there is a manhole. After the bar has been placed through this long cylinder and the bar bearings are placed and accurately adjusted in the outer shaft bearings, the cutterheads and the center bearings are passed into the cylinder through the manhole and placed together on the bar preparatory to boring and grooving. After the boring is done each cylinder has several grooves (3/8-in. x 3/8-in.) turned into the bore. For doing this a very complete slide rest that holds the grooving tool is used. It is shown on the upper end of the cutterhead. On the lower end of the same cutterhead is shown a place to attach a grinding wheel, if necessary. The small solid cutterhead shown is for smaller boring and cutting grooves. The tools on all the cutterheads are arranged to be set by the workmen inside. The steady bearings are easily set by the workmen both as to position and tension on the bar. With the increase in size of engines and the general use of floor plates the demand for special portable tools has greatly increased and there is now a decided call from some of the large stations and engineering establishments for portable machines that are easily handled.

MORE SEMI-CONVERTIBLE CARS FOR DALLAS

The type of the grooveless-post semi-convertible car shown in the accompanying illustration is one of six of a duplicate order furnished recently by the American Car Company for the Dallas Consolidated Street Railway Company, which is under the management of Stone & Webster, of Boston. The cars will be operated on the busiest city lines, and to facilitate the handling of passengers and provide adequate standing room, extra long platforms, 6 ft. in length, are used. These platforms are supported by four wooden knees which extend back to the body bolster and the knees are reinforced by angle-iron with the angle-irons of the center knees reaching 4 ft. back of the body bolsters. The folding platform doors are controlled by the Brill automatic door device. The seats of the car corners are longitudinal and accommodate four passengers each. A feature of the car is the arrangement which makes it possible to raise the windows to any desired height. The interiors are finished in cherry with maple ceilings. Four clusters of three lights each having frosted globes are placed along the center of the dome and the lighting circuit is controlled by a switch located over the door at one end of the car. Length over end panels, 28 ft.; over vestibules, 40 ft.; width over sills, including sheathing, 8 ft. 4 ins.; size of side sills, 4 ins. x 7¾ ins.; center crossings, 4½ ins. x 5½ ins.; end sills, 5¼ ins. x 6⅞ ins. The trucks are of the Brill No. 27-G type with a 4-ft. wheel base; two motors are used per car of 50-hp capacity each.

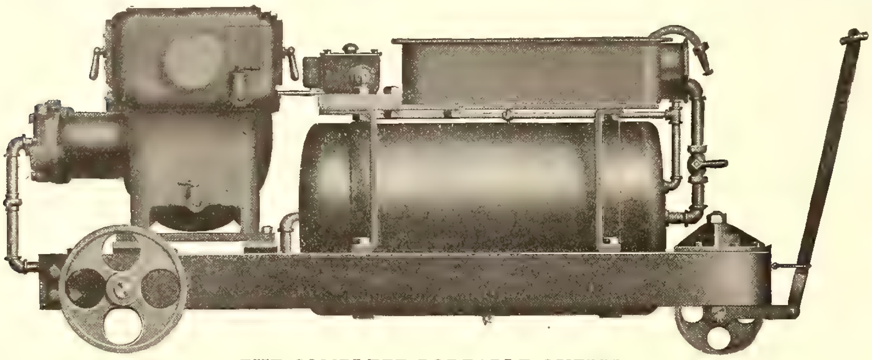
CAR WITH EXTRA LONG PLATFORMS FOR DALLAS



INTERIOR OF CAR FOR DALLAS

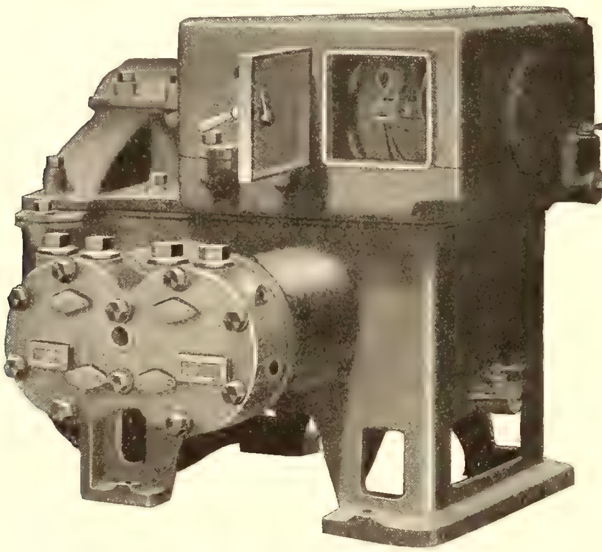
A NEW TYPE OF PORTABLE AIR COMPRESSORS

In the car houses, power plants and trackwork the uses to which compressed air can be employed are almost innumerable. It is particularly useful in blowing out motors



THE COMPLETE PORTABLE OUTFIT

and generating apparatus, and can often be advantageously employed in driving pneumatic drills, riveters and other air-operated tools. The larger shops and power houses are



THE COMPRESSOR AS MOUNTED ON THE TRUCK

usually piped for compressed air from a stationary compressor, but often in a small shop such an installation introduces a greater expenditure than is deemed advisable. In other instances the range of territory over which it is desired at times to use compressed air would, with a stationary compressor outfit, necessitate a great deal of underground piping. Under such conditions a portable compressor outfit is highly desirable.

To satisfy the demand for a compact, self-contained and stoutly-constructed portable compressor outfit, the National Brake & Electric Company has designed a type which will appeal to purchasers desiring a convenient and durable appliance. The outfit comprises a compressor, an automatic type-N generator and necessary piping, an air gage and reservoirs, and a combined switch and fuse, the whole being mounted on a substantial angle-iron frame supported on wheels. The front wheel is hung in a pivoted fork made of cast steel, and the outfit is drawn around by means of a wrought-iron tongue. The compressor is exceptionally narrow, the parts being so disposed as to waste no space on the truck. The width of the outfit over all is only 29¾ ins. This readily permits it to be taken through doors and openings in shops and factories of much smaller size than the average.

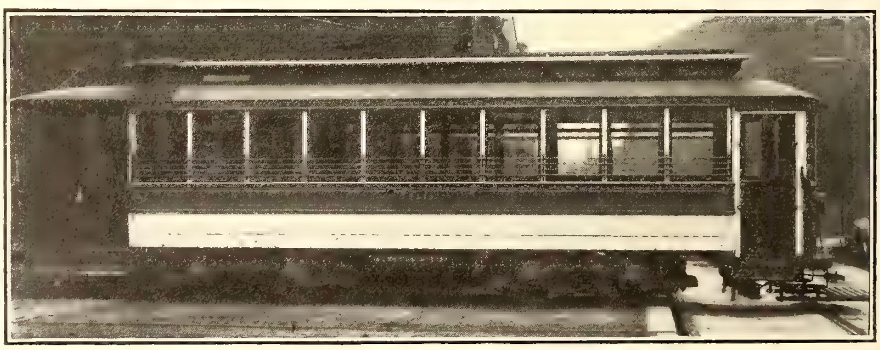
The air compressor furnished with the portable outfit is the National Standard new and improved, in which one of the many distinctive features is the construction of motor and compressor as entirely separate and self-contained units. This compressor was described at some length in the Street Railway Journal, Sept. 8, 1906. The governor, supplied with portable compressor outfits, is a standard type-N oil pneumatic, which has fully demonstrated its absolute reliability and adaptability to the hardest kind of service. This governor was described in the Street Railway Journal for Oct. 13, 1906.

The reservoirs furnished with all sizes of portable outfits are of cold-drawn seamless steel. They are 18 ins. in diameter and 33 ins. long. The compressors are made in sizes ranging from 11 cu. ft. to 50 cu. ft. of free air per minute.

NEW CARS FOR THE LOUISVILLE RAILWAY COMPANY

Fifty new cars have just been received by the Louisville Railway Company, and the company has placed an order with the St. Louis Car Company for fifty 28-ft. car bodies, equipped with St. Louis Company's No. 47 trucks and four G. E-80 motors, to be delivered between April 15 and May 15, 1907. These cars are duplicates of car No. 1000, of which an illustration is presented herewith. These cars have a short vestibule platform on the front and large open platform on the rear. The inside finish is of mahogany with bronze fittings. There are ten rattan upholstered seats on each side. The sash covers and ventilator sash are supplied with locks, so same can be fastened in cold weather.

The Cincinnati Car Company, of Cincinnati, has recently booked orders for equipment as follows: Five double-truck semi-convertible cars for the Eastern Pennsylvania Railway Company, of Pottsville, Pa.; five 33-ft. closed cars



TYPE OF CAR BEING PUT INTO SERVICE AT LOUISVILLE

for the Camden Interstate Railway Company, of Huntington, W. Va.; five 30-ft. closed car bodies for the Consolidated Railway Company, of Bridgeport, Conn., and six 18-ft. single-truck cars and three 45-ft. interurban cars for the Sheboygan Light & Power Company, of Sheboygan,

SMALL DIRECT-CURRENT GENERATORS FOR EXCITER AND OTHER PURPOSES

A complete line of direct-current generators ranging from 1½ kw to 17½ kw has lately been developed by the General Electric Company. The machines are designated as type CQ and embody the compact cylindrical construction which has been found dso satisfactory in the CQ and C R motors. They are especially applicable as exciting units for alternating-current generators or as direct-current generators for small power plant purposes where a low capacity belt-driven generator is suitable.

The bearing heads are so constructed that the machines can be installed on floor, wall, or ceiling, thus adapting generators to crowded locations. Other constructive features also deserve mention. The field and armature coils are form-wound and removable, and both receive an insulation practically impervious to water. The field coils are held by the flanged tips of the steel pole-pieces, which are seated firmly in the field frame by bolts passing through the frame and secured with nuts. The armature coils are held in toothed slots on the core and extend beyond the end flanges, being firmly banded to prevent vibration or movement. This form of winding gives a large radiating surface for the conductors and so keeps the temperature rise very small. The bearings are arranged with ring oilers and, as has been mentioned, can be adjusted for wall or ceiling installation by turning the bearing heads through 90 to 180 degs. Carbon brushes, sliding in finished box guides, are firmly held against the commutator by adjustable individual springs. The generators will operate sparklessly from no-load to full-load without shifting the brushes. These CQ generators are compound wound for 120 to 125 volts and from 240 to 250 volts full load.

A further development of the CQ generator is the balancer set for the regulation of three-wire systems.

FIRE ON TUNNEL SITE

A fire early Wednesday morning, April 2, destroyed the temporary framework covering the area at Church and Cortland Streets, New York, where the proposed twenty-five-story terminal for the McAdoo terminal is being built, and will, it is unofficially reported, delay the work about a month. Operations are carried on here all day, and some of the men at work are reported to have had narrow escapes from injury in reaching the street.

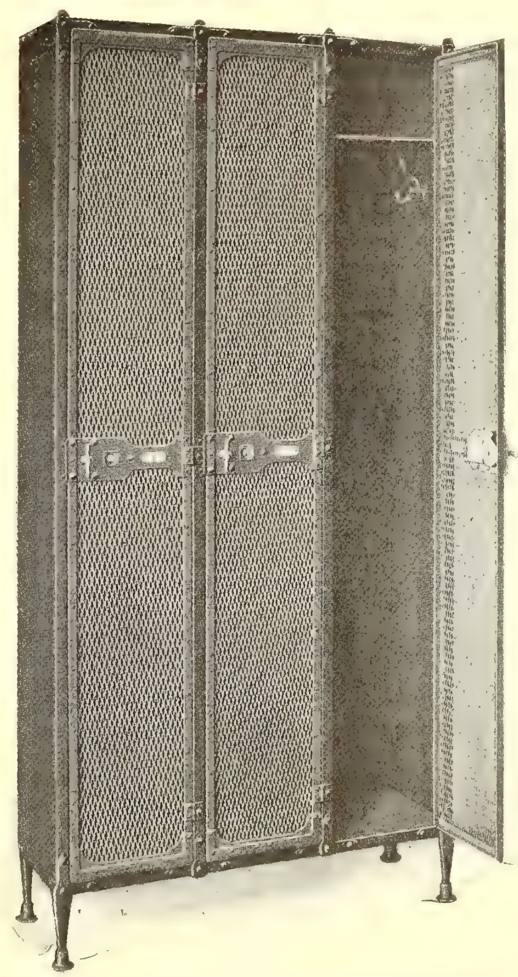
A NEW AIR COMPRESSOR FOR CONTINUOUS SERVICE

A water-jacketed cylinder head has been designed for the new type of compressor for intermittent service recently put on the market by the National Brake & Electric Company, illustrated and described in the Street Railway Journal for Sept. 8, 1906, which permits the compressor to be operated continuously where proper water connections are made with the head. By the circulation of water in the head the valves and those parts of the compressor subjected to the greatest heat are kept comparatively cool with continuous operation of the compressor.

With the water-jacketed compressor there is furnished a water governor which automatically cuts off the circulation of water whenever the compressor is shut down. This governor is very simple and reliable, and eliminates the danger of running the machine without water which might result from neglect to turn the water off after the machine has been stopped. The water-jacketed types of compressors are made in sizes varying from 15 cu. ft. to 35 cu. ft. per minute, and are particularly adapted for stationary installations in power houses and electric railway shops.

STEEL LOCKERS FOR THE MEN

Lockers have come to be an indispensable part of the street railway equipment. The shop, the power station and the employees' club that pretend to order cannot be without them. The extension of their use beyond these limits depends largely upon the methods of management of the different systems and the individual requirements. Lockers make for order, and afford just the protection that is needed. For the trainmen they are especially valuable, as the men can go and come from the car house when they so desire in civilian dress, and often when their runs are irregular are saved the trouble of going home before reporting for duty. A line of steel lockers, especially adapted to street railway use, is offered by the Narragansett Machine Company, of Providence, R. I. Both the single and double-tier type are made. Expanded metal or perforated sheet steel doors may be had, the expanded metal door being especially attractive, considered esthetically. From the standpoint of construction the lockers embody those features that make for strength and durability. The partitions, backs, tops and shelves are of sheet steel, folded and reinforced, and secured



STEEL LOCKER WITH EXPANDED METAL DOOR

by bolts inside the locker only. There are no raw edges to injure the person or clothing. Each locker is a unit, and the cabinets may be made any size and can be readily added to or taken from to suit changed conditions. A variety of locks is offered.

LONDON LETTER

(From Our Regular Correspondent.)

The new tramway system of the Dumbarton Town Council, referred to last month as forming one of the connecting links in an extensive system of tramways from the Lanarkshire coal fields to the banks of Loch Lomond, has now been opened for traffic. The tramways have been constructed by the Electric Supply Corporation, of London, who were the promoters of the company, and on their invitation a party of local gentlemen were invited to inaugurate the system in the usual way. Luncheon was served at the Lesser Borough Hall, Mr. Scott Moncrief, the London manager of the Electric Supply Corporation, presiding. It was intimated in one of the speeches that a new Dumbarton Borough and County Tramways Company was being formed with a view to extending the line to Dalmuir and Balloch.

Last month reference was made to the undue importance which the London County Council Tramways were given in the recent elections at that time in the immediate future. The elections have since taken place, the Progressives suffering a complete defeat, and those of the Moderate party securing a very large majority. Doubtless the warnings that have been sounded for some time back by well-known financial authorities on the tremendous amount of money being spent by the London County Council on tramways and other enterprises have had their effect, the benefits being largely forgotten in the financial alarm. The work of the tramways, however, will have to go on, as many contracts have already been made, and the work, of course, cannot be stopped. It is fairly sure, however, that the London County Council's electric power scheme will fall to the ground, as it is not considered at all probable that the Moderate party will proceed with that ambitious scheme. Time and cool judgment will doubtless eventually decide that some working arrangement between the already existing companies is all that London at present needs, and not the establishment of enormous new power houses at an expenditure of millions sterling of capital, the success of which would be entirely problematical. A report on the working of the southern system of tramways has recently been issued by the highways committee of the London County Council, in which it states that during the past year under review, 183,512,421 passengers were carried, being 83,000,000 more than were carried on the southern system during the year 1899-1900, when the Council first commenced the working of the lines. The report calls attention to a number of the difficulties which the Council is still encountering, and mentions the congestion of the service around the Elephant and Castle. During the first year of the working of the lines, the average number of cars passing that point was about 4000 a day, whereas, now, it has increased to about 5500, even though it has been relieved, to some extent, by taking certain of the Greenwich services via Kennington. The battle of the London County Council with the outlying boroughs as to the system to be used in future is also by no means completed, and the Islington Borough Council has recently advised the London County Council that it declines entirely to allow any overhead trolley system in their borough, so that the electrification of certain of the lines of tramways in the northern portion of London is at a standstill. The Council has recently ordered another lot of 300 electric cars, the car trucks being supplied by Mountain & Gibson, of Bury, who have already supplied a large number of trucks in London. While on the subject of London's tramways, it may be interesting to note that Mr. A. L. C. Fell, manager, has perfected a brake, designed to prevent such accidents at the one at Highgate. The invention is in the nature of a hand attachment to the present magnetic brake, so that if for any reason the current operating the magnetic brake should fail, the brake can still be applied to the rails by means of hand power. It will also be possible for the motorman to apply this brake by hand power at the top of any gradient, so that the brake will be acting as a constant retarding force all the way down the hill, the magnetic action of the brake being only used to bring the car to a standstill, or in an emergency.

An interesting decision has just been made by the Nottingham Corporation Tramways committee. A considerable portion of its overhead construction was erected on the center-pole type and the committee has now decided to remove a number of these center poles and put up span-wire construction. This will obviate, to a large extent, the obstruction in the streets to traffic by means of these tramway standards. Mr. Aldworth, the tramways manager, explains that, in addition, he believes the span-wire system makes for greater economy, as the trolley passing under span-wire construction is not subject to such hard usage as it is in center-pole construction, where the suspension of the trolley wire is much shorter and more rigid. The Nottingham tramways have been, during the past year, considerably extended, and the eastern part of Nottingham is now linked up to the remainder of the city, which will afford great convenience to residents, as narrow streets for some years precluded all possibility of getting tramways to that portion of the city. The County Council, however, vigorously tackled the situation and has made a number of important street widenings and improvements to accommodate the tramways.

The select committee of the House of Lords, which has been for some few days considering the bill promoted by the Birmingham City Council to extend the tramways system to Harborne, about which there has been so much dispute in that city, have given its decision against the bill, so that this important suburb of Birmingham will be without a tramway system at least for some years. There appears to have been great diversity of opinion, but the wealthier classes living in Harborne who were afraid that if tramways were extended to their select suburb it would result in a lot of cheap houses being put up, have won the day. The bill was naturally opposed also by the London & North-Western Railway Company, whose records show a considerable falling off in other parts of the city, owing to the large business which the Birmingham tramways are doing. It is stated that the weekly average of passengers using the tramways is 1,200,000, and it is estimated that the gross takings will amount to £260,000 for the year, with a surplus of at least £40,000 a year.

The Birmingham tramways committee report that, after many conferences with representatives of King's Norton and Northfield Urban District Council, an arrangement has been come to for the working by the Corporation from Jan. 1 last, to Dec. 31, 1927, of the Moseley and King's Heath tramways, and from July 1, 1911 (when the company's lease expires) until Dec. 31, 1927, of the Pershore road and Bristol road tramways, and also of any new tramways within the district of the King's Norton Council which may be physically connected with the tramways of the Corporation. The Corporation is to work the traffic and maintain the electrical equipment, and will receive from the Council 4d. for every car-mile run. The Council is to provide electric current, to maintain the track, and to pay to the Corporation a sum representing depreciation on the cars apportioned to the mileage run in their district. The Corporation is to pay over to the Council all receipts in respect of fares taken within the latter's district.

The annual report of the London United Tramways, which has recently been published, shows gross receipts amounting to over £327,000, and a net revenue of over £144,000. After paying dividends on debentures and preference shares, the company have been able to declare a dividend at the rate of 3 per cent on the ordinary shares. This is, of course, not entirely satisfactory, as this company used to pay a much larger dividend than this, but Sir Clifton Robinson points out that considerable portions of the line are not yet earning money. The directors take, however, a favorable view of the situation, and expect shortly to be able vastly to increase the earning powers of the company. It is expected that by mid-summer their lines will be connected with those of the London County Council at Tooting and Summerstown, and that the new portion of the line from New Malden, Raynes Park and Wimbledon will then be able to be put in operation.

The recent board of trade inspection of the Torquay tramways, which we understand was quite successful, possesses peculiar interest as they have been equipped on the Dolter surface-contact system. The trial car had on board Major Pringle, R. E., and Mr. A. P. Trotter, the inspectors; Mr. H. Jarvis, a director of the National Electric Construction Company, by whom the tramways have been carried out; Mr. E. A. Mitchell, chief engineer to the Dolter Electric Traction Company, for whom they have been laid; Mr. H. Lancaster, general manager, and a few others interested in the work. The total distance traveled by the car was about 8¼ miles, and the routes traversed comprise the whole of the completed portion of the system except the Babbacombe road section, from Torwood Street to St. Marychurch Townhall.

The South Lancashire Tramways Company has obtained the consent of the Swinton and Pendlebury District Council to the

making of junctions at Swinton and Pendlebury, between the company's system and that of the Salford Corporation. In its letter the company stated that the object of the proposed junction is the provision of a through service to Manchester. The Council has acceded to the application, on certain conditions, among which it is specified that no agreement shall be entered into between the South Lancashire Company and the Salford Corporation, whereby running powers shall be given or obtained, without the approval of the Council.

The York and District Tramways bill, the promoters of which sought powers to run tramways in the city of York, has been withdrawn. In the meantime the Corporation has decided to purchase the existing tramway company's system, and apply either by bill or light railway order for powers to work it.

Approval of the proposal to electrify the railways of the Isle of Wight is recommended by a committee of the County Council, as a result of a conference between delegates of public bodies and the United Electrical Construction Syndicate, Ltd. The scheme includes express services and fuller local services by single cars, with stopping places at all cross-roads. The proposal also includes 30 per cent reduction in fares and a considerable increase in the number of trains.

The Paisley & District Tramway Company, which, in the summer of last year extended its line from Paisley to Barrhead, intimates that it intends to apply to Parliament for power to make a further extension as far as Thornliebank, the object in view being to establish a connection with the Rouken Glen, which is also reached by the Glasgow Corporation Tramways. The Corporation is deeply interested in the extension now proposed, because about half of the new line would traverse territory which the Corporation seeks to include within the boundaries of the city.

The Manchester Corporation Tramways committee has decided to retain in support of its Parliamentary bill Mr. Balfour Browne, K. C., Mr. Lewis Coward, K. C., and Mr. G. Rhodes. Four petitions have been presented against the bill, one each on behalf of the Earl of Ellesmere and Earl Egerton, the Cheshire County Council, and the Stretford District Council. With regard to the proposals for inter-running of cars on the Manchester and Salford systems, no decision has yet been reached. The committee is awaiting reports from the general managers of the two systems. The scheme suggested by Manchester is based on the arrangement in vogue with the Oldham Corporation. Under this the conductors of the cars are supplied with the tickets of each local authority, and within the respective areas passengers' fares go to the controlling authority, a weekly balance being afterwards made between the Corporations.

A meeting of the executive committee of the Municipal Tramways Association was held at the Manchester Corporation Tramways offices recently, after which the members were entertained to dinner by the Manchester tramways committee. Alderman Wainwright (chairman) presided, and members of the tramways committee also present were Alderman Bowes (deputy chairman), Alderman McCabe, and Councilor Stewart. The company further included Mr. J. M. McElroy (president of the association), Mr. J. Aldworth (vice-president), Mr. J. B. Hamilton and Mr. A. Baker (past presidents), Mr. P. Fisher, Mr. J. Lancaster, Mr. C. J. Spencer, Mr. Mozley and Mr. A. R. Fearnley (secretary). Alderman Linsley, Councilor Barnes, Mr. G. W. Holford (general manager Salford tramways) and Mr. L. Slattery. An address was presented during the evening to Mr. J. M. McElroy, general manager of the Manchester Corporation Tramways, honorable secretary and treasurer of the Municipal Tramways Association, 1902-06, president of the association this year. In this document the members of the association offered their sincere thanks for the excellent services Mr. McElroy has rendered to the association since its inception.

Clacton, in Essex, has successfully opposed the offer of the Clacton & St. Osyth Light Railways Company to introduce a system of electric tramways. The plea of the opponents at the inquiry was that Clacton is a quiet place, that its visitors are now attracted by the calm and restfulness of the town, and that the introduction of tramways would spoil the reposeful character of Clacton, and drive away not a few of its customary health seekers.

The Town Council of Stirling has received intimation that the negotiations for the acquisition and electrification of the tramway line from St. Ninians through Stirling to Bridge of Allan had terminated, for the present at any rate, without result. The negotiating company made a provisional purchase of the undertaking last August, and reached a working agreement with Stirling Town Council. The County Council, however, insisted that the whole track within its jurisdiction should be blocked between the rails, as well as for a space on either side, and this demand, coupled with other provisos, was regarded as too onerous by the company.

Mr. Graham Harris, the arbitrator appointed to decide the dispute between the Leyton Urban Council and the North Metropolitan Tramways Company as to the amount to be paid by the Council for the company's works, which are situated in Leytonstone, has issued his award. The portion of the company's system situated in Leyton and Leytonstone was compulsorily acquired by the Council. The Council contended, however, that it was not required to purchase the works, which did work for the whole system, except so far as they were necessary to the portion which it had acquired. This contention has been upheld by the arbitrator, who awards the company £19,168, as against the £73,442 demanded.

On the kind invitation of Thermit, Ltd., the British branch of Th. Goldschmidt, of Essen Ruhr, Germany, the inventors and producers of alumino-thermic welding, a large number of gentlemen, some connected with the tramway industry, but most of them with the shipping industry, the Board of Trade and Lloyds, paid a visit to the works of the Thames Iron Works, in London, to witness a demonstration of welding by the thermit process of a fracture of the stern post of a large steamer. Thermit welding, as applied to tramway rails, needs no introduction in these columns, as it is now being used extensively all over the world, the Thermit process having established a most extraordinary record in its rapid adoption and success. It is of interest to mention the fact that this process is entirely suitable for the welding of fractures of large steel frames or castings, such as used in marine work for the stern post of steamers. The demonstration was extremely interesting. Dr. Hans Goldschmidt himself was present, along with Mr. Stutz, the general manager of the London office, and many of the staff from various countries of different companies engaged in this business. An old stern post which had been fractured had been erected in a part of the yard, and when the visitors arrived the mold had already been fixed in place, the stern post in the immediate vicinity of the mold and the mold itself being subjected to considerable heat, preparatory to the introduction of the thermit. Dr. Goldschmidt read a description of the experiment about to take place, and after the visitors, about 150 in number, had been provided with blue glass, through which to look upon the molten metal as it runs from the crucible into the mold, about 200 pounds of the special material was placed in the mold, fired in the usual way. In about a minute's time the whole material had run into this mold and the process of welding was in operation. This took place about 11:30 in the forenoon, and, after luncheon, about 3 o'clock in the afternoon, the molds were entirely removed, when a beautiful clean weld was exposed to view. The experiment was successful in every way, and it only remains for Lloyds' inspectors to make such tests of the complete joint as they may desire.

A. C. S.

LIST OF BOOKS ON CEMENT AND CONCRETE

The Book Department of the McGraw Publishing Company has just issued a leaflet containing a list of all of the recent works on cement and plain reinforced concrete. An effort has been made to make this complete, and it contains the names of some books which have been put on the market only within the last few days.

The McGraw Publishing Company has also issued a leaflet and list of books on steam turbine engineering.

COLLINS COMPANY SECURING BIDS FOR MATERIAL

The Collins Construction Company, 92 LaSalle Street, Chicago, Ill., which has secured the contract for 65 miles of electric railroad from Canton to Youngstown, is now taking bids on all classes of material and equipment needed for the complete construction and equipment of the road, consisting of concrete work, trestle work, drain pipe, steel bridges, ties, steel rails, rail-joints, frogs and switches, boilers, turbine generators and accessories, power-house building, car house and shops, poles, brackets, trolley-wire transformers and all accessories for the complete overhead work; passenger coaches, freight motors and motor equipment. The estimated cost of construction and equipment is $2,000,000.

THE CLEVELAND SITUATION

The plan of Mayor Tom L. Johnson, as divulged at a mass meeting in Cleveland on Wednesday of last week, to confine his scheme of 3-cent fare within the city limits, opened the eyes of some of the friends who have been staunch advocates of his theories. Up to that time the Mayor had been very careful never to mention the limit of possibilities for the 3-cent ideas that he has entertained, but through skilful questioning by President Horace E. Andrews, of the Cleveland Electric Railway Company, he made the admission, which is considered by many a confession of his inability to do what he has promised. Mr. Andrews had figured upon operating the entire system upon whatever fare might be adopted, feeling that the zone idea had been exploded long ago, but according to what the Mayor said, that is what he has been counting on all the time. He said he would not even entertain the idea of giving Collinwood a 3-cent fare on the holding plan, even if the village should be made a part of the city, nor would he allow any of the other outlying villages anything less than a 5-cent fare, unless their contracts with the Cleveland Electric specifically provide for it, or that it could be proved that the cost of carrying passengers is less than that. He said he did not believe in operating the lines outside of the city at the expense of those living in the city. Their people must pay a higher fare and allow the people in the city to pay just enough to make the company self-sustaining. The stand the Mayor explained seems to sustain the points made in the report made by Mr. Du Pont to the City Council, in which he said that the franchises in the outlying villages are worthless after the grants to the connecting lines within the city limits expire. Whether or not the report was submitted to the Mayor for his approval before it was read to the City Council, its contents seem to coincide with his views.

East Cleveland and some of the other villages have contracts with the Cleveland Electric Railway Company by which they are to have whatever rate prevails in the city, no matter what that may be. Under the leasing plan they would be able to force the leasing company to honor this franchise contract, and Mayor Johnson said that he would not interfere where such contracts exist. The line that reaches East Cleveland also goes to Euclid Beach, a popular resort which is largely patronized by both city people and visitors. Although a long run, this line does a heavy business through the summer and must make money for the company. The Mayor said he did not know what view he would take of the question regarding its fare. The owners of the resort are taking an interest in this matter.

At the meeting Wednesday, Mayor Johnson appointed a committee, with himself as chairman, to consider the communications of Presidents Andrews and Du Pont, and to suggest ways and means of getting together at the meeting to be held Saturday afternoon. This committee held a meeting or two, but no suggestions were made that would reduce the width of the gulf between the two companies. The later meeting really resulted only in a passage of words between the Mayor and Mr. Andrews and Messrs. Andrews and Du Pont. The Mayor attempted by a series of questions to induce Mr. Andrews to go into detail and give data from which he arrived at conclusions, but his questions were parried until finally Mr. Andrews said that the data collected were for the information of himself and Mr. Du Pont in their negotiations, and that they were not to be made public unless a settlement was arrived at. Then the Mayor started out with some information that proved to be data regarding the road and asked Mr. Andrews if there were any objections to giving it to the Council members for their consideration. Mr. Andrews repeated what he had said before, to the effect that the data are the company's private matter and were intended only for himself and Mr. Du Pont, and were not, under the agreement, to be given out. He said he did not propose to furnish ammunition for campaigns against the company later on. Mayor Johnson claimed that the stand taken by the company would block any further negotiations, as the Council had nothing upon which to base an offer, to which Mr. Andrews replied that he had supposed the negotiations were between his company and the Municipal Traction Company, and he could not see what good such information to the Council would be.

At the meeting on Wednesday, City Solicitor Baker presented Mr. Andrews with a list of sixteen questions, the answers to which, he said, would enlighten Council upon the matter. Following are the questions, with the answers formulated by Mr. Andrews and read before the meeting:

1.—It is claimed that in Chicago 20 per cent was added to the actual value of the physical property of the street railroads as compensation for contractors' profits, brokerage, interest during construction and engineering charges. This is the so-called Chicago plan.

In Cleveland it was suggested that one-ninth of the aggregate value of the physical property and franchises should be added and the sum so arrived at capitalized to be redeemable at one-tenth which is equivalent to 21 per cent additional to the actual value of the physical property and franchises together. This is the so-called Cleveland plan.

In your determination which of the plans did you use, or did you use both?

Answer: In Mr. Du Pont's communication to the Council, under date of Jan. 10, he stated that the Municipal Traction Company would be willing to make a contract with the Cleveland Electric Railway Company for the operation of its properties similar to the contract between his company and the Forest City Railway Company. That contract provides, as stated by him, for the payment as rent of "the equivalent of 6 per cent interest upon the stock of the company, issued at not less than 90 cents on the dollar and redeemable at $110 a share." He stated that the stock of that company represented the "physical and construction value of the property." The items mentioned in the first paragraph of this question are a necessary part of the cost of the construction of every street railroad, and were certainly included in the "physical and construction value" of the property of the Forest City Railway Company, against which $100 of stock of that company was issued for every $90 of cost. For this reason they should be included in the reproduction value of the Cleveland Electric Railway Company and, as the proposition is that a contract be made with the Cleveland Electric Railway Company similar to the contract made by Mr. Du Pont's company with the Forest City Railway Company, one-ninth should be added to this reproduction value, including the items mentioned. For these reasons the items mentioned were so included, and to the value so ascertained one-ninth was added in exact accordance with Mr. Du Pont's original proposition.

2.—Did you base franchise value upon estimated profits per passenger or per car-mile?

Answer: Per car-mile.

3.—Did you take average earnings upon the entire system or average earnings upon the several lines in finding the franchise values?

Answer: Average earnings upon the entire system.

4.—What percentage of the gross receipts did you assume as net earnings?

Answer: Forty.

5.—What rate of interest was deducted from net earnings as interest on physical property before capitalizing for franchise value?

Answer: Five per cent.

6.—In determining the franchise value, did you use the present worth of future profits?

Answer: Yes.

7.—What rate of interest did you use in determining present worth?

Answer: Five per cent.

8.—What rate of annual increase did you assume?

Answer: Eight per cent compounded. This is the rate of increase in earnings in the past four years, and in the past twelve years.

9.—From what date did you estimate franchise value?

Answer: July 1, 1907. (This date should be Jan. 1, 1907, as that was the date agreed to in determining physical values).

10.—Are your franchise values based on the assumption that the franchises in Central and Quincy Avenues have expired?

Answer: Yes.

11.—What date of expiration did you fix for the so-called cable road grants outside of Glenville, including St. Clair, Superior and Payne?

Answer: Jan. 5, 1910, for St. Clair; and Jan. 26, 1910, for Superior and Payne.

12.—What date of expiration did you assume for the Woodland Avenue and West Side grants?

Answer: Feb. 10, 1908. The company believes, however, that the grants run to a later date.

13.—What dates of expiration did you assume for the Euclid and Prospect Avenue lines west of University Circle?

Answer: July 13, 1913. The company claims, however, that its rights do not expire until after that date.

14.—What date of expiration did you assume for Detroit Avenue, west of Highland Avenue?

Answer: Sept. 5, 1924. The contract with the Rockport Plank Road Company, referred to by Mr. Baker at the Council meeting on the 27th, was not included, nor was it included in our valuation of the physical property.

15.—What value did you give to outlying franchises after the expiration of the inside connections?

Answer: The present worth of the net earnings per car-mile, after deduction of interest upon the value of the physical property, as stated in my answers to questions 2 and 3, in exact accordance with the method of franchise valuation suggested by Mr. Du Pont.

16.—What method did you use in ascertaining the franchise value of the outlying grants after the expiration of the inside connections?

Answer: My answer to question 15 answers this.

In the course of the questioning, Mr. Andrews said that he thought for a while that they would certainly reach an agreement, or at least an agreement upon values, if they had been let alone. The Mayor demanded to know what the expression meant. Mr. Andrews did not answer definitely, but intimated

that if others had not had so much to do with it, he and Mr. Du Pont would have gotten along better. During the discussion Mr. Du Pont several times denied that he had used certain methods and agreed to certain rules for arriving at results. Each of the men intimated that the other had not been fair in some of the statements made.

With all his ingenuity at persuasion and questioning, the Mayor endeavored to get President Andrews to say what he thought would be a fair value on the property for leasing purposes. Mr. Andrews replied that he could see no reason for making a price to the Council, but that if negotiations in good faith are desired he is willing to continue them. He said he had not taken the matter of price up with the directors of the company, but only matters that came up at former meetings had been discussed.

At the meeting on Wednesday, Mr. Du Pont presented a letter, in which he criticised the report made by Mr. Andrews to the City Council on Monday evening. In answer to this, Mr. Andrews handed the following communication to the City Clerk at Wednesday's meeting:

Mr. Du Pont's letter of the 27th, I wish to reply to in several particulars:

1. As to my not giving him a copy of my letter of March 25 to your Honorable Body, I received a letter from Mr. Du Pont late Sunday evening, enclosing a copy of a communication that he said he expected to send to you. The Council met at 7 o'clock the next evening. Mr. Du Pont left the city on Sunday. I learned, upon inquiry, that he did not return to Cleveland until after the Coucil meeting. I therefore had no opportunity to send him a copy of my communication to you in time for him to consider it before your meeting.

2. As to the adoption of what is referred to as the "Chicago rule" for the appraisal of the physical property. In Mr. Du Pont's communication to you of Jan. 10, in which the negotiations were suggested, he said: "The present contracts by which the Municipal Traction Company operates the lines of the Forest City Railway Company are upon the basis that the Municipal Traction Company shall pay as rent the equivalent of 6 per cent interest upon the stock of the company, issued at not less than 90 cents on the dollar, and redeemable at $110 a share; the stock of that company representing only the physical and construction value of the property.

"I am directed by the directors of the Municipal Traction Company to say that it would be entirely willing, on behalf of the public, to make similar contracts for the operation of the Cleveland Electric Railway Company's properties, the rent to be fixed by a careful determination of the value of the physcical property and the present worth of the unexpired franchises of the Cleveland Electric Railway Company, adding to that sum one-ninth thereof, and upon the sum so derived paying as rent quarterly at the rate of 6 per cent per annum."

The Municipal Traction Company pays 6 per cent upon the face value of the stock of the Forest City Railway Company, issued at 90 cents on the dollar; this representing the "physical and construction value" of the property of that company. The "construction value" undoubtedly included all the expenses of engineering, superintendence of construction, cost and use of tools, lawyers' fees, expenses of obtaining consents of property owners, court costs, carrying charges, etc. All these items were, of course, included in the 90 cents, one-ninth of which was added, bringing the value of the property up to the face value of the stock, and upon which value 6 per cent dividends are to be paid. If the city shall elect to purchase the property it is to pay the Forest City Railway Company or the Municipal Traction Company 10 per cent additional, the redemption of the stock being $110 per share. He said to you that his company would be willing to make a similar contract with us. The cost of reproducing our property at present market prices of material and labor was to be determined by him and me, and this cost, of course, should properly include legal expenses, carrying charges, the use of tools and everything that goes into the cost of constructing a street railway.

Depreciation, proportioned to length of time each item of property has been in use, was to be deducted from this total cost, the depreciation to be figured on the legal and advertising expenses, etc., as well as on the cost of labor and material. To this depreciated present value one-ninth was to be added, just as it was added to the physical and construction value of the Forest City Railway Company's physical and construction value. The "Chicago rule" was used, not to determine the amount of the bonus, but to determine the amount that should be included in the value of the physical property. In the Detroit valuation report prepared by Prof. Bemis some years ago, 22 per cent was added, representing the items above referred to.

3. As to the value of the franchises: He says that I never told him how I arrived at the value of the Cleveland Electric Railway Company's franchises. I arrived at it by a method suggested in every particular by himself, and, at the time, I stated I thought his plan was equitable, and could suggest no improvement, and that it was acceptable to us, and I gave him the complete data, in writing, as to the duration of franchises, length of track and number of trips, by which he could reach a value by the same method and check the result that I might obtain. If he completed a calculation on this basis the result must have coincided with the result reached in our office, as I made no changes whatever in the method suggested by him and taken down stenographically by Mr. Davies, and used the rates of interest and percentages of operation arrived at after considerable argument on both sides. I did not suppose that we had reached a complete disagreement as to the basis on which the value of the franchises of the company should be calculated until I received his letter of March 13, which was accompanied by a printed argument in which he assumed a physical property value to which we had not agreed, and which did not contain all the items of value, and adopted a method of calculation of franchise values that had not only not been agreed to by me, but was very different from the plan that he had suggested, the plan that he had used in his valuation of Chicago franchises, and the only plan upon which I have made any calculation of franchise value.

For the company I entered into this negotiation with good faith, and am willing to resume it in the same spirit, but as the methods of valuation were suggested by Mr. Du Pont, and especially those for the valuation of fraichises, it is difficult to reconcile with the good faith that ought to control such negotiations the present refusal to abide by the results so reached.

At a public meeting in the Council chamber Tuesday forenoon, March 5, Mayor Johnson expressed his determination to exclude from any agreement between the Cleveland Electric Railway Company and the Municipal Traction Company a clause binding the latter to a fare not to exceed 3 cents in the city and 5 cents outside the limits. All along it had been expected that this would be one of the conditions of the contract and the officers of the Cleveland Electric Railway Company had understood the matter in that light. The Mayor was willing to give the Cleveland Electric Railway Company a twenty-five-year franchise at the rate of seven tickets for a quarter as security in case the Municipal Traction Company failed to pay the interest on the value fixed, or to keep the property in proper condition, but that is all. Even then he wanted the Council to be the judge as to whether the proper care was taken of the property.

Further questioning on the part of President Andrews, of the Cleveland Electric, brought out the fact that the Mayor wanted the Municipal Traction Company's fare regulated by action of the City Council, with the idea that, if it was found that the system could not be operated on a 3-cent fare, a change to a higher fare could be made. But the Mayor made it appear, as far as possible, that he wanted the matter thus arranged so that the Council might reduce the fare, if the business produced a surplus.

A committee appointed by the Mayor at a former meeting, consisting of his honor, as chairman, City Solicitor Baker, and Councilmen Koch, Biesinger, Pfahl, Argill and Haserodt, made a report at this meeting which recommended that an offer be made to the Cleveland Electric Railway Company to lease its property on the basis of 6 per cent on a valuation of $60 a share, redeemable at 10 per cent in advance of this. The report referred to a number of lines, whose franchises expire within a few years, as being of little value, and the committee, it seems, considered the franchises in suburban towns as without value after the franchises of the connecting lines had expired. In order to make matters easy for the holding company, the committee suggested that the company should be paid 3 per cent on the valuation fixed for the remainder of this year, 4 per cent next year, 5 per cent the succeeding year, and 6 per cent thereafter.

The report of the committee was adopted, with the understanding that Councilmen voting for its adoption were not binding themselves to support the holding plan. The Mayor explained that whatever plan was adopted should be submitted to the people for their approval, but it is not believed that he desires to have anything submitted to the people. Since he has been forced to admit that the change may result in 3-cent fare and may not, the idea will probably not be so popular and people may conclude that it is better to be sure of the seven tickets for a quarter, as offered by the Cleveland Electric, than to run the risk of having the Municipal Traction Company charge any fare it may see fit, if so desired by the administration.

President Andrews stated that the company could not operate the system on a 3-cent fare, and that he expected the Municipal Traction Company to fail, if the offer is accepted. For that reason the company would probably be willing to accept the offer, with the provision that the fare be limited to 3 cents. Mr. Andrews said he would bring the city's offer before his board of directors, but he made no offer to the city in any way. He made it clear, however, that the offer would not be accepted unless the limitations mentioned as to fare were placed in the lease. He offered to test the flat 3-cent fare, but the Mayor refused this. Mr. Andrews then said he has spent half a million dollars making tests and that he was not anxious to make this one.

TRACTION WINS IN CHICAGO

Frederick A. Busse, the Republican candidate, was elected Mayor of Chicago at the election on Tuesday, April 2, having a plurality of 13,121 votes over Mayor Edward F. Dunne. The ordinances settling the street car question were carried by a larger majority. The vote on this question was 165,846 for, and 132,720 against.

The issues of the campaign have been largely based upon the improvement of the local traction systems, as previously mentioned in the STREET RAILWAY JOURNAL. Both parties agreed that present conditions are intolerable, but differed as to the best method of revising them. The Democratic Party, headed by Mayor Dunne, stood for immediate municipal ownership through condemnation of the street car property if the result could not be obtained in any other way. The Republican Party favored ordinances which were recently passed by a Democratic City Council over the veto of Mayor Dunne. These ordinances provided for twenty-year franchises for the street car companies, the city retaining the right to purchase the systems for $50,000,000 plus the amount to be spent for immediate rehabilitation of the lines, six months' notice being necessary of the city's intention to acquire the property. The ordinances also provide for universal transfer throughout the city, a 5-cent fare, and 55 per cent of the net profits of the companies to be paid to the city.

NEW YORK FRANCHISE VALUATIONS

The valuations of the public franchises held in New York City, by the State Tax Commission for the special tax provided for by law, are increased $105,375,700 this year. The valuations placed on the various franchises under the Brooklyn Rapid Transit are increased over $16,000,000. In the tentative assessment, the latter increase was $20,000,000. Against this the officers of the Brooklyn Rapid Transit vigorously protested. The result was a reduction of nearly $5,000,000. In all, in New York City, the increase exceeds $100,000,000. What the tax receipts from these sources will be, however, cannot be determined until it is known what tax rate the legislature will impose. Should it be equal to that of last year, the tax sums paid by these franchise holders will be increased nearly $400,000.

MICHIGAN COMMISSIONER RECOMMENDS THAT ELECTRICS BE PLACED UNDER STATE JURISDICTION

In presenting his report to the State, the Railroad Commissioner of Michigan says in part:

"At the last session of the legislature, a law was passed authorizing the Commissioner of Railroads to require the construction of fencing along the lines of electric railways, and also providing for the construction of farm crossings across such tracks. This was certainly a step in the right direction, but there does not seem to be any good reason why electric interurban railway lines should not be brought fully within the jurisdiction of the Commissioner of Railroads, and the control of said law, to the same extent that railroad lines operated by companies organized under the general railroad laws are now controlled. These electric railway companies have become a very important factor in the carrying trade in the State, and the building of such lines should certainly, under all circumstances, be encouraged. I would, therefore, recommend that the law under which this class of companies is organized be either repealed and the companies required to reincorporate under the general railroad laws, or that such law be so amended as to become fully as effective as the general law. At the present time electric railway companies are not required to make any report to this department and only make a very incomplete and unsatisfactory report to the Secretary of State. It certainly seems very important that the general public should be enabled to inform themselves regarding the actual condition of these corporations, and I would therefore most earnestly recommend that you request the legislature to enact a law which will require electric railway companies to make complete annual reports to the Commissioner of Railroads in about the same form that is now used by the steam railroad companies in making their reports."

TOLEDO, WABASH & ST. LOUIS COMPANY INCORPORATED

The Toledo, Wabash & St. Louis Railroad Company has been incorporated at Augusta, Me., with a capital stock of $6,000,000, and the following Toledo men as officers: Clarence D. Whitney, president; George G. Metzger, vice-president; J. P. McAfee, treasurer; S. L. McAfee, secretary. Riggs & Sherman, of Toledo, will be the engineers. It is said this is a further development of the Toledo & Defiance Railway Company, which was incorporated a few weeks ago. In fact, the Ohio company is to be a holding company. Burr Brothers, of New York, will underwrite the stock of the company, while the Carnegie Trust Company will act as transfer agent, and the Columbia Trust Company as registrar. The Toledo & Defiance Railway Company will secure the right of way, franchises, and all other concessions. The construction work will be done in sections, the first being that between Toledo and Defiance. After that the line will be continued westward. No bonds will be issued, it is said, and no preferred stock. The road will thus stand upon its own foundation. President Whitney is an old steam railroad man, having been traffic manager of the Clover Leaf system. The road will pass through Fort Wayne, Indianapolis, Terre Haute and some other smaller cities of the Hoosier State and will be as nearly an air line as possible. Following this comes the report that the Toledo & Indiana, which has plans for an extension from Bryan to Waterloo, Ind., will build on to Fort Wayne, where it will connect with the Union Traction Company's line. Through traffic arrangements with this company and the roads owned by the McKinley syndicate in Illinois, a through route to St. Louis will be formed. Possibly a number of gaps will have to be closed up, but the Union Traction Company's lines and those of the McKinley syndicate in Eastern Illinoise are now connected. The gaps will then occur between that point and Southern Illinois. The syndicate is now building a line from Alton on the Mississippi River to Jacksonville, in the Central part of the State.

DECISION IN THE MEMPHIS LOW FARE CASE

Sustaining the validity of an ordinance seeking to compel the Memphis Street Railway Company to sell tickets at the rate of six for 25 cents, and declaring that the extended franchise which the company has been claiming since Nov. 20, 1905, is of no legal value, Judge Pittman has decided the damage suit for $2,000 of William G. Byrne against the Memphis Street Railway Company in favor of the plaintiff. Attorneys for the defendant immediately filed notice of appeal. The opinion is elaborate, and sustains the position taken by the plaintiff's attorneys, which is that the ordinance of 1895 was not a contract for the reason that the Legislature of the State of Tennessee had expressly and unequivocally declared that no taxing district should make any contract of any description, except in writing, to be signed by a majority of the fire and police commissioners and a majority of the Board of Public Works. Attorneys for the defendant contended that a decision adverse to the defendant would mean that the franchise of the Illinois Central Railroad, involving about $15,000,000; the Union Railway Company about $4,000,000, and the Memphis Street Railway Company involving $5,000,000 or $6,000,000 would be declared invalid. This view of the situation was not held by Judge Pittman, except with regard to the Union Railway Company, which he declared might be involved.

Isadore Newman & Son, who control the majority of the stock of the Memphis Street Railway company, have issued the following statement:

"Before we became interested in the Memphis Street Railway Company our attorneys reported favorably on the franchise. The franchise provides for a 5-cent fare for a continuous ride, but reserves the right to the city to request the company to sell eleven tickets for 50 cents. The ordinance stipulating six tickets for 25 cents was passed some months ago during political turmoil.

"The company will appeal the decision rendered March 28. We are most confident that the higher court will sustain the rate of fare provided in the franchise, for the franchise constitutes a contract between the city and the company.

"We are advised that no other question as to the franchise is involved in this decision."

WESTERN KENTUCKY PROJECTS

Tillman Bethell, of Henderson, Ky., is enthusiastic over the prospects of the building of two electric railways from Evansville, Ind., into Kentucky territory, both of which will penetrate rich coal and mineral lands, as well as rich agricultural territory. One of the lines will be from Evansville through Henderson to Uniontown. The other line will be from Evansville to Owensboro. It is the aim of the promoters to build the Evansville and Uniontown line first. In this project Mr. Bethell has enlisted the assistance of A. G. Crutchfield and W. W. Cooper, of Henderson County, who are leading business men of their section of the country.

"It is the aim to build a track 5 miles up the river from Evansville," said Mr. Bethell, "and cross the Ohio River at Towhead Island, which lies on the Kentucky side. We can bridge the river at this point for considerably less than $1,000,000. The two lines will then diverge from the bridge on the Kentucky side, one going east to Owensboro and the other west to Uniontown. Both lines will cover a distance of about 25 miles from the river to their termini. The roads can be built cheaply, as they will traverse a comparatively level scope of territory. The Evansville and Uniontown road will tap coal fields that are most excellent in quality. The Owensboro line will tap beds of mineral, especially fire clay."

All of the rights of way have not been obtained, but he says that will be an easy matter. Mr. Bethell is one of the oldest business men in Western Kentucky. For many years he was engaged in the steamboat business, but for the last twenty-five years he has been engaged in farming and other businesses.

SERVICE IN MILWAUKEE

At the hearing recently before the Wisconsin Railroad Commission some interesting facts were given regarding street railway operation in Milwaukee by C. N. Duffy, auditor of the Milwaukee Electric Railway & Light Company. Mr. Duffy said that during the month of February, the Milwaukee Electric Railway & Light Company carried 7,134,180 passengers and operated its double-truck cars 916,890 car-miles, or all told offered a capacity of 38,509,380 car-seat miles. Of this car-seat mileage, only 18.53 per cent was used. Mr. Duffy is quoted as saying: "There were only 7.78 passengers carried to a car-mile. Out of 397 cars possessed by the company, 372 cars were put in service. That is, out of a car capacity of 100 per cent during the month, 93.7 per cent were in use. No other road in the United States can show such a record. It must be remembered that when the last seventy-five cars were put in service, thirty-five old cars had to be taken off. This left only about forty new cars for service improvement. Taking 5.20 to 6.20 at night as the busiest time of the day, if 372 cars are put in service, and only average sixty passengers to the car, it means that 22,320 passengers are carried in 1 hour, or 372 in 1 minute. Three hundred and seventy-two cars an hour means six cars in 1 minute and 1 car in every 10 seconds. I think the capacity of the streets is about reached. You might do something with an increase of car capacity, but you could not increase your transportation capacity."

TRANSFER OF MANAGEMENT OF WORCESTER LINES

A transfer of management of street railway lines controlled by the New York, New Haven & Hartford Railroad, by which Francis H. Dewey, president of the Worcester Consolidated lines, becomes general head of the roads in this section of the State, is announced. President Charles S. Mellen, of the New Haven Road, has resigned the presidency of the Worcester & Southbridge and Worcester & Blackstone Valley Roads, and Mr. Dewey has been elected president of each of those lines. The Worcester & Webster and Webster & Dudley Railways, which are controlled by the New Haven Road, have been leased to the Worcester & Southbridge Company, and both the Blackstone Valley Road and the enlarged Worcester & Southbridge system will be operated from Worcester in connection with the Worcester Consolidated, which is also one of the New York, New Haven & Hartford Railroad properties. E. G. Cornett will be general manager of all these lines.

A. B. Potter, who has been superintendent of the Worcester & Webster, Worcester & Southbridge and Webster & Dudley, has been transferred to the Stamford, Conn., lines of the New York, New Haven & Hartford, and J. W. Anderson, superintendent of the Blackstone Valley Road, will be in direct charge of the enlarged Worcester & Southbridge.

THE NEW YORK CENTRAL ACCIDENT

On March 27 the grand jury in New York City handed down three indictments, charging manslaughter in the second degree as the result of the New York Central accident of Feb. 16. The parties named are the railroad company, Vice-President A. H. Smith, and General Superintendent I. A. McCormack. The presentment states that the disaster was undoubtedly due to the excessive speed. It refers to the fact that the electric locomotives run with greater smoothness than steam locomotives, and consequently men not experienced with them almost invariably underestimate their speed. The jury believed that the engineer of the wrecked train had not received sufficient instruction to enable him to form a judgment of any value as to the speed at which he was running his train.

CALIFORNIA STORM AFFECTS TRACTION PROPERTIES

The severe rainstorm and floods which visited California the week of March 17, resulted in considerable damage to traction properties in the central valleys and crippled the service to a considerable extent in San Francisco. At Orrville the entire town was flooded, and the losses to the Northern Electric Company's railway lines and bridges were very heavy. No trains could be operated for several days, the service between Chico, Orrville and Marysville being suspended on account of the tracks being submerged.

In Berkeley the Key Route train service was blocked for a few hours by a washout. In San Francisco the United Railroads were compelled to depend on its two city power plants, Bryant Street and North Beach, as the power house and transmission service of the California Gas & Electric Corporation was temporarily crippled. Many of the car lines were demoralized for several days.

MEETING OF THE NEW YORK STATE ASSOCIATION

The New York State Street Railway Association has decided to hold its annual meeting at Bluff Point, Lake Champlain, June 25 and 26. A committee of arrangements has been appointed, consisting of E. S. Fasset, C. Gordon Reel, F. V. Green, H. N. Ransom, H. S. Bradfield. Requests for hotel reservations should be made to E. S. Fasset, general manager United Traction Company, Albany, N. Y. It is announced by J. H. Pardee, secretary of the association, that no spring meeting of the body will be held.

STRIKE AT MONTGOMERY

The motormen and conductors employed by the Montgomery Traction Company, of Montgomery, Ala., are on a strike, because the company refused to recognize the union, which was organized a few days ago. Wednesday, March 27, all the cars were run into the car house by the men and for about 2 hours there was not a car running. About sixteen men remained with the company. This was enough to put cars on the road, and with the help of the superintendent and several other employees at the car house about ten cars were run during the afternoon. When the cars came to the car house Manager Ragland made a short talk to the men, telling them the position of the company, saying it did not propose to recognize the union, and those who wanted to remain under those conditions could do so, the others could call and get their money. Nearly all walked out.

The St. Joseph Valley Traction Company, of Elkhart, Ind., which operates with gasoline-motor cars a line from Middlebury, Ind., to Angola, Ind., about 47 miles, has made a mortgage to William P. Knickerbocker, of Elkhart, as trustee, to secure $700,000 bonds, due in 1919. The road was projected to extend from Angola via Middlebury to South Bend, 80 miles. The St. Joseph Valley Railway was organized to build the 28 miles from La Grange to Angola.

EMBANKMENT SUBWAY HEARING IN BOSTON

A legislative committee hearing relative to the proposed subway in Boston from Park Street to the Back Bay Fens district via Beacon Hill and the Charles River Embankment, was held on March 27. Interest centered in the opposition to the project as indicated by various property owners in the Back Bay and by counsel representing parties solicitous lest the work interfere with the attractiveness of the Common. The Boston Elevated Railway Company also appeared in opposition to the plan.

President Bancroft stated that there is now invested, either by by the Boston Elevated Railway Company or the city of Boston, $60,000,000 in rapid transit projects. The company is committed to an investment of $30,500,000 more, of which $10,500,000 is for rapid transit subways in Cambridge; $9,500,000 for the Washington Street tunnel; $8,000,000 for the Forest Hills elevated extension and enlargement of platforms for eight-car trains, and $2,500,000 for surface line and other improvements. To meet the interest, dividend, taxes and subway rental charges on this capital, $1,500,000 extra earnings per year would be required. General Bancroft contended that in view of these capital requirements it would be inadvisable at this time to embark in the Back Bay subway enterprise. The building of a subway for surface cars at the east of the Washington Street tunnel is a matter for consideration in the early future, as is the possible relief of the traffic congestion at Sullivan Square terminal by a proposed elevated extension to Malden and Medford.

When the Cambridge subway is built the present traffic on the Boylston Street tracks of the present subway should be materially relieved. Fifty-one cars per hour are now run into this subway from Cambridge, and thirty of these can be withdrawn. When the Washington Street tunnel is completed, the latter part of next year, forty of the sixty-eight Huntington Avenue cars per hour can be deflected through Dartmouth, Chandler and Tremont Streets to the south portal of the Tremont Street subway, including twelve Berkeley Street cars. In other words, eighty-two cars per hour out of the present 225 can be withdrawn, making a reduction of about 36 per cent. As yet no definite plan is in consideration for a subway connection between Park Street and the South Station, but this is a natural line of travel which will probably be established in time.

REPORT ON STEEL CARS BY PENNSYVANIA COMPANY'S COMMITTEE

Covering a comprehensive plan for substitution of all steel for wooden passenger cars on the Pennsylvania Railroad system, a report has been completed by a special committee to which this important matter was entrusted. Within the next three years it is proposed to buy and construct 2000 all-steel passenger cars. This marks a complete change in all existing standards of passenger equipment and entrance into an entirely new field and involves a tremendous cash outlay. This year it is the purpose to build about 200 steel passenger cars. About fifty cars will be built in the Pennsylvania Railroad shops at Altoona. What the Pennsylvania Railroad management is aiming for is to have sufficient all-steel passenger equipment for every train which will be operated into the New York tunnel terminal system.

THE NEW HAVEN'S PROPOSED BERKSHIRE LINES

In the issue of the STREET RAILWAY JOURNAL for March 30, brief mention was made of the plans of the New Haven Company for trolley extensions and improvements in the Berkshire district. It is now learned that from the southern terminus of the Berkshire system at Canaan, Conn., a line will extend clear across Massachusetts from south to north, with numerous lateral branches, tapping districts, many of which have had no improvement in transportation since the days of Massasoit and King Philip's War. A section of the system for which early construction is planned is that running north from Canaan to Great Barrington, where it will join the line already in operation running north from the latter city. There will be a spur running from this new line southwest ot South Egremont, and just before it reaches the Massachusetts line a branch will be thrown to circle through a territory which has now neither trolleys nor steam lines. Running eastward to Clayton, it will then turn north through Ashley Falls to Hartsville. Another loop of this same line, leaving it near Ashley Falls, is to swing eastward through Southfield and New Marlboro, then back to Hartsville. From that point it is run back to the main line near Great Barrington. East of this wide developing loop a line, beginning at Montville, is to run southeast through West Boston and New Boston, down into Connecticut, to connect with the Hartford lines.

From Great Barrington there is now in operation a trolley line which runs through Van Dusenville, Pittsfield and North Adams to the northern boundary of the State at Williamstown. The plans for new construction provide for numerous branches of this line. From East Lee a long line is to run eastward through the valley of the Westfield River, which will thus be connected with the outside world for the first time, to Huntington. From this point a line to Springfield is already in existence, so that if the Legislature approves of President Mellen's proposal the Berkshires will have electric connections not only with Springfield, but also with Boston, Hartford, New Haven and New York. Further north on the main line comes the spur to Mount Greylock, the highest point in Massachusetts. From the present terminus at Williamstown a line is already under construction to Bennington, Vt., which when finished will open to that city Northwestern Massachusetts, which, on account of the indirect connections, has heretofore been difficult of access from that point.

AMERICAN INSTITUTE OF ELECTRICAL ENGINEERS NOMINATIONS

The board of directors of the American Institute of Electrical Engineers has selected the following nominees for the forthcoming annual election: President, Henry G. Stott, New York; vice-presidents, L. A. Ferguson, Chicago; W. C. L. Eglin, Philadelphia; J. G. White, New York. Managers, P. H. Thomas, New York; B. G. Lamme, Pittsburg; H. W. Buck, New York; Morgan Brooks, Urbana, Ill. Treasurer, Geo. A. Hamilton, New York; secretary, Ralph W. Pope, New York.

AUDITORS ORGANIZE IN OHIO, INDIANA AND MICHIGAN

The auditors of the interurban railway of Indiana, Ohio and Michigan have organized an association, known as the Central Electric Accounting Conference, and Ira E. Guthrie, of Columbus, Ind., auditor of the Indianapolis, Columbus & Southern Traction Company, has been elected secretary. The plans of the association for holding meetings and conducting business are not announced.

BOSTON & WORCESTER COMPANY SECURES CONVICTION OF PERJURER

James J. Barkus, plaintiff in a $5,000 personal injury suit in the Superior Court at Worcester, March 27, against the Boston & Worcester Street Railway Company, after he had been cross-examined by Guy Murchie, counsel for the company, was ordered to be arrested by Judge F. A. Gaskill on the charge of perjury, and held in $1,000 bail for the May term of the Superior Criminal Court. Barkus has appeared as plaintiff in injury cases before, and it is alleged that some of his answers to the questions of the counsel for the Boston & Worcester Street Railway Company were far away from the truth.

Frank B. Hall, counsel for Barkus, said after court:

"As soon as this evidence about Barkus came out, I immediately conferred with the court, and told the judge I was satisfied that Barkus had deceived not only counsel, but the doctors."

A SAN FRANCISCO OFFICE FOR THE STREET RAILWAY JOURNAL

The national character of the Street Railway Journal's circulation is emphasized again by the opening this week of another office for the special convenience of its friends in the Far West. The new office is in San Francisco and will be under the management of Herbert Booth King, who is well known on the Pacific Coast. The San Francisco address is 701 Atlas Building, 604 Mission Street. Copies of this paper and of the books and other publications of the McGraw Publishing Company will be carried in stock and on file for the convenience of friends upon the Pacific Coast who wish to purchase or consult technical literature.

ANNUAL REPORT OF THE BERLIN STREET RAILWAY

The annual report of the Grosse Berliner Strassenbahn, covering operation for the year 1906, reveals such a prosperous condition of affairs that despite the losses due to winter breakdown of the conduit system, the directors recommended a dividend of 8 per cent on over $25,000,000 capital as against 7¾ per cent for 1905.

The number of passengers was 364,100,000, equal to an increase of 3.88 per cent over 1905; the passenger revenue was 34,632,051 marks ($8,658,013), or an increase of 4.13 per cent; the car mileage was 51,381,653, an increase of 2.38 per cent, while the gross receipts per car-km increased from 41 pf. to 42 pf. ($.164 to $.168 per car-mile). The total receipts from all sources were 35,174,338 marks ($9,293,584), and the operating costs 18,968,847 marks ($4,742,212), or 53.93 per cent of the gross receipts as against 54.68 per cent in 1905.

Owing to a general increase in wages and shortening of the conductors' working time, the labor account rose over $120,000, making a total of 11,554,877 marks ($2,888,719). The company also gave 657,371 marks ($84,343) for employees' pensions, sick and death benefits, legal aid, society, etc.

The trackage of the company was increased from 506.8 km (314.2 miles) to 511.9 km (317.3 miles).

STREET RAILWAY PATENTS

[This department is conducted by Rosenbaum & Stockbridge, patent attorneys, 41 Park Row, New York.]

UNITED STATES PATENTS ISSUED MARCH 12, 1907

846,481. Brake; Van Buren Lamb, New Haven, Conn. App. filed Oct. 6, 1905. Provides a brake-shoe so constructed that when it becomes partially worn it may be detached from the brake-head and attached to the wearing face of a new shoe so that the material thereof may be completely used up.

846,516. Means for Attaching Rails to Ties; William C. Smith, Minneapolis, Minn. App. filed Dec. 21, 1906. The base flanges of the rail are slotted to receive bolts which pass diagonally downward into the ties.

846,524. Rail Joint; William P. Thompson, Lansdowne, and Samuel G. Thomson, Altoona, Pa. App. filed Aug. 30, 1906. A splice bar for rails having a freely depending flange extending below the base of the rail, said flange gradually decreasing in thickness toward its lower edge.

846,528. Air Brake System; Walter V. Turner, Wilmerding, Pa. App. filed Aug. 1, 1903. An air brake system in which there are contained an air pump, main, supply, and application reservoirs connected therewith. Supplies air under pressure from two reservoirs to operate the exhaust mechanism of the train pipe, by admitting air from the application reservoir to the exhaust mechanism.

846,533. Electric Controller; Ferdinand Volk, Pittsburg, Pa. App. filed Sept. 29, 1906. A controller of the type in which motor reversals are secured by movements of the handle to opposite sides of a central position. Has a detent to prevent overthrow in either direction.

846,626. Controller for Electric Motors; Frederic Schaefer, Wilkinsburg, Pa. App. filed Feb. 20, 1906. Designed to regulate electromotive force and circuit connections for starting and operating alternating-current motors. Has a sectionally-wound transformer coaxially disposed in the controller casing and segments symmetrically disposed thereabout in such a way as to require only a very limited number of contact fingers. The length of the connecting leads and the number of the contact members is also reduced to a minimum, and as the transformer is rotatably mounted in oil it may be reduced in size and weight.

846,707. Composite Brake-Shoe; Daniel O. Ward, Oak Park, Ill. App. filed Jan. 22, 1906. Has a back plate without marginal enclosing partitions provided with one or more projecting inserts upon its short side, in combination with a body positioned upon the back, arranged about and secured to said inserts and means for securing said shoe in position.

846,724. Means for Attaching Rails to Metallic Ties; Jacob F. Bowman, Artesia, N. M. App. filed Dec. 8, 1906. A clamp for holding rails to metallic ties. Is similar to the clamp used for holding work on a planer bed.

846,755. Brake Shoe; John J. Newbaker, Steelton, Pa. App. filed Dec. 5. 1905. A brake-shoe consisting of a body portion having corrugated rear faces and provided with projecting tongues spaced apart to provide an intervening recess.

846,764. Switch; William R. Thompson, South Norwalk, Conn. App. filed April 21, 1906. A form of signal operating switch adapted to be secured above a trolley wire and engaged by the trolley wheel in passing. Has a pneumatic time mechanism so that the duration of the signal current is constant for all speeds of the passing cars.

846,779. Signaling Apparatus; Clarence W. Coleman, Westfield, N. J. App. filed Oct. 12, 1905. Relates to signal systems of that type in which liquid carbonic acid gas is used as the motive force. The present patent relates particularly to details of the pistons for moving the semaphores.

846,799. Track construction; James W. Leahy, Jersey City, N. J. App. filed Dec. 20, 1906. Track construction for tunnels. Has cross-ties embedded in a concrete bed, shoes at the end of each tie, longitudinal runways bolted to the shoes, and tracks secured by the runways.

846,862. Metallic Railway Tie; Edward C. Potter, Chicago, Ill. App. filed Nov. 24, 1906. A cast metal tie having its central section of deep and narrow form while its end portions are flat and perforated to receive the track bolts.

847,073. Rail Joint; James S. A. Hunt, Mattie, W. Va. App. filed Feb. 28, 1906. Railway joint or chair having side or fishplates connected at the center with an integral bridge, which constitutes a small rail section intermediate the ends of the usual rails.

847,105. Signal; William H. Parrish, Jr., Nashville, Tenn. App. filed Nov. 3, 1906. A semaphore apparatus having lamps of different colors, arranged in the quadrant of a circle. Four quadrant shutters move angularly to expose different lamps under the influence of electromagnets in the signal circuit.

847,110. Railroad Tie; Joshua H. Price, Cleveland, Ia. App. filed Nov. 21, 1906. A hollow metallic tie having a core of concrete and means for attaching the rail to the tie.

847,157. Signaling Apparatus; Harold G. Brown, West Ealing, London, and Ernest DeM. Malan, Highgate, London, England. App. filed April 4, 1905. The locomotive is provided with a row of depending shoes or tappets, which contact with special plates adjacent to the track rail. The purpose is to complete different annunciator circuits in the locomotive cab.

847,163. Trolley; Thomas Cope, McKees Rocks, Pa. App. filed Nov. 17, 1906. In place of the usual trolley wheel there is provided a V-Shaped shoe having balls inserted in recesses in its face which contact with the trolley wire.

847,170. Trolley Stand; Harry E. Eastman, Richmond, Va. App. filed Jan. 5, 1906. The pole is pressed against the wire by a spring, the faces of which can be released by a detent. There is a link connection from the pole to this detent so that the spring is released in case of excessive upward movement of the pole.

847,187. Railway Rail Joint; William H. T. King, Dallas, Tex. App. filed Nov. 6, 1906. Details of construction of a locking key which passes through two adjacent bolts of a rail-joint.

847,259. Car Replacing Frog; Leon Pluard, Chicago, Ill. App. filed Oct. 10, 1906. The bottom edge of the frog is sharply serrated so as to firmly bite the lower flange of the rail so that the frog will not slip off when replacing the wheel. Has specially formed grooves and channels in the upper face for the same purpose.

847,289. Signal Device for Street Cars; Harry H. Miller, St. Louis, Mo. App. filed July 30. 1906. A device to prevent passengers alighting from a street car, being struck by a car approaching from the opposite direction. A signal bell and an alarm flag is displayed by circuits completed by the motorman when he sees the car from the opposite direction approaching.

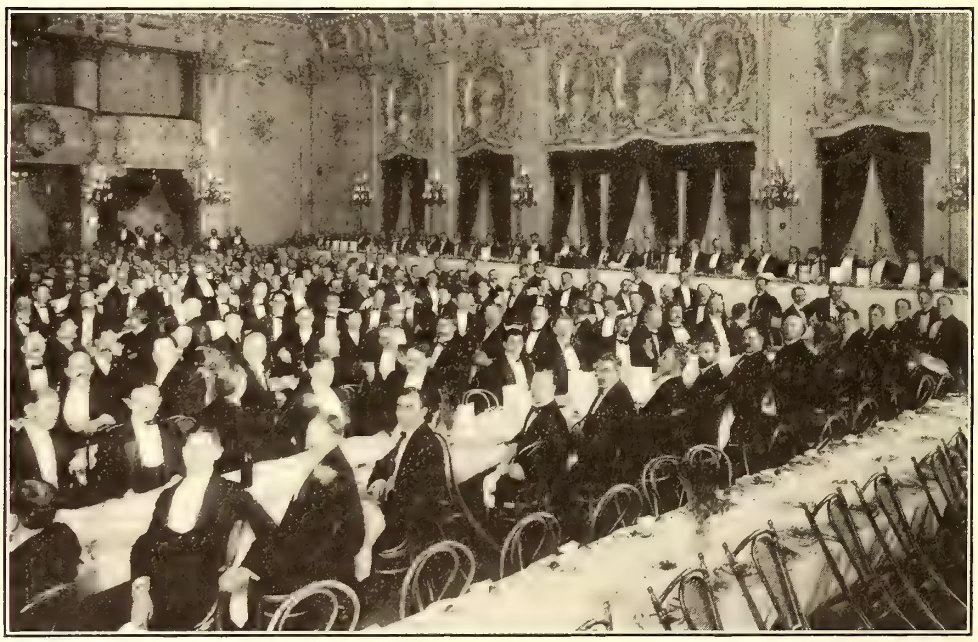
BANQUET OF NEW ENGLAND STREET RAILWAY CLUB

The New England Street Railway Club held one of the most successful dinners in its history, its seventh annual, at the Somerset Hotel, Boston, on the evening of March 28. About 350 members were present, and speeches were made by John I. Beggs, of Milwaukee, president of the American Street and Interurban Railway Association; Hon. George Tate Blackstock, K. C., a leading member of the Canadian bar, of Toronto, and Rev. Dr. Willard Scott, of Worcester. The new president of the club, Henry C. Page, of Springfield, presided, and Guy Murchie, one of the attorneys of the Boston & Worcester Railway Company, of Boston, was toastmaster.

President Beggs congratulated the New England club upon its membership, which President Page had announced as having reached 645, and referred to the valuable work which these territorial organizations could accomplish. He also mentioned the trip recently made by members of the National Association to Norfolk and Atlantic City to find a place suitable for the next meeting. The American Association, he said, was so large that only a few cities in the country had accommodations for its annual conventions. It would have been pleased to hold its next meeting in Boston, but it was found impossible, because the only hall of sufficient size in Boston was not available within thirty days of the time when the meeting must be held.

Mr. Beggs then urged a broader policy in the relations of the corporations and the municipalities. He said: "It takes courage to stand up against such denunciation of corporations as we are now hearing. I ask of our law makers and our officials a square deal in order that we may be able to give a square deal in return. I am not one of those that excuse altogether the corporations from responsibility for bringing upon ourselves this denunciation. The game has been played too much under the table. It is high time the cards were shuffled and dealt above the table."

He declared that the street railway service of the country was more important than the passenger service of the steam railroads, for the numbers of people carried, he said, were far greater. He considered the street railway business the greatest business in the country to-day, and said it was growing faster than any other.



BANQUET OF NEW ENGLAND STREET RAILWAY CLUB

Mr. Blackstock was introduced as the leader of the Toronto bar and made a strong and eloquent speech, dealing mainly with the relations between the United States and Canada, commercial and otherwise. He touched upon the history of reciprocal relations since the time of the Civil War and said that the abrogation of the reciprocity treaty by this country at the close of the war, and American legislation since, had taught Canada to depend upon herself. Cut off from American markets Canada had sought and found them elsewhere. In fact this experience had developed in his country the spirit of absolute independence. Nevertheless, there is, and always has been, a feeling in Canada that the business relations between the two countries should be improved.

The address of Rev. Dr. Scott was upon the value of comradeship and accomplishment, but had its humorous side as well, and he kept the company laughing with good stories and jokes.

Seated at the head table also were the following named guests:

Hon. James F. Shaw, B. V. Swenson, Hon. Andrew F. Gates, Hon, E. P. Shaw, D. L. Prendergast, Russell A. Sears, A. E. Potter, L. S. Storrs, Charles D. Wyman, Samuel Higgins, Edgar van Etten, Frank Barr, W. F. Ray, Robert S. Goff, J. H. Goodspeed, C. F. Bancroft, Horace B. Rogers, H. H. Crapo, J. H. Neal, E. E. Potter, Paul Winsor, Hugh M. Wilson, Henry W. Blake, Robert Miles Standish, J. W. Lester, Charles F. Libby, E. A. Newman, D. F. Sherman, T. E. Byrnes, C. H. Persons, E. G. Connette, A. P. Langtry, G. L. R. French.

The committee in charge of arrangements consisted of: Charles C. Peirce, chairman, Boston; E. P. Shaw, Jr., South Framingham, Mass.; M. C. Brush, Newtonville, Mass.; Henry C. Page, Springfield, Mass.; Frank A. Barbey, Boston.

The reception committee consisted of: M. C. Brush, chairman, Newtonville, Mass.; Horatio Bigelow, Norwich, Conn.; John E. Bradley, Worcester, Mass.; Charles S. Clark, Boston; J. T. Cunningham, New York; George C. Ewing, Boston; William W. Field, Cambridgeport, Mass.; E. L. Janes, Boston; C. E. Learned, Boston; L. H. McLain, Melrose, Mass.; F. M. Nellis, Boston; W. G. Meloon, Portsmouth, N. H.; E. T. Millar, Concord, N. H.; E. A. Newman, Portland, Me.; H. E. Reynolds, Boston; W. E. Robertson, St. Albans, Vt.; Frank J. Stone, Boston; C. A. Sylvester, Newtonville, Mass.; C. N. Wood, Boston; W. D. Wright, Providence, R. I.

The regular business session of the club was held in the afternoon of March 28 at the Somerset. There was only one ticket and the gentlemen whose names were mentioned in the STREET RAILWAY JOURNAL for March 23 were elected. The new officers are:

President—Henry C. Page, general manager Springfield Street Railway Company, Springfield, Mass.

Vice-presidents: Massachusetts—M. C. Brush, vice-president and general manager Newton Street Railway Company, Newtonville, Mass.

Connecticut—Horatio Bigelow, superintendent New London lines Consolidated Railway Company, Norwich, Conn.

New Hampshire—J. Broodie Smith, vice-president and general manager Manchester Traction, Light & Power Company, Manchester, N. H.

Vermont—F. H. Foote, general manager St. Albans Street Railway Company, St. Albans, Vt.

Rhode Island—D. F. Sherman, president Providence & Danielson Railway Company, Providence, R. I.

Maine—E. A. Newman, general manager Portland Railroad Company, Portland, Me.

Secretary—John J. Lane, editor "Street Railway Bulletin," Boston.

Treasurer—N. L. Wood, street railway supplies, Boston.

Executive Committee—Paul Winsor, chief engineer motive power and rolling stock Boston Elevated Railway, Boston; W. D. Wright, master mechanic the Rhode Island Co[illegible] dence, R. I.; C. H. Hile, assistant to vice-president Boston Elevated Railway, Boston; John F. McCabe, purchasing agent Worcester Consolidated Street Railway, Worcester; E. A. Sturgis, superintendent of equipment Boston & Northern and Old Colony Street Railway Companies, Boston; Charles C. Peirce, manager railway department General Electric Company,

Boston; George C. Ewing, railway department Westinghouse Electric & Manufacturing Company, Boston.

Finance Committee—Henry C. Page, Springfield; John W. Corning, electrical engineer Boston Elevated Railway, Boston; E. P. Shaw, Jr., general superintendent Boston & Worcester Street Railway, South Framingham, Mass.

A biographical notice and portrait of Mr. Page appear in the next column.

PRESIDENT TUTTLE SAYS LET THE ELECTRICS HAVE THE SUBURBAN BUSINESS

President Tuttle, of the Boston & Maine Railroad, in a letter to Charles S. Hoyt, of Winchester, expressed the opinion that the solution of the suburban railroad lies in letting the electrics care for all the traffic. In addition to this he also set forth other opinions which are best expressed by himself in his letter, which is appended:

"Replying to your communication of the 6th inst., your suggestion that this company equip its line between Boston and Stoneham with electricity instead of steam power is an easy one to make, but in the present state of the art the substitution of electricity for steam power in general railroad service has not passed beyond the experimental stage and is not yet sufficiently in use anywhere to demonstrate its practicability or feasibility. It is true that the New York Central and the New York, New Haven & Hartford are completing plans for handling their passenger traffic to and from the Grand Central Station in New York by electrically equipped trains, but as there is no freight traffic handled by either of these roads to and from the Grand Central Station, the problem is not with them as difficult as it would be if they were undertaking to provide electric power for handling all the road's traffic, both passenger and freight.

"In so far as the matter has yet been worked out the details of operating expenses are necessarily incomplete, but there is good reason for the belief that because of electric operation—as compared with that of steam locomotives—it is very much greater, but how much no one can tell.

"Again, in the past fifteen years the introduction of rapid transit by electric railways, which gives greater convenience to suburban travel than can possibly be furnished by steam railroads, has so diminished the volume of steam railrod suburban traffic that it is, upon the whole, now becoming a question whether there is any profit at all derivable by the steam railroads from the carrying of short-distance suburban travel, at the existing low rates charged therefor; and, not only the Boston & Maine, but railroads carrying similar traffic everywhere, are fast coming to the belief that the surrender of this kind of travel to the street railways and interurban trolley lines will be, from every point of view, the best solution of the problem.

PERSONAL MENTION

MR. J. A. PIERCE has resigned as superintendent of traffic of the Mexico Electric Tramways, Ltd.

MR. H. H. VREELAND, president of the New York City Railway Company, has been elected a director of the Electric Storage Battery Company, of Philadelphia.

MR. C. A. ALDERMAN has resigned his position as chief engineer of the Cincinnati Northern Traction Company to become connected with J. G. White & Company, of New York. Mr. Alderman has had an extended electric railway experience and has occupied many positions of trust and responsibility. For the past two years as chief engineer of the Cincinnati Northern Traction Company his work has included the reconstruction, straightening and placing on a private right of way of the old electric road between Cincinnati and Dayton. Last year Mr. A[illegible] had charge of the construction from Lima to [illegible]es, of the Lima and Toledo line. Previous to his connection above with the Morgan-Dolan-Schoepf syndicate, he was for eight years chief engineer and manager of the Great Northern Construction Company, which built the Appleyard lines in Wisconsin and Ohio, and a part of the Tucker-Anthony lines in Ohio.

MR. WALTER S. SWAN, prominent in commercial and financial circles in Boston, and a director of the Boston Elevated Railway Company, is dead.

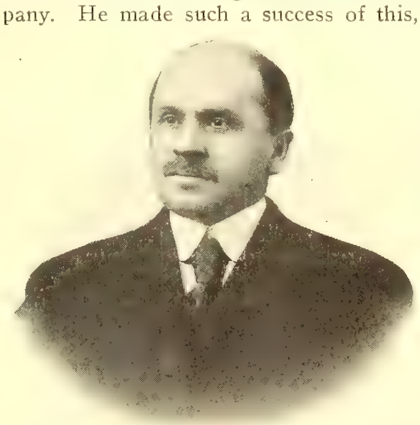
MR. RICHARD E. DANFORTH, a portrait of whom is presented herewith, is the vice-president and general manager of the Rochester Railway Company, of Rochester, N. Y. His appointment as general manager of the railway department of the Public Service Corporation of New Jersey to succeed Mr. Albert E. Stanley was mentioned last week. Mr. Danforth's electric railway career has been one of continuous promotion since his graduation from Cornell University some sixteen years ago, and has included service with the railway system of Buffalo, the Lake Shore Electric Railway Company and the Rochester Railway Company. He has served on the executive committees of the Street Railway Association of the State of New York, and in 1905-06 was president of that body. Owing to the extent of the system of the Public Service Corporation, Mr. Danforth's duties will call for the widest exercise of those executive qualities which have been such a characteristic of his previous work, and have contributed so greatly to the success of his administration elsewhere. Mr. Danforth expects to take charge of his new office on May 1.

R. E. DANFORTH

MR. EDWARD C. NICHOLS, vice-president and general manager of the South Side Elevated Railroad Company, of Chicago, died Thursday, March 28, of pneumonia after a short illness. Mr. Nichols was only thirty-seven years old.

MR. FRED IKES, of Rushville, Ind., has been appointed chief engineer of the Indianapolis & Louisville Traction Company, with headquarters at Scottsburg, where he has located with his family to superintend the installing of machinery.

MR. HENRY C. PAGE, the newly-elected president of the New England Street Railway Club, is well known in street railway circles, having been engaged in electric traction work for many years. He is about forty-three years of age. About twenty-two years ago went to work for the Lynn & Boston Street Railway, and served for three years as conductor. He was then rapidly promoted and finally placed in complete charge of the schedule arrangement and car dispatching of the company. He made such a success of this, that when the Boston & Northern Street Railway Company was formed, taking over many lines, he worked up in the management of the road until he became general superintendent, having charge of 450 miles of track. His particular success on this road was his handling of the employees, and his arrangements of the schedules.



H. C. PAGE

About four years ago he took the position of general manager of the Berkshire Street Railway Company, at Pittsfield, Mass., where he was very successful in the management of the road. He remained there until June, 1905, when the Consolidated Railway Company secured the property, as well as the Springfield Street Railway, when he was appointed general manager of the latter system. This position he holds at the present time.

TABLE OF OPERATING STATISTICS

Notice.—These statistics will be carefully revised from month to month, upon information received from the companies direct, or from official sources. The table should be used in connection with our Financial Supplement "American Street Railway Investments," which contains the annual operating reports to the ends of the various financial years. Similar statistics in regard to roads not reporting are solicited by the editors. * Including taxes. † Deficit.

Company.	Period.	Total Gross Earnings.	Operating Expenses.	Net Earnings.	Deductions From Income.	Net Income, Amount Available for Dividends.
AKRON, O. Northern Ohio Tr. & Light Co.	1 m., Jan., '07	125,191	79,581	45,610	41,339	4,270
	1 " " '06	114,968	76,856	38,112	39,947	†1,835
BINGHAMTON, N. Y. Binghamton Railway Co.	1 m., Jan., '07	22,080	13,663	8,417	7,973	444
	1 " " '06	20,471	12,476	7,995	7,376	619
	7 " " '07	185,081	96,952	88,129	54,260	33,869
	7 " " '06	174,007	88,209	85,798	50,765	35,033
CHAMPAIGN, ILL. Illinois Traction Co.	1 m., Feb., '07	262,363	*147,204	115,159	......	......
	1 " " '06	212,272	*116,554	95,717	......	......
	2 " " '07	541,441	*311,937	229,503	......	......
	2 " " '06	449,320	*243,243	206,077	......	......
CHARLESTON, S. C. Charleston Consolidated Ry., Gas & Elec. Co.	1 m., Feb., '07	52,478	35,080	17,398	13,402	3,996
	1 " " '06	50,793	32,624	18,170	12,708	5,461
	12 " " '07	654,391	414,445	239,946	157,100	82,846
	12 " " '06	614,963	372,608	242,355	157,042	85,313
CHICAGO, ILL. Aurora, Elgin & Chicago Ry. Co.	1 m., Jan., '07	88,893	56,168	32,725	26,492	6,233
	1 " " '06	80,259	51,269	28,989	24,450	4,539
	7 " " '07	789,700	419,999	369,701	183,187	186,514
	7 " " '06	712,452	376,061	336,390	171,093	165,297
Chicago & Milwaukee Elec. R.R. Co.	1 m., Feb., '07	52,777	29,546	23,231	......	......
	1 " " '06	36,593	21,050	15,543	......	......
	2 " " '07	115,409	63,038	52,370	......	......
	2 " " '06	80,037	43,744	36,293	......	......
CLEVELAND, O. Cleveland, Painesville & Eastern R.R. Co.	1 m., Jan., '07	18,032	*10,330	7,701	7,213	489
	1 " " '06	15,858	*9,118	6,740	6,678	62
Cleveland & Southwestern Traction Co.	1 m., Feb., '07	44,707	28,823	15,883	......	......
	1 " " '06	39,718	26,981	12,737	......	......
	2 " " '07	94,265	58,428	35,837	......	......
	2 " " '06	86,285	54,531	31,754	......	......
DALLAS, TEX. Dallas Elec. Corp'n.	1 m., Jan., '07	87,324	*71,165	16,159	16,550	†391
	1 " " '06	78,327	*51,355	26,972	14,939	12,033
	12 " " '07	1,032,132	*718,953	313,179	187,257	125,922
	12 " " '06	946,046	*578,917	367,129	182,554	184,574
DAVENPORT, Ia. Tri-City Ry. & Lt. Co.	1 m., Dec., '06	157,239	92,587	64,652	32,124	32,528
	1 " " '05	144,535	82,777	61,758	......	......
	9 " " '06	1,251,507	752,597	498,910	243,138	255,773
	9 " " '05	1,091,693	692,580	399,113	......	......
DETROIT, MICH. Detroit United Ry. Co.	1 m., Jan., '07	463,735	*293,330	170,405	97,962	72,443
	1 " " '06	417,831	*250,234	167,597	92,242	75,355
	12 " Dec., '06	6,121,940	*3,718,622	2,403,319	2,118,273	285,045
	12 " " '05	5,169,639	*3,041,523	2,128,117	1,675,794	452,323
Detroit, Jackson & Chicago Ry.	1 m., Feb., '07	27,194	*21,945	5,249	15,012	†9,763
DULUTH, MINN. Duluth St. Ry. Co.	1 m., Jan., '07	59,484	33,603	25,881	17,575	8,306
	1 " " '06	54,424	33,722	20,702	17,536	3,166
EL PASO, TEX. El Paso Electric Co.	1 m., Jan., '07	37,043	*28,702	8,341	4,469	3,873
	1 " " '06	27,347	*19,753	7,594	3,749	3,845
	12 " " '07	401,352	*285,352	116,000	47,935	68,065
	12 " " '06	292,444	*195,637	96,807	43,720	53,087
FT. WAYNE, IND. Ft. Wayne & Wabash Valley Tr. Co.	1 m., Jan., '07	91,178	54,795	36,383	......	......
	1 " " '06	80,145	47,731	32,414	......	......
	12 " Dec., '06	1,109,193	676,846	432,347	364,232	68,115
	12 " " '05	949,498	580,832	368,665	317,859	50,806
FT. WORTH, TEX. Northern Texas Tr. Co	1 m., Jan., '07	74,953	*46,096	28,857	10,138	18,718
	1 " " '06	53,535	*36,385	17,150	9,942	7,208
	12 " " '07	875,553	*556,862	318,691	119,778	198,913
	12 " " '06	670,462	*400,904	269,559	118,965	150,594
GALVESTON, TEX. Galveston Elec. Co.	1 m., Jan., '07	25,548	*16,540	9,008	4,167	4,841
	1 " " '06	19,350	*13,967	5,382	4,167	1,216
	12 " " '07	321,334	*194,053	127,281	50,000	77,281
	12 " " '06	269,090	*177,680	91,410	45,000	46,410
HOUGHTON, MICH. Houghton County St. Ry Co.	1 m., Jan., '07	15,945	*15,637	307	3,959	†3,652
	1 " " '06	14,832	*13,347	1,485	3,899	†2,414
	12 " " '07	230,358	*148,546	81,812	47,037	34,775
	12 " " '06	166,224	*167,136	†912	44,149	†45,060
HOUSTON, TEX. Houston Electric Co.	1 m., Jan., '07	50,094	*33,228	16,866	7,795	9,071
	1 " " '06	43,077	*30,137	12,940	8,173	4,766
	12 " " '07	598,368	*382,837	215,531	92,941	122,590
	12 " " '06	525,820	*321,539	204,281	105,289	98,992
HUDSON, N. Y. Albany & Hudson R. R. Co.	1 m., Dec., '06	27,125	*19,370	7,755	7,292	463
	1 " " '05	25,241	*20,018	5,223	5,000	223
	6 " " '06	199,169	*143,586	55,583	43,750	11,833
	6 " " '05	193,738	*143,225	50,513	30,000	20,513
KANSAS CITY, MO. Kansas City Ry. & Lt. Co.	1 m., Jan., '07	479,022	238,018	241,004	147,519	93,485
	1 " " '06	427,330	213,977	213,353	136,289	77,065
	8 " " '07	3,851,643	1,896,741	1,954,902	1,165,135	789,767
	8 " " '06	3,471,369	1,688,557	1,782,811	1,095,186	687,625
LEXINGTON, KY. Lexington & Interurban Rys. Co.	1 m., Feb., '07	35,267	24,680	10,587	......	......
	1 " " '06	30,509	23,062	7,447	......	......
	2 " " '07	75,033	51,816	23,216	......	......
	2 " " '06	68,316	49,764	18,552	......	......
MILWAUKEE, WIS. Milwaukee Elec. Ry. & Lt. Co.	1 m., Feb., '07	283,927	150,234	133,693	90,466	43,227
	1 " " '06	257,206	126,301	130 905	86,095	44,811
	2 " " '07	593,435	313,313	280,122	184,516	95,606
	2 " " '06	535,358	265,918	269,440	170,311	99,128
Milwaukee Lt., Ht. & Tr. Co.	1 m., Feb., '07	48,675	25,235	23,440	29,447	†6,008
	1 " " '06	40,872	17,907	22,966	21,953	1,013
	2 " " '07	102,211	53,060	49,151	59,638	†10,487
	2 " " '06	85,787	37,748	48,039	43,691	4,348
MINNEAPOLIS, MINN. Twin City R. T. Co.	1 m., Jan., '07	456,837	243,097	213,740	115,258	98,482
	1 " " '06	407,865	205,519	202,346	109,708	92,638
MONTREAL, CAN. Montreal St. Ry. Co.	1 m., Jan., '07	271,956	189,498	82,459	40,165	42,294
	1 " " '06	238,230	158,830	79,400	37,090	42,310
	4 " " '07	1,083,992	705,921	378,072	159,173	218,898
	4 " " '06	957,599	616,134	341,465	102,838	238,628
NORFOLK, VA. Norfolk & Portsmouth Tr. Co.	1 m., Jan., '07	147,789	91,817	55,973	......	......
	1 " " '06	123,831	78,577	45,254	......	......
PHILADELPHIA, PA. American Rys. Co.	1 m., Feb., '07	192,829	......	......	......	......
	1 " " '06	178,094	......	......	......	......
	8 " " '07	1,894,378	......	......	......	......
	8 " " '06	1,737,651	......	......	......	......
PLYMOUTH, MASS. Brockton & Plymouth St. Ry. Co.	1 m., Jan., '07	6,195	*5,835	361	1,732	†1,371
	1 " " '06	5,736	*5,794	†58	1,745	†1,803
	12 " " '07	112,234	*70,935	41,300	21,842	19,458
	12 " " '06	102,742	*70,672	32,070	21,119	10,952
ST. LOUIS, MO. United Railways Co. of St. Louis	1 m., Feb., '07	764,680	*548,479	216,201	231,324	†15,123
	1 " " '06	713,664	*463,041	250,623	231,991	18,632
	2 " " '07	1,591,017	*1,126,349	464,668	462,866	1,802
	2 " " '06	1,495,453	*954,409	541,044	464,046	76,998
SAVANNAH, GA. Savannah Electric Co.	1 m., Jan., '07	45,442	*30,613	14,830	11,687	3,142
	1 " " '06	49,618	*31,863	17,755	10,904	6,851
	12 " " '07	607,039	*377,796	229,244	135,244	94,000
	12 " " '06	594,514	*354,283	240,231	128,045	112,185
SYRACUSE, N. Y. Syracuse R. T. Ry.	1 m., Jan., '07	97,179	53,647	43,532	24,619	18,913
	1 " " '06	86,060	49,591	36,469	21,758	14,711
	1 " Feb., '07	90,478	51,608	38,870	25,100	13,770
	1 " " '06	79,350	44,349	35,001	22,092	12,909
	2 " " '07	187,657	105,255	82,402	49,719	32,683
	2 " " '06	165,410	93,940	71,470	43,850	27,620
TAMPA, FLA. Tampa Elec. Co.	1 m., Jan., '07	43,994	*31,153	12,841	960	11,881
	1 " " '06	37,840	*20,410	17,430	......	17,430
	12 " " '07	475,377	*290,701	184,675	2,383	182,292
	12 " " '06	418,464	*238,642	179,821	19,829	159,992
TERRE HAUTE, IND. Terre Haute Tr. & Lt. Co.	1 m., Jan., '07	76,472	*50,325	26,147	14,844	11,303
	1 " " '06	59,831	*39,150	20,681	10,417	10,264
	12 " " '07	839,803	*480,047	359,756	164,639	195,117
	12 " " '06	643,344	*423,480	219,863	123,873	95,990
TOLEDO, O. Toledo Rys. & Lt. Co.	1 m., Jan., '07	170,684	*99,039	71,645	44,168	27,459
	1 " " '06	159,053	*83,148	75,905	42,290	33,615

Street Railway Journal

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NOTICE TO SUBSCRIBERS

REMITTANCES.—Remittances should be made by check, New York draft, or money order, in favor of the STREET RAILWAY JOURNAL.

CHANGE OF ADDRESS.—The old address should be given, as well as the new, and notice should be received a week in advance of the desired change.

BACK COPIES.—No copies of issues prior to September, 1904, are kept on sale, except in bound volumes.

DATE ON WRAPPER shows the month at the end of which the subscription expires. The sending of remittances for renewal prior to that date will be much appreciated by the publishers.

CLUB RATE.—On five or more subscriptions from one company or its employees, a club rate of $2.50 each per annum is quoted.

NOTICE TO ADVERTISERS

Changes of advertising copy should reach this office by 10 a. m. Monday preceding the date of publication, except the first issue of the month, for which changes of copy should be received two weeks prior to publication date. New advertisements for any issue will be accepted up to noon of Tuesday for the paper dated the following Saturday.

Of this issue of the Street Railway Journal 8,000 *copies are printed. Total circulation for* 1907 *to date* 122,650 *copies, an average of* 8,177 *copies per week.*

Rail Corrugations

The subject of rail corrugation, which has attracted considerable attention in this country, has created much more interest abroad, where the difficulty seems to be more pronounced than here. We have on several occasions referred to the large number of theories which have been advanced to account for this phenomenon, and in this issue present an argument by a British tramway engineer who claims that the fault lies in the rolling stock and not in the rails. Briefly, he believes that the action can be attributed to the play of the axles in the truck frame, caused largely by the application of the power through the gear at one side of the axle. The effect of guard rails on curves is to intensify this action, as the flanges on the skewed axle striking the guard rail oscillate in the groove and give rise to intermittent skidding. If this theory is correct it would account to a considerable extent for the more general prevalence of the trouble abroad, where the rails have narrower grooves than in this country and where double-deck cars cause a tremendous weight per wheel on the track. We think, however, that Mr. Panton's theories, though interesting, will not be generally accepted until further light is thrown upon the subject, and while the examples which he cites seem to bear out his claims, others which might be quoted would indicate an entirely different cause. While the problem is a baffling one it does not seem entirely incapable of solution. Our opinion is that it should be approached by the process of elimination, that is, by taking up each of the most plausible and most easily tested theories first, and by a careful examination and series of experiments determine whether the causes suggested were responsible for the trouble. By thus gradually eliminating some of the possible causes the chances of finding the real reason would be considerably greater.

Overalls for Interurban Motormen

It would not be presumed at first thought that the question of whether or not motormen should wear overalls would be weighty enough to claim the attention of a meeting of interurban railway operators, yet at the recent Dayton meeting of the Central Electric Railway Association considerable time was spent in discussing it. After all, it is a question worthy of a great deal of consideration, as it is connected in a roundabout way with the operation of every interurban road. At the meeting referred to we are inclined to believe that those advocating overalls had the best of the argument. The strongest contention of the opposing side was the appearance of the men dressed in the garb of a day laborer. The argument supporting overalls was that the reluctance of the motormen to spoiling a twenty or twenty-five dollar uniform by getting down under the car often prevented them when on the road from making repairs which would enable the car to continue its trip to the end of the line instead of being stalled until pulled in. It cannot be denied that this is an important consideration. The percentage of cars that could be repaired by reasonably intelligent motormen could be found by examining the repair shop reports, and an investigation would no doubt

result in motormen being given every encouragement to make such repairs. The first step in this direction should no doubt be the substitution of overalls for the conventional motorman's uniform.

The opponents to overalls contend that a man in a dirty and greasy suit of overalls should not be placed up in the front of the car in plain sight of all the passengers and where probably, when the car was filled, passengers might be compelled to crowd up against him. This is, of course, true; but there is no necessity for the overalls to remain dirty very long, and it must be admitted that there is nothing repulsive about a clean suit of overalls.

Dispatchers and Double-Track Roads

The question has been raised whether dispatchers are needed on double-track interurban roads, in view of the elimination of meeting points. It is urged on the one hand that if cars are properly flagged from the rear in case of delays, and if the line is equipped with telephone service throughout, so that any car house can be called without delay, there is very little occasion for the services of a dispatcher. On the other hand it is pointed out that a road should have a central operating point upon which everything focuses, regardless of the number of tracks. It is contended that emergencies are constantly coming up which can be handled only by a duly authorized dispatcher, and that although such an official has a much easier time of it on a double-track line, his presence is imperatively necessary to the best service.

The latter point of view seems, in most cases at least, the proper one, considering all the operating variations which come up each week on even a double-track interurban road. To the average passenger who rides over the line one day is usually very much like another as far as the road is concerned, but at headquarters very few days are alike in detail. Fluctuations in the volume of traffic, accidents, unexpected failures of equipment on the road, the blocking of the line by external causes like the breakdown of teams, falling of a derrick across the track, etc., all demand immediate action by centralized authority with power to order out extra cars, emergency wagons, call doctors, mobilize snow plow crews, linemen and trackmen, and in general meet the situation with the promptest decision and least possible obstruction to regular traffic. Divided responsibility tends to create delays, and the cost of maintaining a dispatcher on duty at all times is a small expense in proportion to the convenience of always having a firm hand upon the operating situation.

Experimental Work in Shops

The proper maintenance of rolling stock is such an important and pressing problem on all electric railways handling a large traffic that the suggestion of encouraging experimental work in the shop looks chimerical at first flush. The shop exists primarily for the purpose of keeping cars in paying service, and any obstruction of regular repair work is rightly looked upon as intolerable. Yet it is a question if a certain amount of experimental work under the immediate personal oversight of the master mechanic or department heads may not bring exceedingly profitable returns if it is conducted so as to be out of the way of the routine repair jobs.

There is so much still to be learned about the best mixtures of bearing metals, the most economical fuel for boilers, the best compositions of copper and brass to use in trolley wheels, the most desirable tool steels for general shop work, the cheapest ways of wiring up special rigs and putting together jigs, the determination of lamp candle-powers, efficiencies and life, the breakage of cement briquettes, the study of lubricants, boiler feed water and scale prevention compounds, etc., that a little space set aside in the shop for odd investigations is likely to be well worth its rental value. Out of these experiments and studies often come valuable gains in the life of equipment parts, for the analysis and testing of supplies is coming to be more and more important on progressive roads. If a quiet place with good light and steam connections, compressed air and power taps is reserved for these tasks, and if the company encourages originality on the part of its responsible employees, the results ought to be more readily secured than under the distractions and crowding of the main shops. There is a place for the so-called "laboratory method" even in the strenuous life of street railway repairs.

Lamp Signals at Electric Track Switches

The advantages of the electric track switch in reducing delays to traffic and in decreasing the number of switchmen required on surface lines are now widely recognized. It is customary to notify motormen of the presence of an electric track switch by a small sign fastened above the trolley wire at the point where power is to be cut on or off to set the switch. These signs are readily seen in the daytime, but at night it is hard to locate them unless they are situated in a brightly lighted street. The same thing applies to section insulators located in dark places, although the motorman usually looks out for these more easily because the degree of accuracy required in shutting off power at a certain spot is not as exacting as in the case of the track switch.

In places where the traffic is heavy or where the schedule is figured closely with regard to the capacity of the motors and the number of stops, it might pay to install two or three lamps at the point above the trolley wire where the electric track switch sign is hung, placing the other three or two lamps of the series near the switch itself so that the movement of the switch tongue can be more quickly seen by the motorman. Without any illuminated signal it is largely a matter of guess work just when to shut off power, and there is considerable chance of setting the switch for the wrong route, with the possibility of the car's leaving the proper line and having to be reversed and backed down perhaps a hundred feet to get a fresh start. When a track switch is located on an ascending grade the time lost in drifting, the uncertainty as to the overhead connection and the extra cost of accelerating are worth considering. On a line with short headway interruptions in the regular movement of cars are far-reaching in their effect. If the cost of maintaining five lamps at a track switch looks too large, it ought not to be a difficult matter to install a single lamp over the sign which will light automatically when a car approaches, say within 300 ft., and go out when the car passes the switch.

Turbine Power Station Operation

In spite of the fact that steam turbines aggregating several hundred thousand kilowatts in capacity are in operation in this country, very little in the way of actual operating statistics is available, yet the manufacturers probably have a larger aggregate capacity of turbines in course of design, construction and erection than the total in operation. That purchasers of steam motive power should have adopted the steam turbine to such a large extent is no doubt due to its advantageous features other than economy, as it has been shown and some of its warmest advocates have admitted that in consumption of steam it is not superior to the best steam engines. These other claimed advantages, most of which have been proven, comprise economy of space and foundations, lessening of expense for lubricants, absence of pulsations in speed, the possibility of installation on upper floors of buildings, the low cost of maintenance, large overload capacity, etc.

Generally the course of advance in the design of electric power stations has been by very short steps, each carefully tried and proven before advancing to the next. Conservatism has been the rule, and usually nothing but apparatus whose reliability and economy has been proven by experience has been adopted. The point was reached, however, where a further improvement in these directions from the reciprocating engine was very difficult, if not practically impossible, and where the next move had to be in an entirely different direction. A complete departure from the engine in type and principle, the steam turbine, appeared at this time, and has been adopted to an extent that even its advocates did not hope for a few years ago. Its design at once showed the possibilities in the directions mentioned, as well as a low cost of manufacture, including the electric generator, as compared with the reciprocating engine. Difficulties regarding details of manufacture were predicted, met and overcome, and now no complaint is heard on the score of reliability of operation. Enough experience has been had to prove that the amount of skilled attendance required is less than with the engine, and that the speed control may be perfect. All this aside from the matter of steam economy. Working under the same conditions as the modern reciprocating engine, the difference is not great. The turbine's advantage in the matter of economy lies in the fact that it can be designed to take advantage of the expansion of the steam as long as this force is capable of imparting an effective velocity in the steam itself, and its efficiency at this extreme limit can be made practically as great as where the pressure is high. The best engines, opening to exhaust at 7 or 8 lbs. absolute pressure, of course lose the expansive force of the steam below that point, but a great part of it is utilized by the steam turbine if a high vacuum is available. There is also a great saving with the turbine with the use of highly superheated steam, due to the reduction of the skin friction between the steam and the turbine blades. As the steam comes in contact with no oil or packing, a much higher degree of superheat can be used than is possible with the engine. Except by raising the degree of superheat and expanding the steam to a low absolute pressure—beyond the point where the steam engine is capable of working—we may not expect any great gain in economy by the use of the turbine over that possible with the engine, except that the turbine is more economical on light loads, due to its small mechanical losses. It is consequently better adapted for widely varying loads than the reciprocating engine.

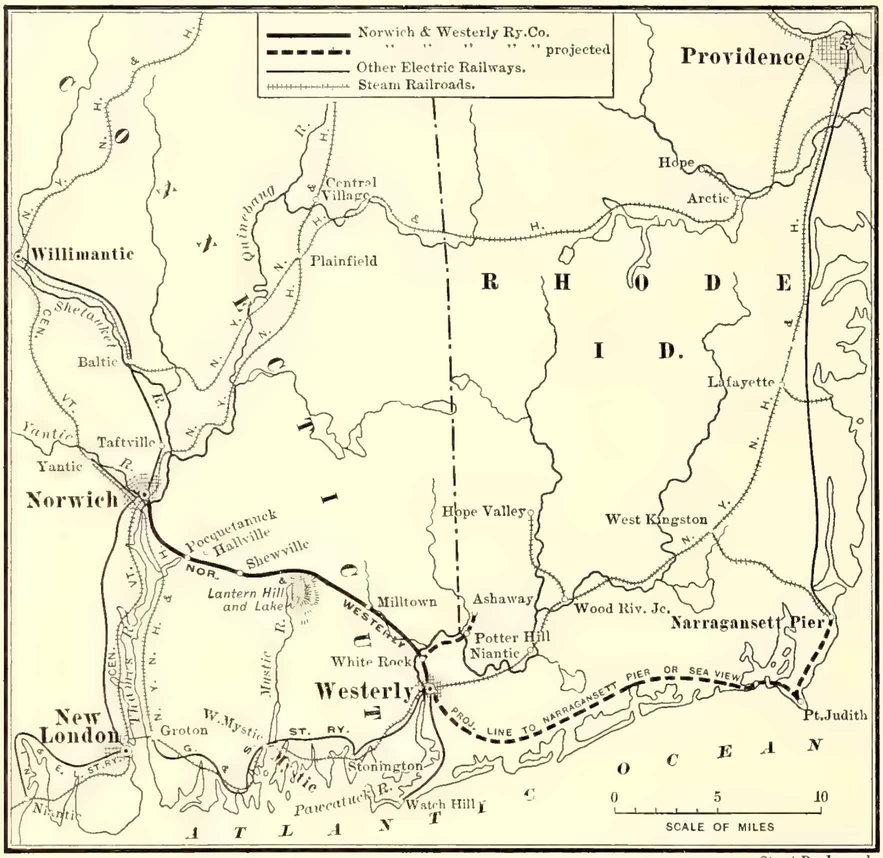
Theoretically, all these things are true, and they have been demonstrated as true, repeatedly, in shop and special tests. The majority of turbine installations, however, have been in stations where they are operating alongside of and under practically the same steam and exhaust conditions as reciprocating engines. Not many purely turbine stations are in operation, and very few data on costs of operation of such stations have been published.

It is, therefore, gratifying to receive definite figures on the actual performance and operation of a steam turbine plant of large capacity such as were printed in last week's Journal in the article on the Neasden power station in London. The station contains four 3500-kw turbo-generator units, which during the tests described were operated with about 185 lbs. steam pressure and 150 degs. F. superheat, the average exhaust pressure being 1¼ lbs. absolute. The "full-load" test, covering six hours run at an average load of 3850 kw, showed an actual steam consumption of 18.3 lbs. per kilowatt-hour, although the load varied from 1200 kw to 6000 kw. During a "half-load" run of two hours, the load averaged 2175 kw, varying from 800 kw to 3400 kw, the steam consumption being 22.2 lbs. per kilowatt-hour. With allowances made for the large variations in the load, and for other reasons not stated in the report, it was considered that the steam consumption was within the guaranteed 17 lbs. per kilowatt-hour at full load. When it is remembered that these figures are on the basis of a kilowatt-hour of electrical energy generated, and include the losses in the turbine and generator, and that they are results under actual operating conditions, they appear very favorable, indeed, in comparison with the performance of reciprocating engines under the same conditions of load.

The report also includes the principal operating statistics for several months. The total output being nearly doubled during the time covered, the coal consumption per kilowatt-hour varied from 4.4 lbs. to 4.0 lbs., the cost of coal remaining fairly constant near 0.5 cents per kilowatt-hour. The cost of labor, given as 0.2 cent per kilowatt-hour, seems high when compared with plants in this country using reciprocating engines, but as the data given on this point are meager, further comment cannot be made. The cost of supplies is given as 0.01 cent per kilowatt-hour, which is quite low, and doubtless due in great measure to the small amount of lubricant needed by the turbines, it being stated that the total consumption of lubricating oil for the entire station, turbo-generators, exciters, coal conveyor, pumps, etc., is under 100 gals. per month.

It is to be hoped that similar operating data and costs may soon be made public from some of our distinctly turbine plants. Such figures are not forthcoming as often as we might wish, even from the reciprocating engine plants, but their publication from turbine plants at this time should tend to increase the confidence with which the development proceeds. We hope before long to present even more complete figures from some American plants.

THE NORWICH & WESTERLY RAILWAY



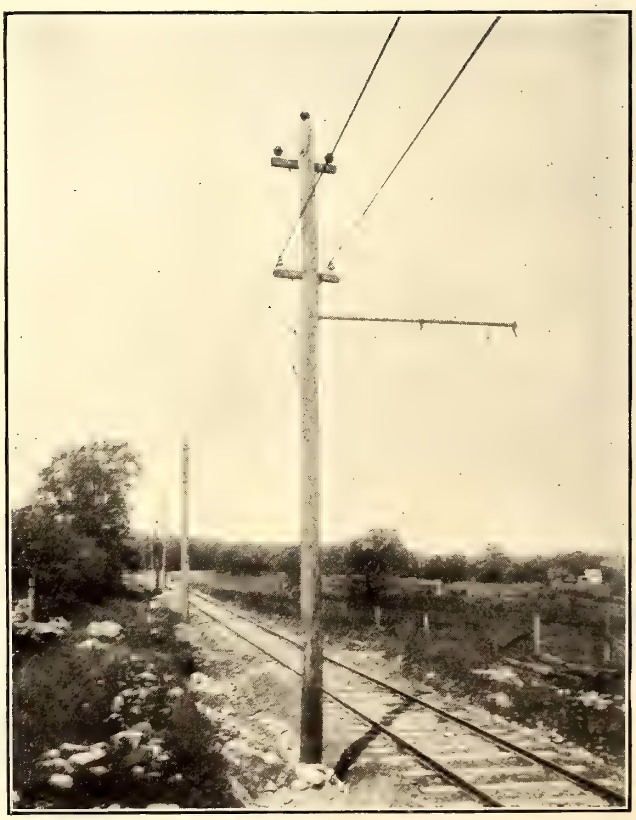
MAP OF A PORTION OF EASTERN CONNECTICUT AND WESTERN RHODE ISLAND, SHOWING THE PRESENT AND PROPOSED ROUTES OF THE NORWICH & WESTERLY RAILWAY

With the opening last fall of the Norwich & Westerly Railway between Norwich, Conn., and Westerly, R. I., citizens of those States had the pleasure of riding for the first time on their pioneer high-speed interurban electric railway. To those familiar with the trend of interurban development in Ohio and Indiana it may be a surprise that one of the oldest and most thickly settled portions of the Union should have clung so long to city standards of construction. This, however, has been due to a variety of local causes, such as the larger proportion of riders living along the highway; the shorter distances between towns; the greater percentage of pleasure traffic for which speed and engineering considerations must often be subordinated to permit the full enjoyment of the scenery; and finally, the difficulty experienced in securing the franchises and right of way to compete effectively with the through service of the steam railroads.

An examination of the accompanying map, showing the steam railroads in this portion of Eastern Connecticut and Western Rhode Island, will reveal that before the construction of this electric railway the only rail connection between Norwich and Westerly was via New London on the steam railroad. Of course this is a round-about way, the steam railroad representing roughly two sides of a triangle of which the Norwich & Westerly forms the third. The length of this shorter route is 22 miles, which is traversed in 45 minutes by the limited cars and in 55 minutes by the locals. The trip via steam railroad requires one to one and one-half hours, depending on connections at New London. The fare on the latter is $1.25, or $0.27 more than on the electric line. Unquestionably the new railway will get most of the through traffic between the two cities, besides a large part of that going beyond each terminal city, as to Willimantic. The company has another source of income from its privilege to carry freight and express right through Westerly, this being included in its twenty-five-year franchise. The running rights in Norwich cover the use of the local company's tracks for about 1200 ft. Compensation for this is on a car basis.

THE ROUTE

The line starts in the business district of Norwich within a few feet of the New York, New Haven & Hartford Company's station, with which, however, it has no rail connection. On leaving the town the railway enters on its own right of way, the public highway being used for only a small portion of the entire route between the main terminals. The first station is adjacent to the State Hospital for the Insane, 3.4 miles from Norwich, which harbors several thousand patients. About half a mile further there is a connection with the New York, New Haven & Hartford Railroad, at the village of Fox Point. The power station and car house are 0.4 mile from Poquetanuck on a large tract owned by the company. Part of this area is wooded and has a small river which at present is used for water supply only, but later will help to form an attractive lake for boating, as the company intends to have an amusement resort at this place. North Stonington, the most important town along the line, is 10.4 miles from the power station. Some 3.7 miles beyond



TYPE OF OVERHEAD AND TRACK CONSTRUCTION ALONG THE RIGHT OF WAY

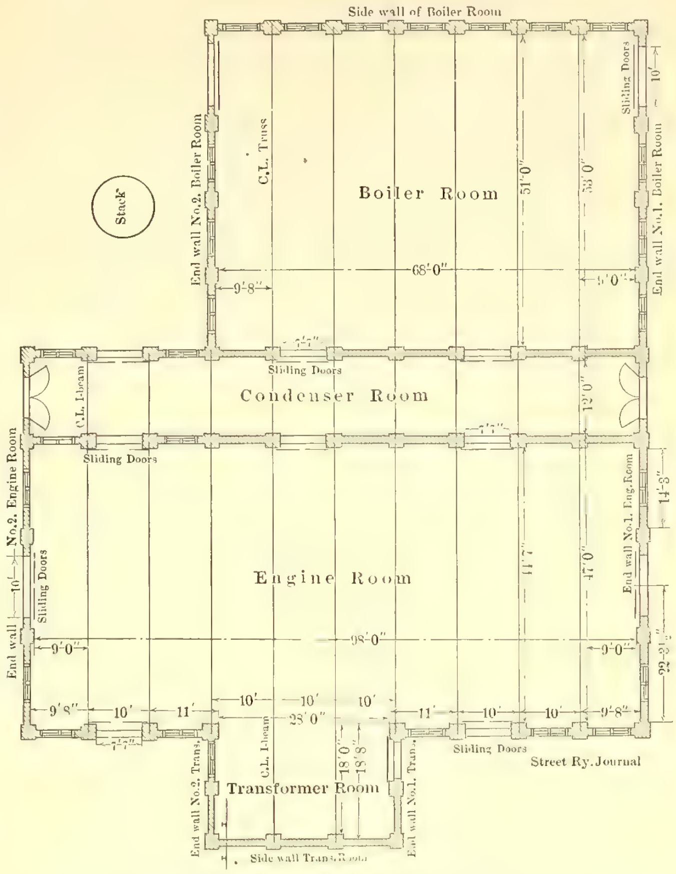
North Stonington is the sub-station. From the latter the distance from Westerly is only 2.1 miles. The total distance between the terminals is 21.6 miles, including 1200 ft. in Norwich and 800 ft. in Westerly.

Although the Norwich & Westerly Railway is an inland line entirely, the rolling country through which it passes has induced quite a little pleasure riding. One of the most attractive places along the route is Lantern Hill, from which an excellent view of the surrounding hills and the nearby seacoast can be secured. During the coming spring the line will be extended for several miles from Westerly as far as the coast. This will greatly increase the traffic during the summer, as it will make available some fine bathing beaches.

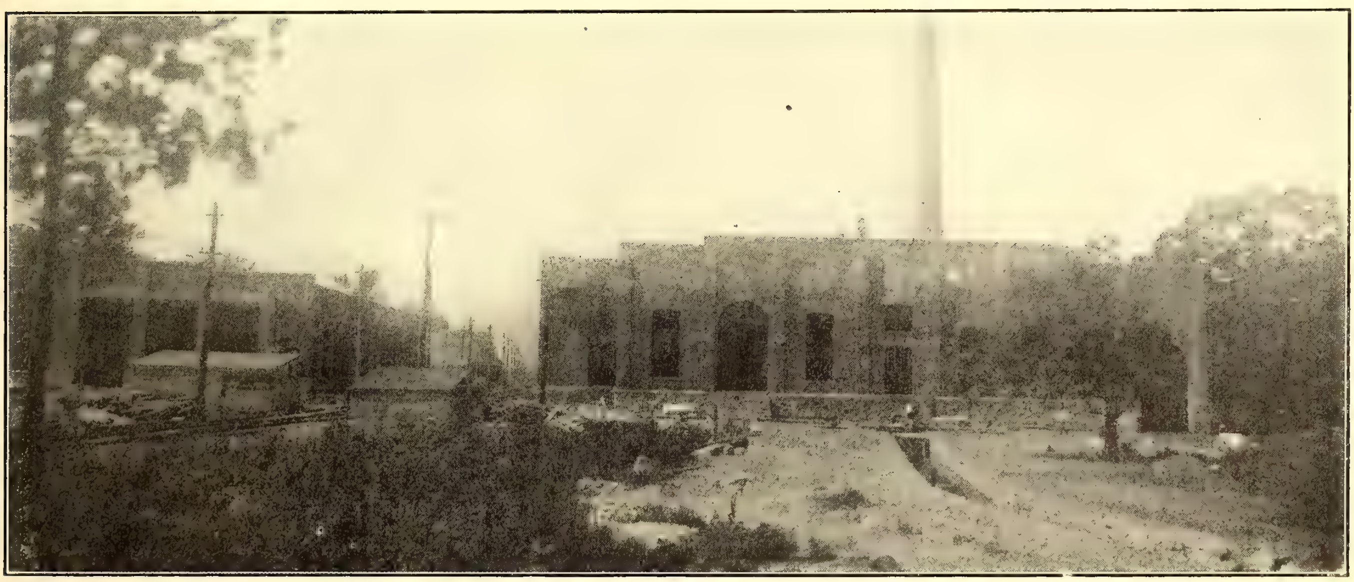
ROADBED AND OVERHEAD CONSTRUCTION

As the line was built primarily for high-speed operation, curves and grades are few in number. All curves have the outer rail elevated according to standard steam railroad practice for passenger train speeds. The maximum grade is 4.5 per cent. There are many cuts and fills on the line, some of the former being through rock. This disadvantage was balanced in one way, as it enabled the company to use a great deal of rock ballast. In fact, one of the accompanying views along the line shows clearly the rocky nature of this territory. Excellent gravel is also found in large quantities at different points along the line. Hence the abundance of good material also permitted the construction of unusually substantial fills.

In the open country the track consists of 70-lb. T-rails laid on wooden ties. The city sections are laid with 107-lb. girder rails to comply with the local regulations. The track is double bonded with two 0000 Chase-Shawmut soldered bonds. The overhead construction is principally of the side-pole type, carrying a 0000 trolley wire, a 500,000-circ.-mil feeder and a 16,000-volt three-phase transmission line from the power house to the sub-station.



PLAN OF POWER STATION OF THE NORWICH & WESTERLY RAILWAY COMPANY


CAR HOUSE AND POWER STATION OF THE NORWICH & WESTERLY RAILWAY

THE POWER STATION

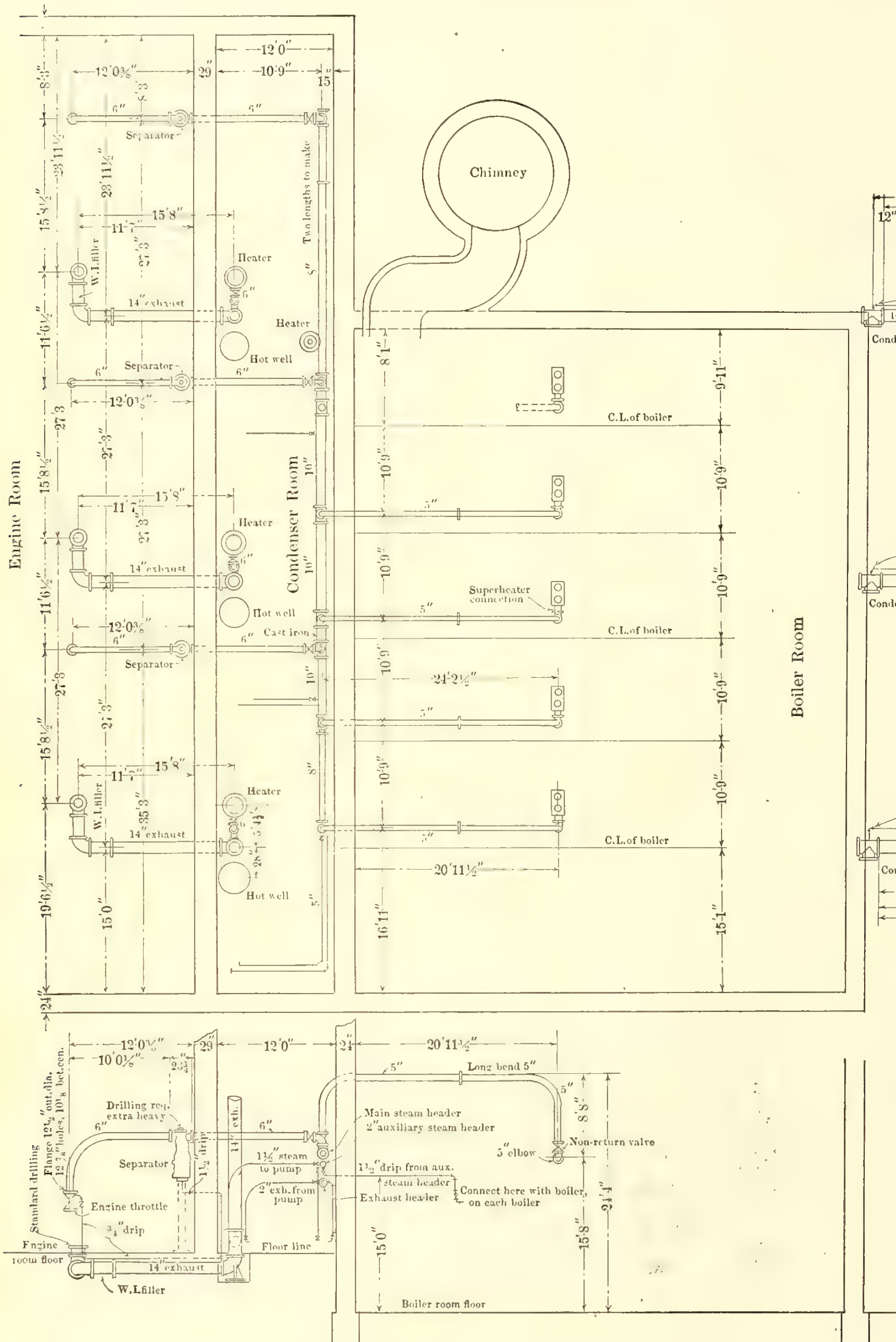
The power house, as previously noted, is located on an extensive plot purchased by the company about 5 miles from Norwich. The accompanying illustration shows that it is a brick structure with one 7-ft.-diameter radial brick stack 175 ft. high. The plant is designed for a normal load of 1860 hp and 1228 boiler hp, with an overload capacity of 50 per cent. The building is so designed that several additional units can be installed without disturbing any of the units now in use. The piping, feed pumps, valves and flue are also arranged to take care of the boiler and generating set to be added to the equipment in the near future. The piping and valves were laid out so flexibly that any or all of the boilers can operate with any or all of the engines. The engines can operate either condensing or non-condensing, and, likewise, the heater and economizer are so piped that they can be cut out of service without interrupting the service. The steam mains to the engines are provided with

Stratton separators. All steam piping is covered with Johns-Manville magnesia.

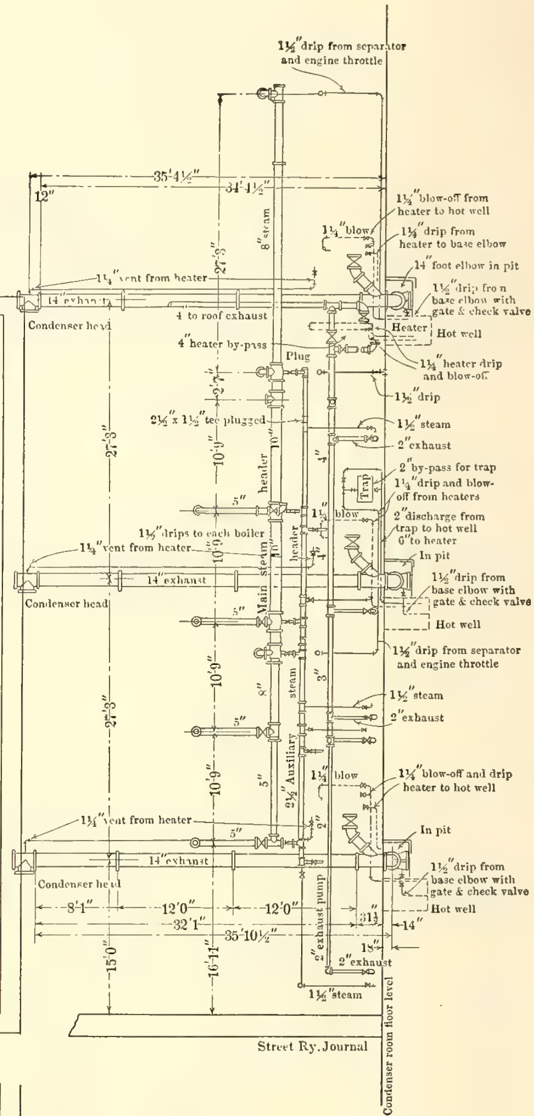
The boiler outfit consists of four 307-hp Franklin water-tube boilers for a working pressure of 160 lbs. Each boiler is furnished with a Foster superheater capable of raising the temperature of the steam 100 degs. Behind the boilers a 600-hp Green fuel economizer of 320 pipes has been installed with the flue so arranged that the furnace gases can be conducted through the economizer or direct to the stack. This economizer was also designed with reference to future enlargement.

Each engine exhausts into a separate barometric Spirojector condenser made by the George F. Blake manufacturing Company. Every exhaust line is laid on the induction plan to a Goubert 300-hp primary feedwater heater. There is also a 250-hp feedwater heater of the same type to take care of the auxiliaries. The horizontal circulating condesing pumps and the two duplex outside-packed plunger boiler feed pumps were furnished by the Deane Steam Pump Company.

One of the illustrations shows the compartment where all valves, pumps, heaters and condensers are installed. This room is located between the boiler and engine divisions, and it will be noted that the apparatus in it is arranged for very easy access, unlike any other power houses where it is so difficult to get at the auxiliaries when something goes wrong. The placing of the auxiliary machinery in a separate room also keeps it free from the dirt of the boiler room.



Section Boiler, Condenser and Engine Rooms.



Section through Condenser Room.

PIPING SYSTEM FOR STEAM, EXHAUST AND DRIPS IN THE POWER STATION OF THE NORWICH & WESTERLY RAILWAY

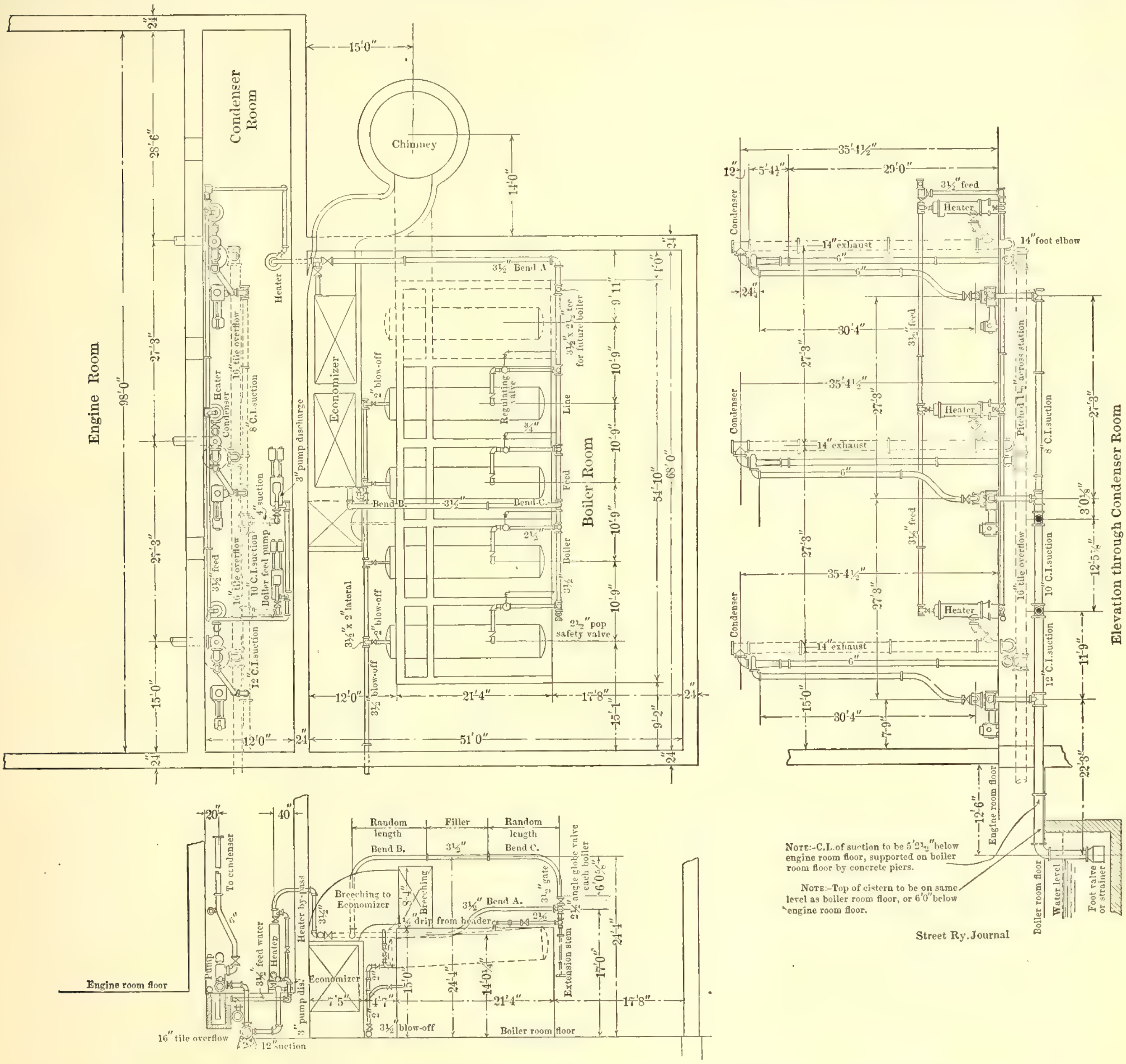
Coal is brought into the boiler room in charging cars running on a narrow-gage track led from an outside coal supply secured by dumping from cars which are run up a trestle outside the boiler house. The water for the boiler feed and circulating pumps is drawn from a specially constructed reservoir just outside the condenser room. This reservoir is fed by gravity from the neighboring stream, but which is tapped at about 500 ft. above the power house. This was done to insure as cool a temperature as possible and to prevent any possibility of the overflow from the hot wells discharging at a point in the stream where it could heat the circulating water.

The principal steam units consist of three cross-compound Hamilton-Corliss engines operating at 150 lbs. pressure with 150 degs. superheat. Each of these engines is connected to three 400-kw three-phase revolving-field generators operating at 25 cycles, 370 volts, 107 r. p. m.

There are two exciter sets, each capable of exciting all three generators when operating at 50 per cent overload and 80 per cent power factor. One of these exciters consists of a 50-kw, compound-wound, 300-r.-p.-m., 125-volt generator connected to a Westinghouse standard engine. The other exciter set is of the same capacity but is driven by a three-phase, 25-cycle, 370-volt induction motor.

There are two 300-kw rotary converters giving 600 volts direct current at 500 r. p. m., equipped with starting motors and mechanical oscillators. There are also three 200-kw oil-insulated self-cooled transformers stepping up from 370 volts to 16,000 volts, used in connection with the transmission line to the sub-station.

The electrical apparatus is controlled from an eleven-panel switchboard. The panels are each 90 ins. high x 24 ins. wide x 2 ins. thick, built up in three sections of Vermont marble. All panels are mounted upon angle-iron framework supported on an angle-iron base. The instruments, switches and metal parts are finished in dull black. Panel No. 1 controls the high-tension side of the step-up transformers; panel No. 2 controls the exciter sets, and has in addition to the usual instruments a four-pole double-throw switch whereby the station lights may be put on the exciter bus-bars or upon the lowering transformer from the generator bus-bars; panels 3, 4 and 5 each control one of the 400-



WATER-PIPING SYSTEM IN THE POWER STATION OF THE NORWICH & WESTERLY RAILWAY COMPANY

kw generators; panel No. 6 is a load panel and controls the high-tension side of the step-up transformers and besides the regular instruments contains a totalizing wattmeter; panels 7 and 8 control the a. c. end of the 300-kw rotaries; panels 9 and 10 are the d. c. rotary panels; panel No. 11 is a two-circuit d. c. feeder. Mounted on swinging brackets at the right and left of the eleven panel switchboards are a. c. high-tension voltmeters, a. c. low-tension voltmeters and synchroscopes.

CONDENSER AND PUMP ROOM

Static protection is afforded by three low-equivalent lightning arresters with choke coils and the usual disconnecting switches. All of the electrical apparatus was furnished by the Westinghouse Electric & Manufacturing Company. The wiring in this station is of the slow-burning waterproof type required by the fire underwriters' latest specifications.

It will be noted from the foregoing description of the power house that the most careful arrangements have been made to provide for contingencies, both in the steam and electrical sections. The number of steam auxiliaries is also rather unusual for a railway station of this size.

An interesting feature in connection with this plant is the speed with which it was erected, owing to the railway company's desire to get a portion of the heavy fall travel in 1906. The contract covering the design and equipment of the steam portion of the plant was taken by the Washington Company, of New York, on Feb. 15, 1906, when ground had not been broken for the building. By May 15 all material was on the ground and on July 15 the first generating system was delivering power.

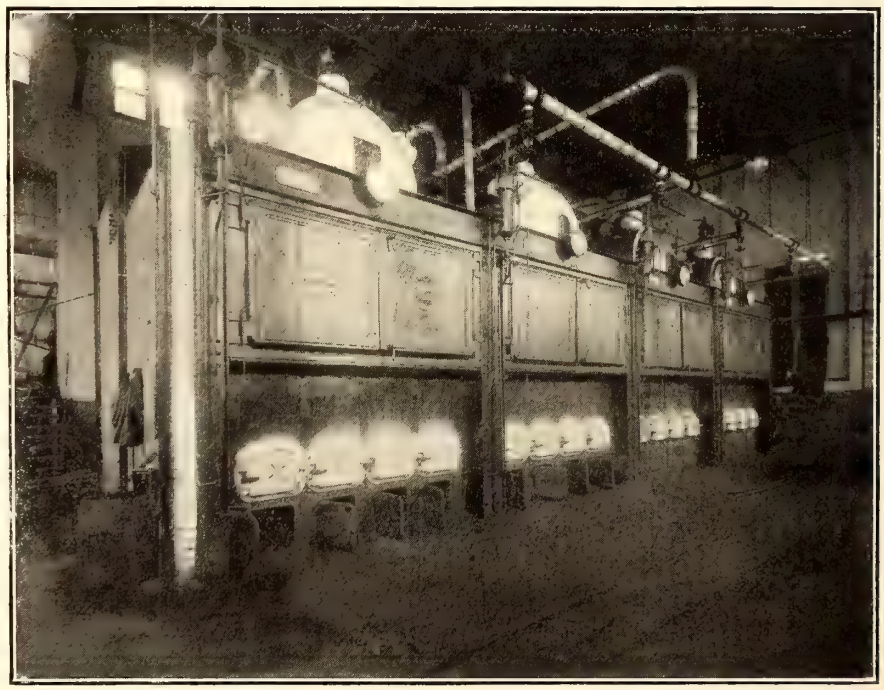
THE SUB-STATION

The sub-station is a small brick building located on the line 15 miles from the power plant or two miles from Westerly. It contains two 300-kw rotary converters equipped with starting motors and mechanical oscillators like those in the power house. There are also six 100-kw, oil-insulated, self-cooling lowering transformers to reduce the 16,000 volts transmitted to 370 volts for the rotaries. The primaries and secondaries of all transformers have caps to adjust the voltage to within 5 or 10 per cent.

The switchboard is of the same type as that used in the power station. It consists of two d. c. rotary panels, two a. c. panels, and one d. c. two-circuit feeder panel. All of these are duplicates of similar panels in the power house. There are also two high-tension panels for the control of the high-tension side of the step-down transformers. Aside from the usual apparatus on the panels there is an a. c. voltmeter mounted on a swinging bracket. Static protection is afforded by three low-equivalent lightning arresters with choke coils and disconnecting switches. The electrical apparatus manufactured in this sub-station is also of Westinghouse manufacture.

ROLLING STOCK

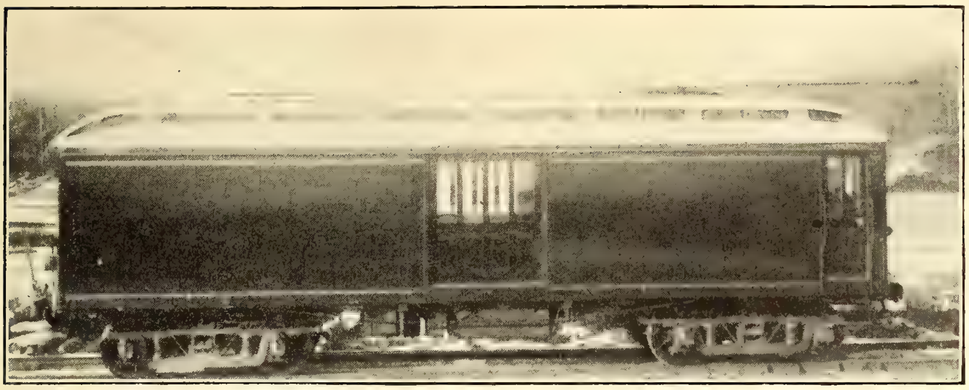
The high standard followed by the company in its track and power equipments was maintained in selecting the rolling stock. At present the equipment consists of four semi-convertible, four closed passenger cars and one motor freight car. Two of the closed cars are of the combination passenger and baggage type with folding seats for smokers in the baggage compartment, and the two others have a regular smoking compartment seating fourteen people. All of the closed cars have a toilet compartment. These cars are furnished by the Southern Car Company; they are about 47 ft. long and weigh, equipped, about 35 tons. They are furnished with end doors for convenience in train operation. The semi-convertible cars are fitted with Wheeler rattan seats and the closed cars with Heywood plush seats.



BOILER ROOM IN THE POWER HOUSE OF THE NORWICH & WESTERLY RAILWAY

All of the cars are mounted on the Baldwin trucks of the 78-22 type. The wheel base is 78 ins.; diameter of axles, 5

in. at the motor bearings; journals, 4¼ ins. x 8 ins. and 33-in.-diameter National steel-tired wheels. All of the features of the regular Baldwin type of truck are incorporated,

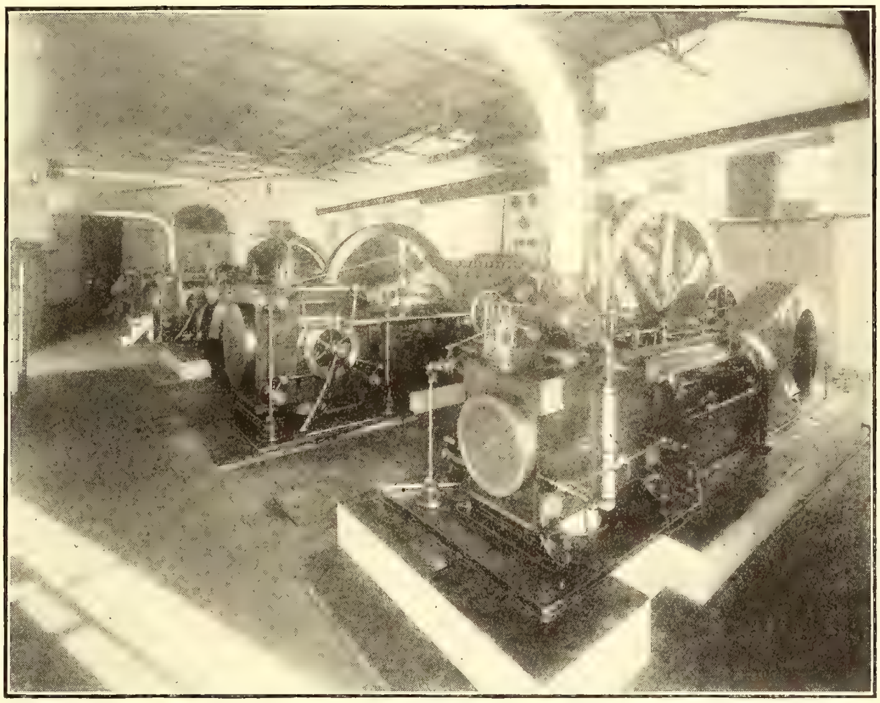


STANDARD EXPRESS CAR ON THE NORWICH & WESTERLY RAILWAY

among others the top member of the frame is of wrought iron forged solid in one piece; the transoms are of channel iron; the swing bolsters are adjustable for height and wear; there are double equalizer bars and trussed side frames. No member of these trucks is designed to withstand strains and stresses with less than a factor of safety of five. In spite of this high factor, the truck, owing to the careful distribution of weight, is comparatively light for the load carried, each truck complete weighing only 8000 lbs.

Both the freight and passenger cars are each equipped with four Westinghouse No. 112, 75-hp motors and unit switch control for train operation. The equipments are geared to maintain a schedule speed of 36.2 m. p. h. with stops every two miles approximately, thus giving a maximum speed of between 45 and 48 m. p. h. on level grades with 500 volts at the motor terminals. The equipments have been making these speeds, which is the fastest electric schedule in New England, for some time. On certain trips of the day the cars are operated in trains and the rest of the day singly.

The braking equipment consists of the Westinghouse Traction Company's "A. M. T." automatic air brakes designed for use in trains of from one to five cars. They embody the graduated release of brake cylinder pressure and means to supplement with straight air release if desired, quick recharge of auxiliary reservoirs and quick service application of the brakes. Each equipment includes a D-2-E G motor-driven air compressor, capacity 24.29 cu. ft. free air per minute. Every car is also furnished with one Amer-



VIEW OF THE RECIPROCATING ENGINES AND DIRECT-CONNECTED GENERATORS IN THE POWER STATION OF THE NORWICH & WESTERLY RAILWAY COMPANY

A TRAIN ON THE NORWICH & WESTERLY RAILWAY, MADE UP OF TWO MOTOR CARS

ican automatic slack adjuster type-E-1 and standard train air signal equipment. In addition to this power braking the cars are furnished with vertical hand brakes made by John S. Baker, of Beverly, Mass. Among other details of the car furnishings are Knutson trolley retrievers and Van Dorn drawbars.

CAR DISPATCHING AND GENERAL

All cars are dispatched by telephone in accordance with regular steam railroad practice. The conductor on receiving orders fills out and signs the blank illustrated. The motorman receives and also signs a duplicate of the same order. These orders are turned in at the end of every run and examined daily by the traffic superintendent. This method has operated very successfully.


NORWICH AND WESTERLY RAILWAY CO.

Telegraphic Train Order No.______

Superintendent's Office,______190

FORM 31. To C. & M. of ______ at ______ FORM 31.

By______ Dispatcher.

CONDUCTOR AND MOTORMAN MUST EACH HAVE A COPY OF THIS ORDER.

Time received______M. ______given at______M.

CONDUCTOR.	MOTORMAN.	TRAIN	MADE.	AT	RECEIVED BY
				M.	
				M.	
				M.	
				M.	

STANDARD DISPATCH ORDER BLANK

The Norwich & Westerly Railway was resurveyed, relocated, designed and equipped by the National Construction & Equipment Company, of New York, of which E. McKernan is president and E. W. Jackson is chief engineer and general manager.

PORTABLE TRANSFORMER STATION ON THE VALTELLINA RAILWAY

Among the interesting features of the three-phase system used on the Valtellina Railway, Italy, is a portable transformer sub-station, which is used either to take the place of a stationary transformer station when the latter is undergoing repairs or to help out portions of the line carrying unusually heavy loads. The transformer, which is of 430-kilovolt-ampere capacity, is mounted in a freight car built entirely of iron. The car body is divided in two unequal portions, the larger of which contains all the high-tension apparatus, as follows: Transformer, electrically-driven ventilator, three-pole hand-operated cut-out switch, three-pole automatic 20,000-volt oil switch, three two-pole hand-operated 3000-volt oil switches, three automatic cut-outs, relays, lightning arresters and choke coils.

The smaller compartment contains three hand wheels for the oil switches of the secondary circuit, and a hand wheel for the primary switch, as well as the bell and lamp signal apparatus of the relays which immediately indicate the cut-out switch opened. In this case, three secondary switches had to be installed, as at one point on the system the transformer station supplies current to three lines. Insulators are on the roof for both the primary and secondary circuits.

This portable transformer station can be connected to operate without auxiliary resistances in parallel with a stationary transformer, in which case the current divides in the ratio of 43:30. This scheme has been a success even in cases where this parallel connection was made from a substation more than 3-km distant and not at the place where some fixed transformer was cut out of the circuit.

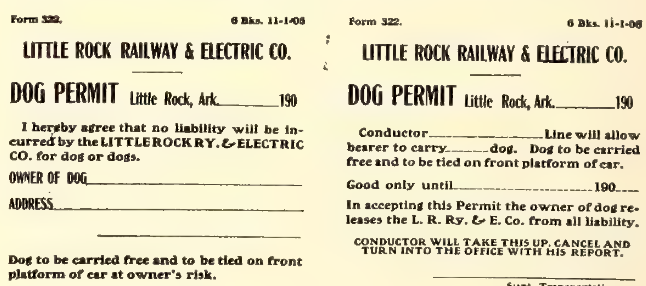
PROPOSED SUBWAYS IN PITTSBURG

E. K. Morse, of Pittsburg, recently presented a paper before the Engineers' Society of Western Pennsylvania on the subject of a proposed subway in Pittsburg. According to the speaker, the business district of Pittsburg now occupies a very congested area, only 210 acres in extent, between the Allegheny and Monongahela Rivers. This section is surrounded by water on all sides except to the east, where it is hemmed in by a ridge, which practically confines the business district to the space now occupied. To aggravate matters there is only one street in this district which is 80 ft. wide. Most of the others are 40 ft. and 50 ft. between building lines. All of the inbound cars must bring their passengers into and to this area.

Elevated railways are not considered suitable either in this district or elsewhere because of the narrowness of the streets, the grades which would have to be surmounted, and their interference with light, which in the smoky atmosphere of Pittsburg is a serious consideration. A subway is therefore recommended. Such a line could make a loop in the business district on Oliver Avenue, Liberty Avenue, Perry Street, Third Avenue and Grant Street. It would then extend east from the corner of Oliver Avenue and Grant Street in an almost straight line until reaching the corner of Penn Avenue and Franklin Avenue. For about a third of the distance it would extend under Center Avenue. It would then extend out Frankstown Avenue to Beachwood Boulevard. Mr. Norse recommends branches to be run south, one to Schenley Park and another to Brady Street; also a branch to extend from the down-town loop under the Allegheny River to Allegheny.

DOG PERMIT AT LITTLE ROCK

The people of Little Rock, Ark., probably because of a more affectionate disposition for animals than residents of other cities, for some time caused the Little Rock Railway & Electric Company considerable annoyance by bringing their dogs on the cars with them. On the Forest Park line, which extends several miles into the country, the practice was particularly troublesome. To check it the company adopted the policy of requiring the owners to


Form 322. 6 Bks. 11-1-06

LITTLE ROCK RAILWAY & ELECTRIC CO.

DOG PERMIT Little Rock, Ark.______190

I hereby agree that no liability will be incurred by the LITTLE ROCK RY. & ELECTRIC CO. for dog or dogs.

OWNER OF DOG______

ADDRESS______

Dog to be carried free and to be tied on front platform of car at owner's risk.

Form 322. 6 Bks. 11-1-06

LITTLE ROCK RAILWAY & ELECTRIC CO.

DOG PERMIT Little Rock, Ark.______190

Conductor______Line will allow bearer to carry______dog. Dog to be carried free and to be tied on front platform of car.

Good only until______190___

In accepting this Permit the owner of dog releases the L. R. Ry. & E. Co. from all liability.

CONDUCTOR WILL TAKE THIS UP, CANCEL AND TURN INTO THE OFFICE WITH HIS REPORT.

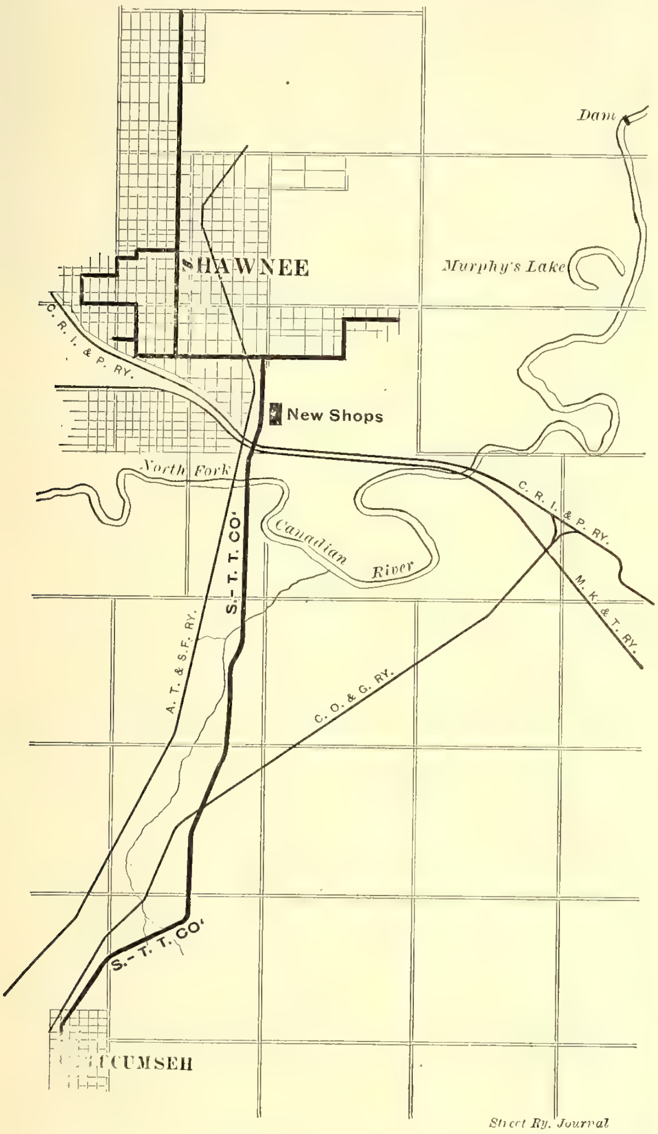
Supt. Transportation.

CONTRACT FORM COVERING THE ISSUANCE OF DOG PERMITS BY THE LITTLE ROCK RAILWAY & ELECTRIC CO.

obtain special permit for every dog carried on the cars. These permits are issued free, but the fact that the owner must call at the office of the railway personally and sign a release relieving the company from liability for injury to the animal does much to discourage the practice. In fact, only about one-fourth the number of dogs are brought on the cars as were carried before permits were required. Under the conditions of the permit the dog is tied to the front platform, out of danger to and out of the way of passengers.

THE SHAWNEE-TECUMSEH TRACTION COMPANY

The Shawnee-Tecumseh Traction Company is the one purely interurban railway in Oklahoma. Like everything else in this region, it is capable of great future development, and if the rate of increase of population that both the towns and the farming country of Oklahoma are now enjoying continues, it will no doubt be advisable within a few years to build so many extensions that the present trackage will be but a small portion of a large system. This railway extends south from Shawnee 5 miles to Tecumseh through one of the richest and most populous regions of the new State. It is located on the Santa Fe and the Choctaw, Oklahoma & Gulf Railroads. Tecumseh is the county seat of Pottawatomie County, in which Shawnee is located, and is very closely connected in business affairs with Shawnee.



ROUTE AND CONNECTIONS OF THE SHAWNEE-TECUMSEH TRACTION COMPANY

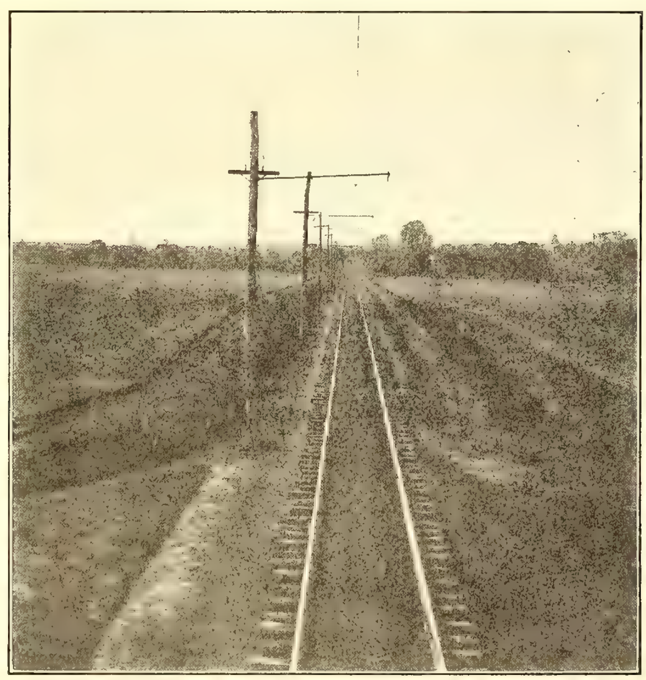
Shawnee is situated on the North Canadian River and the adjacent river bottoms are the most fertile lands in this beautiful agricultural district. The city has had a phenomenal growth, as it was a mere hamlet in 1895, while by 1906 it had reached a population of 22,000. As Shawnee is located in almost the geographical center of the new State it will probably become the capital when the State's legal headquarters are removed from Guthrie in 1910. A site of 210 acres already has been offered for the State buildings. Along the interurban line between Shawnee and Tecumseh are located several points of interest to the traveling public. About one mile from Shawnee are the new shops and round houses of the Santa Fe Railroad Company. About half way between the two cities is the Shawnee Indian Training School, or Indian Mission, a government institution, for educating Indian children and instructing them in agriculture and other industrial pursuits.

The interurban line is owned and operated by the Shawnee-Tecumseh Traction Company, in connection with a city system with a trackage of about 6½ miles in Shawnee. The company acquired the original system in Shawnee at a receiver's sale in 1906. Since that time the new interurban line has been constructed, the city system has been rebuilt and new equipment obtained. At the present time new car shops are being erected.

A REVERSE CURVE ON THE INTERURBAN LINE

THE CITY LINES

The mileage of the city system is made up of one route in the eastern part of the city, a second in the western portion running due north, and a third due north from the central portion of the city upon which a 1½-mile extension has just been completed. One mile of track is laid with high T-rail, but with this exception the rails are all 70-lb. standard

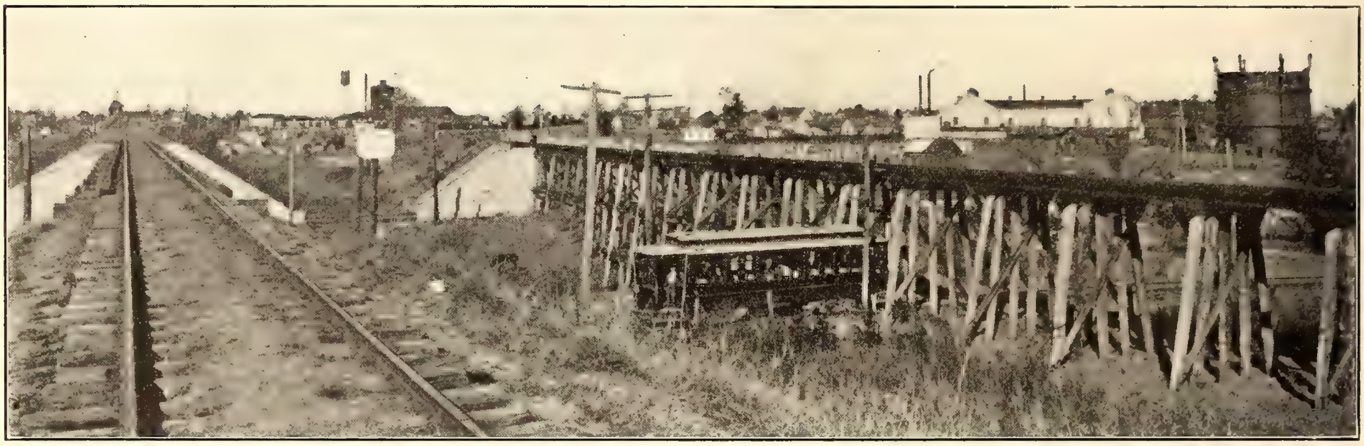


BERME DITCHES, FOR CARRYING AWAY SURFACE WATER

section. The trolley is of No. 0 wire and is placed 17 ft. above the rails.

THE INTERURBAN LINE

The interurban line was opened for service Sept. 1, 1906, and is built on a private right of way 100 ft. to 130 ft. wide. Provision has been made for double-tracking by building the track 6 ft. off center. Where the road crosses the Canadian River near Shawnee two trestles, aggregating 500 ft. in length, were erected, but other than these no large structures were required. Steam road crossings occur at four places. Two are at grade crossings on branch lines, while two near each other in Shawnee are under-grade crossings. At this point, fortunately, the steam roads were carried across a ravine on a trestle, so that no depression of the electric line was necessary. No heavy cuts were required in the construction of the line, but there is one short 18-ft. fill and a sand fill 6 ft. high and 1 mile long just south of the Canadian River. With the exception of about 400 yds. of track in Tecumseh laid with high T 7-in. rails, the interurban line was constructed of 70-lb. standard section rails in 33-ft. lengths. Sidings with 300 ft. of straight track, and located at intervals of about 1 mile, are equipped with Elliott frogs and switch stand of steam railroad type. The joints are bonded with American Steel & Wire Company ribbon bonds and cross-bonds are installed at 1000-ft. intervals. Oak ties are placed sixteen to the rail, or about 2 ft. center to center. Ballast is largely of sand. It is proposed to ballast the whole interurban line with broken stone during the next year. A more permanent roadbed was obtained and drainage facilitated by making the cuts and fills very wide, as shown in the illustration. At the top the fills are 18 ft. and at the bottom the cuts are 20 ft. in width. One of the views shows some of the ditches dug behind the cuts to protect them from surface water. The company has now under consideration the building of an extension to connect the Shawnee lines with the Oklahoma City lines, a distance of 40 miles.



ENTERING SHAWNEE FROM THE EAST, SHOWING THE UNDERGRADE CROSSING

A STREET SCENE IN SHAWNEE, OKLAHOMA

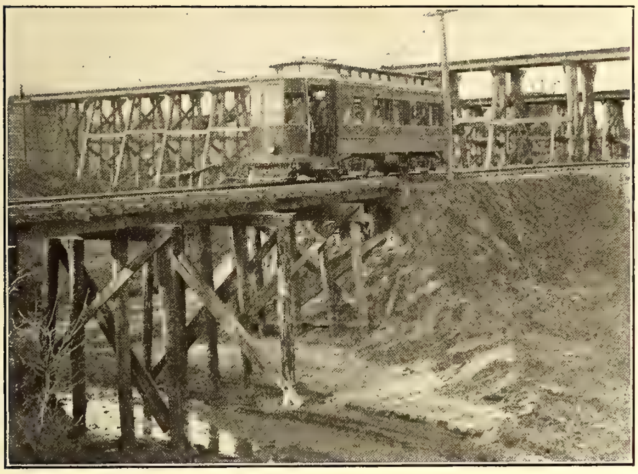
POWER SUPPLY

Power is rented on a meter basis from the Shawnee Lighting Company. The current is transmitted from a 500-kw, 2300-volt alternating-current Westinghouse turbo-generator in the power house in Shawnee, and is converted to direct current by a 300-kw General Electric motor-generator set. The power house also contains two 500-volt d. c. machines, one 150-kw and the other 200-kw, used when occasion requires.

OVERHEAD CONSTRUCTION

Bracket overhead construction is employed except on

sharp curves and in the towns. The poles are of chestnut, placed at 100-ft. intervals. On the interurban division the single No. 00 trolley wire is carried 19 ft. 6 ins. above the track. A No. 0000 copper feeder is carried within ½ mile of Tecumseh on a cross-arm just below the bracket. Lightning arresters which are grounded to copper-ground plates are placed on every tenth pole or 1000 ft. apart. A cross-



ANOTHER VIEW OF THE UNDERGRADE CROSSING

arm above the bracket carries the wires for the Eureka automatic electric signal system with which the railway is equipped. The signals are placed at each of the four sidings and at terminals to divide the road into five blocks. Cars are operated by them alone, the usual telephone dispatching system being dispensed with entirely.

CARS

The equipment consists of fifteen cars, eleven of which were built by the St. Louis Car Company and delivered

ALONG THE LINE NEAR THE PROPOSED PARK

in the summer of 1906. Of the new cars, four with single trucks and 20-ft. closed bodies are for regular city service in Shawnee. Four twelve-bench open cars, termed park cars, are used for special service this summer. Three cars for interurban service are 41 ft. long over vestibule posts and 8 ft. 5 ins. wide over all. The interior of the interurban cars is furnished in oak and is divided into two compartments. Cane seats for forty-four passengers are provided. The cars are heated by Johns-Manville electric heaters and are equipped with Parmenter fenders. They are mounted on the St. Louis No. 23-A-E trucks with 6-ft. wheel bases. Cast-iron wheels 33 ins. in diameter and with 3-in. tread and 1 5-16-in. flanges are employed. The cars are equipped with K-28-B controllers and four G. E.-80 motors.

NEW CAR HOUSES AND OFFICES

A new building, 50 ft. x 300 ft., to be utilized as a storage space for cars and for repair shops and storeroom, is nearing completion. The building is a concrete and brick structure with a steel truss roof. The floors are of concrete and the pits of brick laid in cement. In the rear portion of the building a space of 26 ft. is partitioned off from the car storage section in front for use as a storeroom and a machine shop. The shop will be provided with a lathe, drill press, grinder and air compressor outfit. Heavy wheel work such as boring and pressing on wheels will be done in the shops of the Rock Island Railroad as at present. Plans have been made for the erection of an office building measuring 34 ft. x 36 ft. near the new shops.

OPERATING FEATURES

The interurban line enters into competition with the Rock Island system and has caused that road to take off a local train between Shawnee and Tecumseh, although both roads charge the same one-way fare and the steam road makes a cheaper round-trip rate. The one-way fare on the electric line is 15 cents. This does not include a transfer to the city lines. In fact, the city lines are so routed that there is no necessity of giving transfers between them at all and the management is thereby relieved of a perplexing feature of railway operation. Two cars are operated regularly on the interurban line. These maintain a half-hour schedule with a lay-over of five minutes at each end of the line. The four city cars are operated under a fifteen-minute headway. The company is not bothered with the pass question. Employees and newspaper men only are given passes, the latter only to the value of the advertising account. The company makes special rates for chartered cars. A charge of $5 is made for the first one and one-half hours and $2.50 for each additional hour. A great deal of chartered car business results from theater parties of Tecumseh people attending the theaters in Shawnee. For such parties $9 is charged for the round trip.

The company does not operate a park at the present time, but ground for one has been acquired and it will be built during the coming season. The park will be located on a waterway about 2 miles south of Shawnee. Willis E. Fertig is president of the operating company. O. H. Weddle, as general superintendent of the system, has complete charge of its operation. G. S. W. Brubaker, of Philadelphia, acted as engineer and superintendent of construction of the interurban line, and J. P. Algie and Jas. W. Beebe as assistant engineers.

The Steinway, or Belmont, tunnel under Forty-Second Street, New York, and the East River to Long Island City, is to be opened for traffic Aug. 1, according to present plans. The work in the north tube, it is expected, will be completed in less than thirty days. The excavation on the Manhattan end under the city's streets has been finished, so that it is now a question whether an injunction restraining the company on account of the alleged defects in its franchise will retard the work of getting the tunnel ready for traffic. Steel cars similar to those in the subway have been ordered.

RAIL CORRUGATION*

BY JOSEPH A. PANTON

The question of rail corrugation has, until recently, been surrounded with a great deal of mystery, and has presented one of the most puzzling problems with which the traction engineer has been called upon to deal. Even at the present time, great diversity of opinion still exists as to its real cause. It is because generalization has been attempted without careful and detailed investigation that so much of a misleading character has been published on the subject. In the present paper the author proposes to deal with the subject in a general way, confining himself as briefly as possible to the practical side of the corrugation problem, without entering to any extent into the question of materials and methods of manufacture. Details will be given of the method employed by the author in investigating the corrugation problem, and of the results which have led him to adopt his present theory, special attention being paid to some of the latest developments, which it is hoped will prove of interest. In dealing with a subject of such fundamental importance it becomes necessary to consider certain points which, though familiar to all, would, from their very nature and bearing on the subject, leave the treatment incomplete if omitted. Little actual work has been done in connection with the subject under consideration, therefore few practical details are available. Recent experiments carried out with rail grinders have turned out more or less unsuccessful.

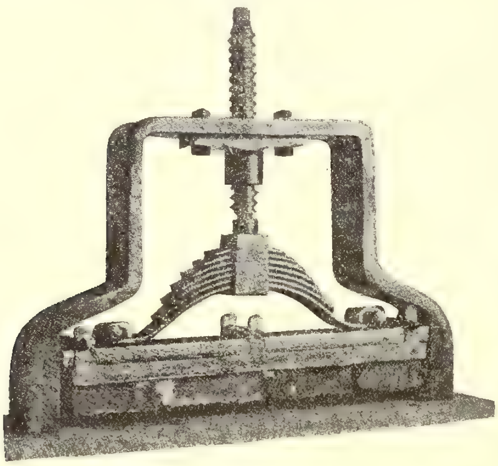


FIG. 1.—RAIL GRINDER

Rail Grinding.—At present, as a partial remedy, we keep on grinding rails—and money—away, without making headway toward finding the actual cause of the trouble. Rail grinding can be accomplished by fixing to the car or locomotive a combined letter press and slipper block fitted with refill carborundum shoe (see Fig. 1). There are four carborundum blocks, 6 ins. x 3 ins., fitted in the shoe. This arrangement is by no means the best, as when a grinder of this length is riding on the crest of a wave, the outer ends have a tendency to dip into the hollows. To obviate this, one continuous block of carborundum would be preferable, in order to gain rigidity when negotiating waves of the same length. The author finds that a coarse grit of carborundum (No. 16) used on a wet day, with a medium file-cutting pressure, gives the best results. As regards wear of the carborundum blocks and power required to drive them, Figs. 1 and 2 (Fig. 2 illustrates shavings obtained with the grinder) clearly indicate in a general way what can be done in the way of a temporary expedient. Rail grinding is, however, by no means a remedy, as the corrugations soon reappear, which indicates that we must look to the equipment directly or indirectly in contact with the rails, and not to the rails themselves, for the cause of the trouble.

Rails.—Seeing that the actual corrugations occur on the rail, it is but natural to suppose that their presence or absence depends on the quality of the rail. The author has given careful consideration to this view, and has come to the conclusion that no satisfactory evidence has yet been put forward in support of it. In fact, enough evidence has now accumulated to contradict any rail theory that might be promulgated. It therefore behooves us to look elsewhere for a solution of this problem. In this connection the author would give the following among other reasons why the rail theory fails to account for the presence of corrugation:

1. Because rails manufactured by every firm in the world have corrugated since the advent of electric traction.
2. That the rails did not corrugate in the days of horse and steam cars.
3. That the check or guard rails are corrugated to an equal degree, and parallel to that on the crown of the rail.
4. That rails did not corrugate so long as the armatures were built on the axle.
5. That it takes on the average three years to develop corrugations on a new system, and only three weeks on relaying with new rails thereafter.
6. That an ordinary railway rail taken from the straight road of an electrically operated railway (where no corrugations occur) and relaid on a checked curve soon corrugates.

FIG. 2.—SHAVINGS FROM RAIL

These are a few of the principal reasons why we cannot attach the blame to the rails or their manufacturers. Further, corrugated rails have been tested and found to contain all the chemical constituents and to possess the physical qualities required of them. It has been said, and continues to be repeated, that the trouble is due to the chattering of the rollers at the rolling mills, owing to play in the pinions and bearings of the rolls driven by antiquated steam engines. Let me here say that such statements are misleading and without foundation. For the sake of argument, assume that the chattering of the rollers does corrugate the rails. Why, then, is it that the rails on electrically operated railways only corrugate on checked curves, the remaining

* Paper read at a meeting of the Institution of Electrical Engineers (London), March 21 1907.

seven-eighths of the track being perfect? And why does it take so long to corrugate tramway rails on a new system, and so short a time on renewals? And why are not corrugations found on our steam railroads, running at 60 miles per hour? These are facts which one cannot get away from, and which entirely dispose of the rolling theory. Further, in this country and abroad we find corrugations 24 ins. to 30 ins. in wave-length. If chattering is going on in the Middlesbrough rollers on so gigantic a scale, the noise of it should be audible for miles around.

Defective Railway Rolling Stock.—The author's attention was first drawn to defects in rolling stock as a means whereby corrugation might be caused about three years ago, by the action of a flanged brake block or shoe then being tried to keep down wheel flanges. The tendency of the flanged brake blocks was to cut into the outer edge of the wheel tire, as here shown (Fig. 3), and it appeared difficult to

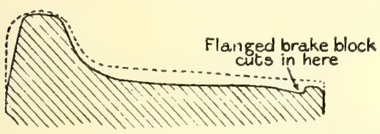


FIG. 3.—WHEEL CUT BY BRAKE-SHOE

account for this peculiar action. Later on it occurred to the author that the bogie truck frame and the wheels were not acting in unison, especially when rounding sharp curves. The truck frame, by means of the hangers, communicated to the brake block a twisting movement, that is to say, the truck frame and brake block had a tendency to get out of line with the wheels when on the curve, but were being prevented by the flange of the brake block; hence the thrust on the said brake block and its tendency to cut the wheel tread. On reverting to the brake block without a flange no cutting of the wheel-tread occurred. Having got thus far, by judicious watching it soon became apparent that this brake block had a decided tendency to run off the wheel tread on one side and cut into the flange on the other, as represented in Fig. 4. On further examination, it was soon found that the frames were out of square and the axles out of line or oblique to the line of motion, as already stated, this being due probably to the axle being geared at one end of the shaft only, the tendency being to form diamond-shaped truck frames. To prove this remarkable result of defective gearing, the author has only to draw attention to the case of the Liverpool Overhead Railway during the first nine or ten years of its existence, when the armatures were built on the axle, whereby a symmetrical drive was obtained. During this period there was no sign of any corrugations. On introducing single-ended geared axles into the same trucks, a series of difficulties cropped up when running over the same rails, necessitating the renewal of rails on checked curves—a serious additional expense. If, in the light of this result, we consider the fact that at least 75 per cent of our present-day electric railway and tramway equipments are unsuitably mounted on trucks of weak foreign design, the main feature of which is lack of durability, due to cheap methods of production, the outlook is anything but hopeful.

Defective Tramway Rolling Stock.—Many similar cases have occurred on tramway undertakings where the conversion from steam to electric traction over the same rails has brought about corrugation. The tendency of a gear is to get away from the pinion, and it can do so in time, due to the wear of the motor brasses, axle sleeve brasses, horn slides, etc. Being geared at one end and mounted in a weak truck frame, the whole tendency is to push the frame out of square and the axles out of line, and, as an examination of the wheel tires clearly indicates, a grinding action takes place between the wheel flanges and guard rails. The wheels soon become groove-locked when speed is attained, and the wheel flanges striking the check rail intermittently cause the whole axle to jump or oscillate in the groove, giving rise to intermittent skidding and producing the peculiar flattening of the rail known as corrugation. Corrugations will also be found on the check rail, equal and parallel to those on the crown of the rail, which clearly demonstrates that the wheels oscillate in the groove. This soon brings

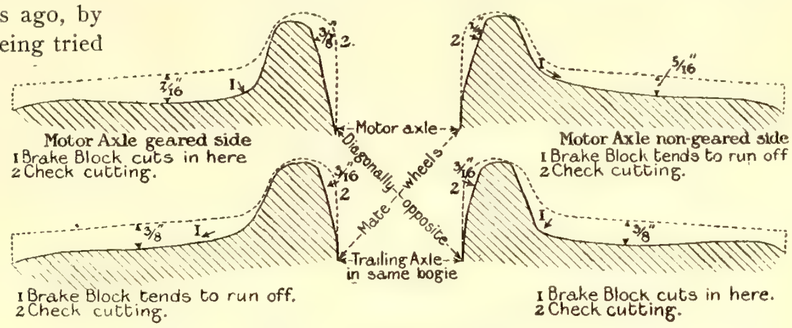


FIG. 4.—TIRES OF DOUBLE TRUCK EQUIPPED WITH ONE MOTOR

about unequal tires on the same axle, which causes a momentary slowing or lagging behind of one tire, and this still further increases the tendency to locking of wheel tires, as can readily been seen by the severe indentations on the check rail, each indentation tapering off to nothing as the tire is freed. Immediately the tire is freed it jumps forward the required distance to bring it into line, producing a sort of case-hardening effect on the head of the rail which remains high, and as it is at the same time revolving, in doing so it scoops or grinds intermittent hollows in the rails, the wave-lengths being determined by the speed and elasticity of the track. In the matter of wheels, we have clung to old practices longer than might have been expected, and longer than would have been the case had not first cost been a factor that had to be considered. We have retained the multitude of flange shapes and treads that existed in the horse-car days, having made few changes in their dimensions or contour, a matter which requires immediate attention; for as we have considerably increased the speed and

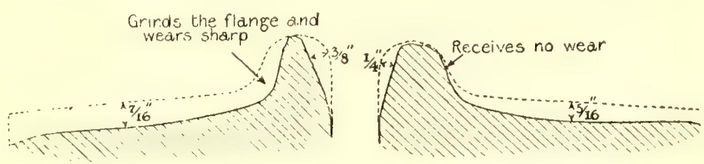


FIG. 5.—TYPICAL EXAMPLE OF TRAILING TIRES

weight of cars, the tread and wheel flanges ought to be suitably modified to adapt them to the new conditions. Again, the running of a ¾-in. thick flange in a 1-in. wide groove requires further consideration, especially when rounding curves.

Excessive Wheel and Flange Wear.—It would be safe to assume that 75 per cent of our electric railways and tramways are troubled more or less with excessive and irregular flange and tread wear of their wheels. In the case of bogie trucks sharp flanges are produced on wheels in diagonally opposite corners of the truck, and square flanges on the mate wheels (see Fig. 4). This peculiarity has developed greatly since the advent of electric traction, and clearly indicates to the author's mind that the method of single-ended

gear-driven axles has the tendency to send the geared end of the axle forward, while the mate wheel has the reverse tendency; hence the sharp flange on the wheel nearest the gear, which, being the aggressor, is found to be of smaller circumference than the mate wheel, as shown in Fig. 4. The slightest difference in circumference of two wheels on the same axle will throw additional weight and wear on the smaller or slow wheel; the author has repeatedly measured differences in circumferences varying from ¾ in. to 1 in. The slow wheel therefore grinds the flange and causes it to wear sharp (see Fig. 5), while the flange of the mate wheel is drawn away from contact with the rail and receives no wear. We therefore arrive at an unbalanced condition of the car-body, especially when rounding curves, which throws undue and constant pressure on the smaller wheels. In the case of street cars, where we have no elevation on curves, the inequalities of wheel circumferences are further aggravated. It will also be found that in short wheel base trucks secured to the car-body the two smaller wheels will be on the same side of the car, thus making an unbalanced condition of the car whether running on the straight or curved track, the wheels on one side being cut into at the back of the flanges, while on the other side the tires are frilled over the rim, which will tend further to increase corrugations where unequal rail level of the track exists. In serious cases this unbalanced condition has caused a cant or tilt of the car-body representing ⅞ in. in 9 ft. 6 ins. This accounts for the varying conditions of corrugations so often found on the straight track. The type of truck known as "Brill E 21" cannot get out of square so easily, but the axles still get skewed, though remaining parallel to each other. Taking into consideration the direction of motion, the accompanying diagram (Fig. 6) will illustrate why the two smaller wheels come to be on the same side of the car. Speaking generally, corrugations are most likely to be found in towns and cities where sharp loops and curves are negotiated regardless of speed with top-heavy, double-deck cars and trucks that were never designed for such circumstances, consisting of a few stampings and castings bolted together regardless of accurate fitting. Such frames are unable to retain their original squareness, however well reinforced with corner plates. This lack of squareness means axles out of parallel, motors out of alignment and bearings out of truth, resulting in climbing wheels, hot boxes, unnecessary consumption of power and rapid deterioration of rolling stock and rails. Some twelve months ago a set of Corporation tramway trucks were put through the engineering shops, thoroughly squared up, planed, fitted and finished. These trucks were then put on a particular route, and it is very gratifying to hear that the wheel flanges are greatly improved and the corrugations reduced to one-half their original size. The author has also taken in the side frames of a Brill E 21 truck 1 in., still finding the same bolt holes in the car-body; the result is a much steadier running car with better wheel flanges. One therefore arrives at the result that corrugations on electric railways and tramways are caused by weak bogie frames and trucks, unable to withstand the side strains of our top-heavy cars running at high speed on flat curves of short radii, the weakness being intensified by unsymmetrically driven axles being run through sharp loops and turnouts. Hence in towns where corrugations do not appear you will find a perfect track with trucks of sound mechanical design, preferably "former" built under refined engineering conditions. Recent trucks have been designed to permit the wheels and axles to move laterally upon curves, but how much lateral play can be expected with a ¾-in. flange running in a 1-in. groove, admitting inequalities in track gage?

Check Cutting.—This is one more instance of skewed axles and unequal tires on the same axle, resulting in the wearing away of the back of the wheel flanges, as seen in Figs. 4 and 5, representing something like ¼ in. to ⅜ in. More serious still, however, is the wearing away of the check rails, necessitating the renewal of checks every twelve to eighteen months. Not only so, but the filings given off have a tendency (as will be readily understood) to get into the motors and bearings, causing further complications. The author finds that check cutting is not due to want of lubrication between the car-body and bolster of the bogie, as at first seemed apparent, but rather to the oblique running of the wheels and axles, especially with tires of different diameter on the same axle. This leads to another important subject, viz.:

Broken Axles.—Taking the case of axles which are not deficient in material and construction, the author has observed that these fractures occur on the geared side of the axle, where the shaft enters the hub of the wheel. A fractured axle appears to be short in the grain, as if all the nature had gone out of the steel. Samples of this material have been tested, and the tensile strength and ductility have been found to be up to the standard. On examination, however, it will be noticed that the complete break is composed of a series of short fractures, evidently caused at different times and places, round the outer circumference of the shaft, which cannot be observed outwardly with the eye or lens. The author is strongly of opinion that these fractures are caused by the skewed axles coming up to the curve at the wrong angle, as shown in Fig. 7, this occurring when the axle is rigidly held in position by the motor on the geared side. With such a deviation it is quite obvious that the flange of the wheel (especially the wheel nearest the gear) strikes the check rail violently on entering the curve, the blow being determined by the horse-power of the motor, speed, weight of the train or car, and leverage from wheel flange to axle shaft.

This leverage is also responsible for broken spokes in solid cast wheel centers of motor axles. This skewing of axles is quite apparent on short radius curves, the check rail showing a decided cutting away of the ramped part of the check as the wheel enters the curve. It therefore appears that the only hope of saving axles at the present time is to keep the power switched off the motors as far as possible when rounding curves, so that the axles can move freely to suit the circumstances.

Roaring Rails.—Roaring rails (so called) are found principally on Indian steam railroads, and, reviewing the evidence from that direction, we can only surmise that the trouble originates in much the same way as corrugation, viz., from defects in the rolling stock, such as excessive play at the journals or longitudinal play between the journal box and pedestal, which would in time, by constant hammering, cause the sides of the truck frame to spread outwardly, at the same time distorting other parts of the frame connected therewith. Such faulty truck design allows the centrifugal forces to center at various points in the truck, thereby shifting the center of gravity horizontally and causing unequal strains on the wheel flanges and unequal tires on the same axle. Consider a truck of this description when rounding a curve. The centrifugal forces acting on the vehicle and truck frame, the kinetic energy is being dissipated in taking up the play between the journal box and pedestal; the wheels and axles remain unsuited to the curve, the avail-

able momentum not being sufficient to carry them to the high side of the curve. This is more apparent on electric railroads by reason of the extra weight of motors on the axles, and consequent friction between wheel and rail—a further reason toward the early development of corrugation as compared with steam and cable railroads. (The above action of vehicles when rounding curves has already been confirmed with reference to flanged brake blocks.) The outer wheels must therefore lag and skid round the curve like the oar of a rowboat. Wheels of different circumference are formed, the two smaller wheels being on the same side of the truck, especially when trains or cars are run on the same route and in the same direction without being turned round, or where there are more curves on one hand than the other. This, then, ought to convince one that it takes time to distort truck frames on a new system—speaking generally, three years at the outside, if they are going to give at all. Once distorted, there is no difficulty in corrugating newly laid checked rails, a matter which by this time has come under the notice of most tramway engineers. In a similar way, you will find the two smaller wheels on the same side of trailing bogies on electric railways. Fig. 5 illustrates a typical example of two like pairs of defective wheels obtained from a strained trailing bogie or truck out of square. Now, if a train is composed of more or less strained trucks of this type, drawn by a locomotive, one might expect roaring rails, because the axles are free to lag and lock across the track gage on any part of the road, according to the varying circumstances of the wheel tires. On the other hand, if the same train is driven by geared motors, the power of the motor overcomes the tendency of the wheels to lag, which therefore run steadily though skewed and unchecked. It is only when such skewed axles meet check rails that the leading tires tend to groove-lock. Then it is that the two combined effects (i. e., the groove-locking and the wheel lag) are able to overcome the inertia of the motor, the opposing forces causing the axle to oscillate intermittently when checked. Hence corrugations can be produced at will, on checked curves or where check rails are used, be it on the straight or curved track. In the case of electric railways, any light depressions the trailing coach wheels might make on the rail are obliterated by the harshly acting and heavy motor coaches that follow. We therefore find no corrugations or roaring rails on the straight unchecked track of electrically operated railways. Roaring rails have most irregular ridges and hollows not confined to any one length, and quite distinct in appearance from corrugations, though caused by one and the same thing; add to this the climatic conditions and varying elasticity caused by the different qualities of ballast and packing, and we have a train supported by wheels of varying circumferences, unchecked in their career, lagging and hopping along a track consisting of inequalities in rail level. Hammered roaring rails are the inevitable result.

Elasticity and Vibration.—A great deal has been said about rail vibration. The author fails to see why an ordinary tramway rail, laid in solid cement, should vibrate, unless it is caused to do so by the hammering action of skewed wheels, locking and oscillating in the groove, which in turn sets up a vibration of the car and rail. Where deep corrugations have been found the vibrations set up in the rail by the car passing over it cause the sets or paving blocks to separate themselves entirely from the rail, the rail eventually becoming waterlogged. Similar cases will be found where cars when negotiating points and crossings have a tendency to gallop, due to the inequalities in the points and roadbed setting up a periodicity of blows that synchronize with the car springs. Whether this periodicity can be made to agree with the corrugations on the tongue of the points and rail remains to be determined. With regard to bridge-constructed railways, one can feel and hear the vibrations of the structure when the approaching train is half a mile off, yet there is not the slightest sign of corrugations on the straight track when no check rails are used. Take the average case of a tramway where the track is laid like an anvil, and the speed thereon is 10 miles to 12 miles per hour; you get corrugations of about 2-in. to 3-in. pitch. Compare this with elevated and bridge-constructed electric railways running at 30 miles to 36 miles per hour, entirely laid with ordinary railway rails on longitudinal sleepers supported every 2 ft. 6 ins.; you would expect to find corrugations in proportion,

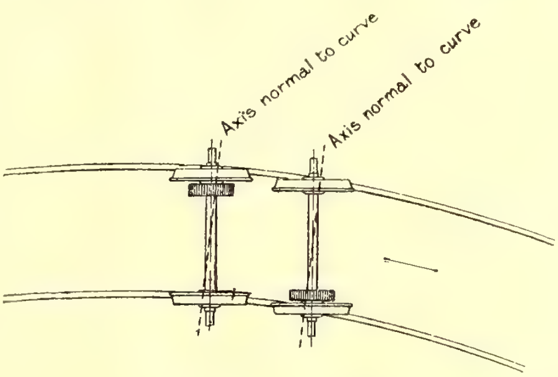


FIG. 6.—PARALLEL SKEWED AXLES

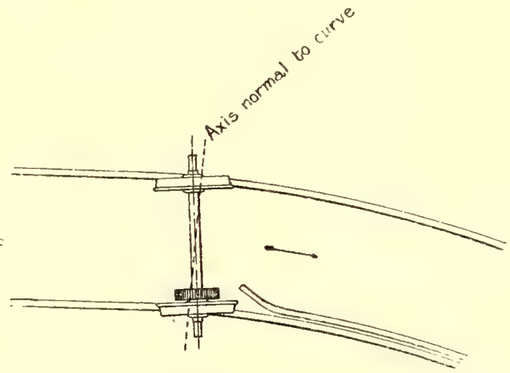


FIG. 7.—UNSYMMETRICALLY DRIVEN AXLE STRIKING GUARD-RAIL

say, of 6-in. to 9-in. pitch; as a matter of fact, the corrugations on the checked curves referred to exceed these lengths considerably, due entirely to the elasticity of the track both horizontally and vertically. Here it may be noted that the corrugations are shorter in wave-lengths at the joints than in the middle of the rail, depending on the rigidity of the joints and fish-plates in question. This proves that the wave-length of corrugation varies with the speed of the vehicle and track elasticity. Speaking generally, the composition of the metal and methods of manufacturing 7-in. girder rails in the early steam tramway days and to-day are not much different, unless it be for the better, yet rails manufactured by every firm in the world have given trouble through corrugations since the advent of electric traction, and rails that did duty for steam traction on being utilized for electric traction corrugated after a few years' service, thus showing that the change in the rolling stock is responsible for the corrugations.

Cable Cars.—We hear very little about corrugations with reference to cable traction, owing to the different method of applying the power to the axles. The speed not being high, the corrugations take considerably longer to form in the first instance, and are of smaller pitch compared with those found in connection with electric traction. There seems no reason for doubting that corrugations on cable roads are brought about by weak trucks on flat curves, as it is here that the greatest damage of all is done, forming the first factor in

making corrugations. The unequal wheels oscillating in the grooves form regular corrugations of definite wave-length, though the wheels are not so harsh in their movements as with geared axles, wherein the two forces are acting against each other. As the width of the check rail varies, so will the pitch of the corrugations. It also follows that as the longitudinal play of the axle increases, the corrugations will be formed at lower speeds. Hence the gradual extension of corrugations over the whole system, deeper at places according to the rail level and road camber.

Truck Design.—This matter of rail corrugation is now receiving the close attention of British manufacturers, the experience with early American designs and practice proving disastrous, as, in the hurry to secure cheap methods of production in order to compete with one another in foreign markets, the standard stamp of durability required in this country was not maintained. It follows, therefore, that a large percentage of the trucks under our street cars are not capable of meeting modern requirements, because of the inability of the frames to withstand side strains, so frequently found in city and suburban districts, where the flat curves (taken at a high speed) are usually frequent and of short radii. Such trucks may be cheap at the beginning, but constantly require repair, while at the same time they need more current to draw them, and are most expensive in the end, as many managers have learned to their sorrow. The present-day bogie truck frames of riveted and built-up construction, as used by most electric railway companies, carry the load in the center, and are themselves supported upon equalizing springs instead of on journal springs. This gives a short spring base for the frame, and in consequence, when the brakes are applied, the frame is pulled down at one end and pursed up at the other. The author has noticed frames tilting 3 ins. or 4 ins., bringing the life-guards down on the rail. This, of course, releases one pair of wheels of their share of the load, with liability at such times of derailment, especially with bogies fitted with one motor, where the total weights per axle vary. The tendency of this type of frame to tilt under brake action necessitates deeper flanges and wider treads than is practicable in electric services. The equalizing bar bears directly upon the axle box, and when the horn slides are worn the boxes take up a rigid position at an acute angle to the jaws of the frame, causing a binding of the boxes and producing the vibration so noticeable in trucks of this design. Hence the lurch and jerk so easily detected when entering a curve, which eventusually wrenches and jars the car-body and passengers, quickly straining the trucks, with consequent loss of squareness and friction in the journals and motor bearings. It is therefore necessary to give up the riveted and built-up construction of bogie frames, which are not capable of withstanding the excessive strains of single-ended gear-driven axles on modern high-speed electric railways. It is entirely due to the weakness in bracing the two sides together, especially under the axle box, that the present-day trucks are unable to withstand the severe side strain they are supbject to. It will therefore be necessary to supplement the present trucks with suitable under frames well braced on either side of the wheels (see Fig. 8, with upper frame removed), in order to prevent the spreading and buckling of frames now going on, which in serious cases may amount to 1½ ins. Adjustable thrust-plates have been tried by some of our prominent railways with little success, the tendency being to further strain the already strained trucks. A motor truck for modern electric interurban services on railways and tramways has to withstand more severe shocks, strains and vibrations (due to higher acceleration and retardation), and carries a much heavier load in comparison than the frames of locomotives or early tramways ever experienced. We must therefore turn our attention to stronger and more substantially designed trucks, with solid forged side frames, equally as strong under the axle box as over it, securely braced together, and capable of withstanding side strains and shocks in every direction, by the use of journal springs to bring the load to the wheels without interfering with the easy action of the boxes in the jaws, and, if possible, by equalizing the weight on the frame before it is equalized on the wheels. In cases where there is only one motor per bogie it is advisable to have the brake gear toward the inside of the frame (see Fig. 9). By this arrangement, the leverage is proportional to the weight on the axles, the total difference in weight carried by the motor and trailing axle varying from 3000 lbs. to 2 tons. This arrangement still has the disadvantage of throwing excessive wear and strains on one side of the jaws or horn cheek-plates, eventually causing skewed and binding axle boxes, so noticeable on tramway systems that have been running for some considerable time with trucks not provided with renewable horn cheek-plates. In the author's opinion, the time is not far distant when we shall have brake blocks on either side of the wheel, especially for street traction. The difficulty with horn slides would then be obviated, with a corresponding reduction in leverage and saving of labor on motormen. Regarding the possibilities of wheel skidding, a suitable tachometer or indicator fixed at each end of the car would give a visual warning to the motorman when the car wheels were skidding. Some careful observations have been made with reference to the effects of retardation on the rails. With heavy electric trains running at 40 miles to 60 miles per hour only barely visible wavy skin depressions appeared on the rails after a hard application of the brakes, the depressions being distorted and finally obliterated by the next train. Sudden braking operates unfavorably on the superstructure, in the sense that the rails are subjected to vibration, and consequently the substructure gets separated. This action has gone on for years at the same place without

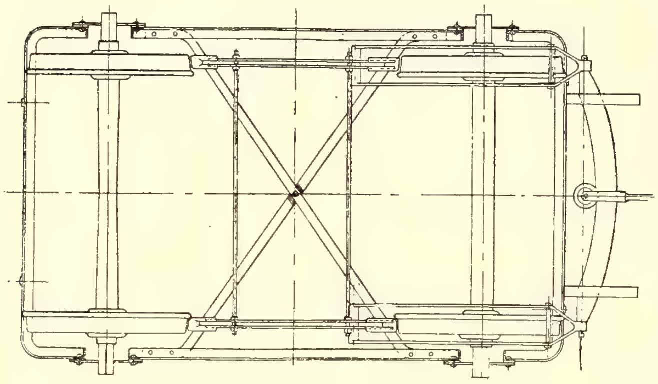


FIG. 8.—METHOD OF BRACING TRUCK

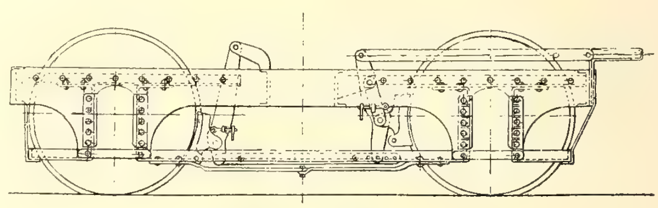


FIG. 9.—INSIDE HUNG BRAKE

creating any impression upon the head of the rail. There is therefore no ground for assuming that the application of brakes has any connection with corrugations or roaring rails.

To sum up briefly, corrugations are caused, directly or indirectly, by lateral play in weak trucks, the weakness being intensified by unsymmetrically driven axles. The whole question can, however, be finally settled and tested only by a full technical investigation carried out by the Board of Trade or a royal commission.

In conclusion, the author would point out that, however erroneous these observations may seem, and however crude the suggested remedies may appear, they are the direct result of practical experience gained since the year in which accelerated electric railway traction made a substantial start. The paper has been written as the direct result of several years' daily labor and thought, and is here submitted to your criticism as an earnest attempt to solve the vexed question of rail corrugations.

DISCUSSION

The discussion was opened by H. M. Sayers, who agreed with the author that corrugation was largely due to the rolling stock employed. All the causes mentioned by the author could be reduced to chattering actions—it might be said that vibrations of short period led to corrugation. Corrugations on one rail only were evidently due to torsional vibration, and generally appeared on the off-side or higher rail. The slight camber of a road often resulted in one side of the track being higher than the other, the latter taking extra weight and wear. He concluded that braking might sometimes cause corrugation, as at three of the Edinburgh cable tramway terminals, where brakes were applied, corrugations were well marked. He had noted on the Streatham route of the London County Council ten places where corrugation occurred, all but one being at a stop—this he believed due to alternate slipping and rolling of wheels under brake action. Wheel flanges were much too close a fit to rail grooves on tramways; it was impossible to compensate for curves by widening the gage, and the laying out of curves necessitated a careful study of the rolling stock. The ductile metal of the present-day rail was rolled up into hillocks, but if harder rails were employed this would not occur. He thought the hard rail was the cure for the trouble. Manganese assisted cold rolling, and even if its absence from the metal rendered the latter brittle, it was preferable in the end. The British Electric Traction Company's lines, constructed between 1898 and 1903, were laid with hard German rails and had not corrugated.

Prof. Carus-Wilson, in analyzing the causes of corrugation, said the latter usually appeared on curves of large radius, due to the skewing of the axles. The fact that an exchange of corrugated and non-corrugated rails in a track resulted in reversing the conditions of the rails, he thought, cleared the rail of blame. Tests showed that smooth rails were soft and roaring rails hard; the pitch of the corrugation dispensed with the suggestion of origin at the rolling mill gearing; from the irregular occurrence of corrugation, he suggested that it originated in the track laying, any irregularity in which might result in the car attacking a particular point on the track. Local conditions were the cause of roaring rails in India, and they were no doubt also partly responsible for corrugation over here. The author proved that distorted trucks were one cause of corrugation—but nothing further. He could not agree with the author that the distortion of the truck was due to side gearing, as both gear wheels were rigidly held in the motor frame, which took the reaction. He held that the corrugations on the Liverpool Overhead Railway track were not due to the adoption of side-geared in place of direct-driving motors, but were due to the 40 per cent greater speed of the newer stock with 100-hp motors, which gave 100 per cent greater flange action as the cause.

Worby Beaumont could not agree with any part of the explanation in the paper. He suggested that the origin of corrugation was the rolling action set up on a track by heavy loads on small wheels. The same action was used in manufacturing steel and other metals, and its recurrence under running conditions must have some effect. He was quite satisfied that rolling compression resulted in pushing the material of the rail gradually forward, and it was then compressed by the running wheel. The difference in pitch of corrugations was due to the quality of the steel.

Mr. Hawtayne agreed that quality of rail material had a good deal to do with the subject. He had used hard Belgian rails for six or seven years, and they had not corrugated.

INSTRUCTION IN COOKING BY ELECTRICITY

With the co-operation of the Union Electric Company, of Dubuque, the Woman's Club of that city has secured a series of fifteen lectures on household economics and cooking by electricity from Mrs. F. V. Sanborn, a well-known writer on domestic science. The first demonstration was given April 1 and was announced by handsomely engraved cards of invitation which were mailed to members of the club. The organization of this course was due largely to L. D. Mathes, the general manager of the Union Electric Company, who has been most assiduous in advancing the sale of current. Mr. Mathes is also president of the Dubuque Baseball League and incidentally the attendance at the ball games has increased materially the receipts of the street railway system.

MR. SHONTS ON NEW YORK TRANSPORTATION

Theodore P. Shonts, who recently succeeded August Belmont as president of the Interborough-Metropolitan Company, of New York, had an article in last week's "Harper's Weekly" on the New York rapid transit situation. He says that since coming to New York he has spent four or five hours each day riding on the subway, elevated and surface lines. He has therefore seen them at their best and at their worst, and admits there is reason for the dissatisfaction of the people with the present transit system. He then makes a strong plea for better facilities. Among the improvements especially necessary are additional tracks on the Second and Third Avenue elevated roads. These could be completed within eighteen months or two years.

The New York transportation companies themselves, however, will also test a number of improvements to better the transit situation. One of these is the introduction of side doors on the subway cars. The chief objection to this change at present is the fact that the station platforms in several instances are on curves, and the proper method of overcoming this difficulty is yet to be decided. Experiments will also be conducted with wider platforms and with pay-as-you-enter cars on the surface lines. A trial will also be made with a car which will refuse passengers after all the seats are occupied, although Mr. Shonts has his doubts as to the success of the attempt on the part of the company to enforce this rule.

SOME BRUSHHOLDER EXPERIENCES

BY HENRY SCHLEGEL

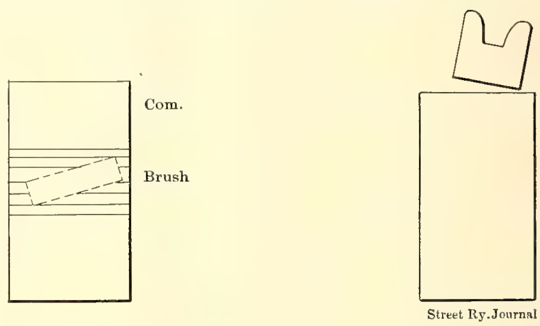
In the STREET RAILWAY JOURNAL of Sept. 8, 1906, under the caption, "Importance of Effective Brushholder Inspection," the writer discussed the several possible sources of error in the adjustment of railway motor brushholders and indicated the requirements of a holder that maintains the brushes in correct relative and absolute position for successful operation. The present article undertakes to give an idea of what may be expected and realized where brushholders are neglected or are maintained by incompetent labor unguided by the necessary jigs and gages.

It can be stated that a number of supposedly similar factory holders subjected to gage tests showed slight differences, but in no case observed was the error sufficient to justify condemning the holder. New factory holders will maintain the correct set for months, because they are made of well-seasoned, paraffined wood and the machines for making them are correctly set for turning out a great number. This cannot be generally said of home-made holders.

With brushes set properly, the brush tension can be made light, thereby conducing to the long life of the commutators as well as high car mileage for the brushes. On a road equipped entirely with factory output, troubles usually begin with flashovers on the road or rough handling in the shop precipitate the necessity for renewing or repairing affected parts. Independent holders of the Westinghouse type require, per se, no gage nor jig further than a square to see that the holder is not bent or otherwise distorted and a plug to try the brush-way for smoothness, trueness and size. The angular frame grooved seat against which the holder is drawn by the holder stud is supposed to insure radiality of the holder, assuming that the holder is true, and repair men are strongly impressed with the desirable feature of adjustment. Unfortunately this impression as generally received must be qualified, because drawing the holder down to its seat in the customary careless manner by no means insures proper adjustment and radiality of the brushes: this is on account of the roundness and obtuseness of the engaging angles on the holder and babbitted holder seat. Assuming the holder seat and insulating washer to be correct and free from burrs, bumps, swells and foreign matter that would throw the holder out of line, if while tightening the stud the holder be lightly shaken from side to side, it will draw down into its true seat and inspection of a new brush against which the commutator has been rotated will indicate the line of bearing contact to be down the center of the brush. On holders of the independent type a line down the bearing surface of a new brush or perfectly square wear of the old brushes is an indication of correct position of the brushes on the commutator. On holders of the yoke type this is not so because brushes are often square with each other, have the correct spacing and make full contact with the commutator, but both are too far over in one direction or the other, thereby causing the brushes to spark for one direction of motion of the car but not for the other. If the line of contact is in the center of bearing of the brushes, the adjustment may be accepted as correct.

If no special precaution is taken to have the apexes of the holder, insulator and babbitted seat coincide, on drawing home the brushholder stud these parts will bind slightly on the diagonal and thereby throw the brushes as much as 1½ bars out of the way, with sparking as a result. If the babbitted seat is not true or the insulation washer is not of uniform thickness, the brush adjustment will be in error. The only way to get the seats absolutely true is to use a babbitting jig preferably obtained from the factory; after securing a correct jig it should not be thrown around and allowed to lay where it will be run into by a truck or barrow or where a motor will be let down onto it from a hoist—a jig that is wrong is worse than no jig at all because it is misleading. Where a holder is so distorted as to throw the brushes across the commutator (Fig. 1) out of parallel with the commutator bars or one end of the holder is further from the commutator than the other (Fig. 2) the brushes are caused to wear more on one end than on the other and may confine the current to an area unable to carry it without sparking—the first impulse of the average repair man is to straighten the holder.

Before changing a holder in any way, proper steps should be taken to ascertain if the faulty setting of the brushes is or is not due to irregularity in the holder itself. Under no circumstances should a holder be altered until it is proven to be wrong. A simple way to localize the fault is to substitute a factory holder that is known to be right and that is reserved just for checking the condition of suspected holders. If the standard holder sets right, then the fault is with the suspected holder that is replaced; but if the standard gives the same evidence of error, the irregularity must be elsewhere—either in the babbitted brushing or insulating washer. In either case correction there means that distortion of the holder by bending to straighten (?) it has been wisely avoided. In testing the adjustment of any holder, care must be taken to see that the stud bolt is drawn sufficiently tight to draw all parts firmly to their seats, otherwise an apparent error in adjustment will be due to the operator and not to the holder. At times a holder will be found actually to need straightening—probably foolishly bent on a former occasion when the fault was really elsewhere. Bending a holder without firmly securing all parts except that to be bent annihilates the original dimensions and angles of the holder and distorts the brush-way so that it must be filed to pass the brushes freely.

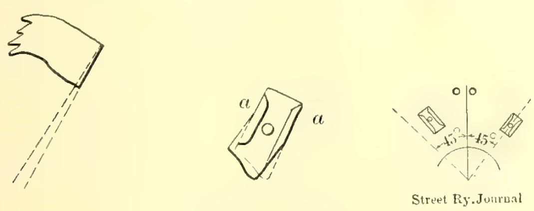


FIGS. 1 AND 2.

Another popular way of abusing the Westinghouse type of independent holder is to use a hammer and chisel for forcing the holder up or down on the insulating head when it is desired to move the holder in or out of accordance with commutator wear. This treatment burrs or swells the brass holder into the insulator, thereby so much increasing the interference between them that in future adjustments the holder must be removed from the motor—a feat that cannot always be accomplished without opening the motor frame. Such holders will go unadjusted out in the operating house, where the importance of brush adjustment is not generally acknowledged and where the general topography of the lower part of many cars may be such that it is impossible to adjust holders unless that can be done easily. For purposes of adjustment where the holder strongly resists being moved in or out on the insulating head a pair of tongs

similar to those used by a blacksmith to hold 4-in. to 5-in. stock can be used to advantage. The handles must be about 5-ft. long and the jaws shaped to suit the space conditions around the holder. To use this tool (Fig. 3) one jaw of the tongs is rested on the insulator and the other on the brass part of the holder, pressure being then exerted by resting one handle against the shoulder and pulling on the other; it takes a very obstreperous holder to withstand this pressure.

On all yoke types of holder the most prolific source of error is in the yoke itself, for if the yoke is wrong in the first place it will stay wrong and become worse, because where the proper precautions are not taken to prevent the yoke from shrinking as a result of the heat to which it is exposed, it will shrink and put the brushes in error. The guide mountings are also qualified to give much trouble. In some shops the guides on which the holders slide are bought finished and then mounted on the yoke; in other shops the rough castings are bought, then mounted on the yoke and afterward milled in position. Either method can be carried to successful results if proper care is taken, but it is very hard to maintain necessary care where the demand for holders is insufficient to warrant permanent setting up of the machines engaged in their making. It is difficult to keep the output from gradually drifting into error, assuming that all conditions are correct in the first place. As stated before, unless a great deal of care is taken to get thoroughly seasoned wood and to so treat it that it will not afterward absorb water, the resulting holders will warp and almost imperceptible warpage in the holder itself will introduce appreciable error in the set of the brushes several inches away (Fig. 4). The same, in effect, is true of the holders and the guides on which they slide. If the guides are not adjusted to a true right angle with the apex at the center of the armature, then will the brush-count increase or decrease with commutator wear, according as the apex is above or below the armature center. An error in the angle that the holders make with each other due to irregularity in the position of the guides is multiplied at the points where the brushes bear on the commutator. Where the finished guides are mounted on the yoke, there is liable to be error in the mounting; where the rough guides are mounted on the yoke and then machined, there can easily be error in the



FIGS 4, 5 AND 6

milling, either as a result of the machine being set up wrong or of the yoke being flimsily supported so that the cut runs off at the end, thereby producing a holder with curved guides (Fig. 5). If the guides are finished too narrow for the guideways on the holder, there results play which will introduce error in the set; if the guides are finished too wide for the guideways in the holder, either it will be impossible to install the holder on the guide or it will be installed against an interference that not only will give the brushes the wrong set but will so distort the guideways that they will have no precision in future. If the yoke goes out to a depot where everything that is done is done in a hurry and with no room nor light for working, the probabilities are that the holder will earn its right to the scrap pile.

Where the guide is too wide for the guideway, the tendency to file again asserts itself; in a depot this may be the only practicable way to get a much-needed car on the road; but in the shop no filing should be done until proper gaging shows which part is in error. It must be borne in mind that not only must the guides make a right angle with each other, but their axes must intersect at the center of the armature; furthermore the axes must make equal angles with a

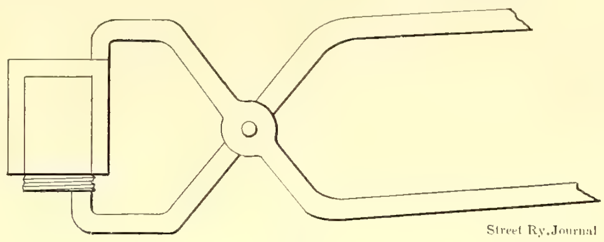


FIG. 3

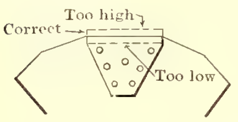
line drawn to intersect the armature center and the center of the line of support of the holder (Fig. 6), otherwise the brushes will spark in one direction of movement of the car but not in the other.

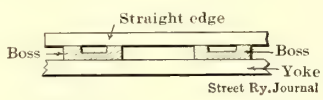
Assuming that the guides test to a true angle and that they are located symmetrically with regard to the center line but that on fitting them with holders, putting them in a motor and counting the set the brushes prove to be too far apart, the only thing to do is to reject the holder for correction. If, however, the error is such as to bring the brushes too close together, their distance apart can be increased to almost any reasonable degree (and without introduction of other errors) by inserting between the holder supporting bracket and the machined seat that it engages on the upper shell a fiber liner that is effective in moving the holder bodily downward. Before tightening the holder yoke, the holders must be loosened, because lowering the yoke moves them closer to the commutator, and if the yoke is tightened with the holders bearing on the commutator, the results will be misleading. The practicability of so correcting a faulty brush set is convenient in depot practice, but is not to be used in shop work. A yoke issuing from the shop should be per se correct in every respect. Such a feature suggests the possibility of error coming in as a result of the brushholder supporting bracket being planed off too much or too little (Fig. 7), the effect being to move bodily the yoke and holders nearer to the center of the armature or further from it, thereby introducing variations in the brush set. Unless great care is taken to mill the seat of the supporting bracket correctly the result will be to introduce error in a yoke that is otherwise all right. To illustrate the importance of this feature, it may be stated as a fact that a yoke and holders that give the correct brush adjustment when the armature bearings are new will bring the brushes too close when the bearings are worn, because such wear lowers the commutator bodily, thereby causing the brushholder axes to intersect at a point above the center of the armature. The effect of bearing wear is most noticable on motors the armature bearings of which are babbitted above the center to increase the life of the bearings. The change of brush adjustment may amount to as much as three-quarters of a bar. Brushes that are three-quarters of a bar too close together will give more trouble than those three-quarters of a bar too far apart; in fact, in one case within the writer's knowledge the behavior of a lot of GE-1000 motors, that were being abused, was much improved by setting the brushes more than a half bar too far apart.

In counting off the set of brushes it is important that the brushes rest parallel to the commutator bars, otherwise an

error in count is liable to obtain. The usual cause of error in parallelism is that the machined bosses (*a, a,* Fig. 5) against which the brushholder guideways bear are not in the same plane. On old yokes this may be due to the yoke having warped into a curved shape: the only treatment for such a yoke is to discard it. On new yokes the guides may be milled unevenly or they may set on the yoke unevenly; in any of these cases the effect is to have the brushes set crossways on the commutator bars, with the result that the brush, instead of short-circuiting two or three bars, will short-circuit from three to five bars and produce sparking in both directions. The test for evenness of the bosses on which the guideways rest is to lay a straight edge across them; the straight edge should touch every boss (Fig. 8). In milling the bosses in position, care must be taken that the yoke sets level so that the same amount may be cut from the bosses on both sides of the holder. In trying a complete yoke in a motor to count off the brush set, clean the frame seat against which the supporting bracket bears, because dirt or the remains of a liner formerly used there will cause error in the set.

Tests of a large number of carbon brushes show that the variations in their thickness are considerable, especially in the case of brushes due to different makers. When a shop man or depot man finds that a brush will not go into a brush-way freely, he immediately proceeds to sandpaper the brush to the required thinness; in doing this the copper plating intended to improve the contact between the brush





FIGS. 7 AND 8

and brushway is removed, leaving a tendency for heating to take place at this area. Aside from the question as to whether this detrimental effect attains a degree to be considered serious there is no question as to whether or not it would be well to have brush-ways and brushes of uniform thickness, and to this end gages should be used; if a brush is wrong, change it or use one the thickness of which is known to be right. If the brushway is too narrow, inspection will generally reveal some local imperfection that can be easily corrected. If the brushway is too wide the holder should be discarded, because where there is too much play between the brush and way the bearing surface of the brush wears to two surfaces at angles to each other—one surface for each direction of rotation, and not only changing the brush set but reducing the bearing contact to a degree that may cause the brush to heat. Brushes also may be thicker on one end than on the other, so that the brush may show some clearance when first installed, but as it gets shorter from wear and the thick end enters the holder there ensues a binding action certain to result eventually in a flash-over Excessive clearance between the brush and brushway is especially liable to cause trouble where no attention is given to adjusting the distance or clearance between the holder and commutator. This distance should be the least that will allow the holder to clear everything. On many neglected armatures in which wear in the thrust collars permits excessive end play, it is not practicable to run the brushes as near as they should because when the armature pulls over to the commutator end the holder will strike the commutator ear. Such a condition is generally indicated by a brush hanging over the end of the commutator or resting too far from it, and should be tested by forcing the armature as far as possible in both directions to determine the end play; in any case an armature with excessive end play should not be passed. A satisfactory clearance between the holder and commutator is 1/8 in. Satisfactory end play is 1-32 in. when the armature is hot and the motor cold. It is not uncommon to see the holders in a motor just from the factory almost 1/2 in. from the commutator. Another important feature much neglected is brush tension, that is, the tension of the springs that press the brushes down on the commutator. We are not in a position to recommend just what the brush tension per square inch of bearing surface should be, but feel safe in saying that on a good rail and with brush adjustment in all respects correct it need not exceed 5 lbs. per square inch. On rough rail abetted by absence of regard for brush inspection, the brush tension must be strong, otherwise brushes will jounce at joints and cause flashovers. When one knows that motors of the same capacity shipped to the same service by different companies vary as much as 50 per cent in the tension, it is hardly doubtful but that difference of opinion to be respected exists in regard to what the tension should be. All tension in excess of what is needed is expended in causing useless wear of commutator and brushes; brush tension, then, is evidently a condition worth considering. While the absolute tension per square inch under given conditions may be an open question, there is no excuse for having the tension of one brush on a motor 2 lbs. and that on the other 6 lbs. per square inch. There might be some difference in the tension to be recommended on holders of different types, because some are more effective than others; but this difference is not nearly as great, so far as the writer has been able to observe, as the differences that exist on the different brushes of the same motors where this feature has been neglected for years. As an instance, take the cases of springs of the kind used on the old No. 3 and the newer No. 68 Westinghouse motors; these give satisfaction and have done so for a long time or they would have been discarded. Where the spring is properly assembled and installed there is but slight variation in pressure between the two positions occupied by the finger when the brush is new and when it has been allowed to wear a safe amount; but if the contact finger be so made or so fastened to the spring that when winding up the spring to get the proper tension the hump in the finger is caused to bear against the side of the brush instead of the top the force conponent tending to press the brush to the commutator is small and a much greater total tension must be used. In getting this greater tension the tip is liable to be drawn over so far as to leave no finger room on the end for raising the finger. On brushholders of the General Electric type, using the spiral spring, once the proper tension (hence the proper size and composition of wire) has been selected, steps should be taken to maintain this selection, otherwise springs of various kinds, sizes and characteristics will creep into repair practice and cause uniform changes in brush tension.

Finally, a word about the number of brushes to be used in each holder. There are good motors with two brushes per holder and there are seemingly just as good motors with one brush per holder. The writer may be prejudiced in favor of two brushes because he once saw a lot of hill-climbing motors cured of bucking by substituting two brushes for one; but aside from prepossession in their favor, common sense seems to be on the side of using two brushes per holder. Two brushes certainly better tend to equalize general faults of adjustment and to secure a fairly good brush contact under conditions not to be obtained with a sin-

gle brush. When a single brush is stuck in one place it usually might just as well be stuck all over. With a single brush the effect of uneven brush tension on its two sides increases with age; with double brushes it remains the same. The fact that the manufacturing companies have practically adopted the double brush would leave little doubt as to which is considered the best; yet the operating companies in possession of motors provided with single brushes do not seem to be in any particular hurry to change. From the depot man's point of view consider a single wide brush with two contact fingers that do not stay raised; the brush man has to hold up both of them in order to withdraw or insert a brush. With the tension twice what it should be, the motor hot and the brush man in a position representing a compromise between rope walking and piano moving, evidence indicates that the pleasure is not all his and that those brushes will not be renewed any oftener than they need be; generally he will use his gas tongs to hold the fingers up and in doing so he runs the chances of getting a burn or shock. We consider it an advantage to have brush-holder fingers that have no neutral position because it is impracticable to leave them up. Where the brush is split it is easy to hold up the fingers one at a time. Where a single brush is wide and has two fingers that have no neutral position, renewals will be made as often as they should be.

Theoretically, on a four-pole machine the correct spacing of the brushes is one-quarter of the circumference of the commutator. Calling a bar and its mica body a unit, a circumferential count from the center of one brush to the center of the next should include one-quarter of the total number of units. On railway motors it would be impracticable to count from center to center, so the count is made from the inside edge of one brush to the inside edge of the next one; this is seen to be one-quarter of the total number of units less the number of units covered by two half brushes. Assuming the brush holder to be strictly correct, as the commutator wears, the count between brush centers remains the same, but the count between inside edges becomes slightly less because the bars get thinner and two half brushes cover more units to be subtracted. This difference is insufficient to make any practical difference except when data are being collected for making a gage or jig.

ATLANTIC CITY SELECTED FOR THE CONVENTION

Secretary Swenson, of the American Street and Interurban Railway Association, issued a circular letter on April 9, announcing the selection of Atlantic City, N. J., as the meeting place for the 1907 convention. The letter is addressed to the members of the American Street and Interurban Railway Association and its affiliated bodies, and reads as follows:

PRELIMINARY ANNOUNCEMENT OF THE 1907 CONVENTION, APRIL 9, 1907.

PLACE OF MEETING

The annual convention of your association will be held at Atlantic City, N. J., on Monday, Tuesday, Wednesday, Thursday and Friday, Oct. 14, 15, 16, 17 and 18, 1907. The days upon which the different associations will hold their meetings have not yet been definitely decided, but this matter will be given attention in the near future.

At the meeting of the executive committee of the American association, held in New York, on Jan. 28 last, convention matters were given considerable attention, and it was decided that the 1907 convention be held in the East, and preferably on the Atlantic seaboard. Special committees of the American Association and of the Manufacturers' Association were appointed to consider this matter and to decide upon the date and location. After a careful investigation, the choice was narrowed down to Norfolk (Jamestown Exposition), and Atlantic City. Both of these places were visited by the committees, and each has its peculiar advantages from the standpoint of taking care of this year's convention. On the whole, however, Atlantic City seemed to the joint committee to be the more desirable location, and it was therefore definitely decided upon as the 1907 convention city.

HOTELS

Practically the only criticism made in connection with the Columbus convention was the inadequacy of the hotel facilities. If any criticism of Atlantic City were made in this particular, it would be that there are too many large first-class and thoroughly modern hotels. Atlantic City can provide without difficulty at least 3000 rooms in the large beach front hotels, with from 1200 to 1500 private baths. In addition, there is an almost unlimited number of rooms in the best grade of side-street hotels, many of which are provided with private baths. The rates which have been obtained from thirty-five of the largest hotels, of which thirteen are on the ocean front, are the same as the rates guaranteed for the conventions of the Master Mechanics' and Master Car Builders' associations, which will be held in June of this year. The rates for one person on the American plan vary from \$2 to \$4 per day without bath and from \$3 to \$6 with bath. For two persons occupying the same room on the American plan, the rates are from \$4 to \$8 per day without bath, and from \$6 to \$10 (in some instances slightly higher) with bath.

EXHIBIT OF THE MANUFACTURERS' ASSOCIATION

The exhibit of the Manufacturers' Association has become a very important feature of the National Street Railway conventions. The 1907 exhibit will be located on the Steel Pier, which is within a few minutes' walk from the various beach hotels. It is expected that the Manufacturers' Association will have a larger and more attractive exhibit than that at the Columbus convention last year.

CONVENTION HALLS

A large convention hall, with a seating capacity of 800 people, will be provided on the Steel Pier for the opening of the American Association convention, and smaller meeting rooms will be available for the various sectional meetings of the American, Accountants', Engineering and Claim Agents' associations.

FURTHER INFORMATION

Additional information relating to the hotel and railroad facilities, convention halls and manufacturers' exhibits will be made from time to time in later convention bulletins. One of these bulletins will contain a diagram showing the location of each of the important hotels with reference to the Board Walk and the Steel Pier, together with complete information concerning hotel facilities, both on the American and European plans.

The secretary has also announced that the annual reports of the American, Accountants', Engineering and Claim Agents' associations are now in the process of binding, and will be distributed in the near future. One paper-covered volume of each of these reports will be supplied to each member company. In addition to the paper-covered volumes, the four reports will be bound in cloth in two volumes. The first volume will contain the American and Engineering Association reports, and the second, the Accountants' and Claim Agents' Association reports. The first will have a total of 720 pages, and the second of 601 pages.

The Conestoga Traction Company, of Lancaster, Pa., inaugurated a daily freight service on suburban lines April 2, putting six new large freight cars in use on the various lines. A new freight station has been established in Lancaster. Hereafter the company's passenger cars will carry no freight.

REPORT FROM NEW JERSEY'S PUBLIC UTILITY COMMISSION

The commission authorized by the New Jersey Legislature and appointed by Gov. Stokes in October, 1906, to investigate and report upon the feasibility of a law providing for a division of the profits of public utility corporations with the municipalities where they carry on their business, presented its report March 25. The desirability of having such an investigation was considered by the Governor in his message to this Legislature, where he referred to such a division of profits, and said:

Under such an arrangement, public corporations would not be regarded as private monopolies; they would be exempt from political blackmail; they would be free from the suspicion of corrupt legislation. The gain in public morals would be greater than the gain in public revenues. The practical details of the latter suggestion could be worked out only after careful study and investigation.

The committee appointed in accordance with this suggestion consisted of James H. McGraw, president of the McGraw Publishing Company, chairman; A. E. Beach and A. N. Barber. Frequent sessions have been held during the last six months, or since the appointment, and a careful study has been made of the laws of other States on this subject. The report follows:

REPORT

The plan proposed by the resolution suggests that the municipality and the corporation become or be made parties to an agreement by which, after the corporation has received from the operation of the utility under its control a reasonable compensation for the use of its capital in furnishing the service rendered to the public, any additional sum earned shall be shared with the municipality from which the franchise has been obtained.

It will be generally agreed that such an intimate financial relation between the municipality and the corporation, partaking of the nature of a copartnership, would, if based upon conditions mutually satisfactory and faithfully performed, establish the desirable status suggested by the Governor in his message. As, however, many binding contracts between municipalities and public utility corporations have already been made, and such contracts have not provided for a division of profits, it is evident that this general relation cannot be universally established by present agreement. If obtained it must be secured by legislation through which the State, in the exercise of its sovereign power, exacts the payment as a tax of a share of the dividends of the corporation. It would seem, therefore, that the plan submitted for investigation is intrinsically one of taxation, and its merit must depend upon the equity and uniformity of its application and upon the revenue it would produce.

PRACTICE IN MASSACHUSETTS AND RHODE ISLAND

With the object of securing guidance from experience and example, your commission has made inquiry as to the practice of other States, in order to ascertain to what extent, if any, the proposed plan has been adopted and the practical effect of its operation. So far as your commission has been able to determine, but two States have enacted legislation providing for a division of profits beyond a fixed sum, namely, Massachusetts and Rhode Island, and their enactments apply to street railway companies only.

In Massachusetts, street railway companies are required to pay, in addition to other taxes, a tax equal to any dividend paid in excess of 8 per cent, provided dividends averaging 6 per cent have been paid since beginning operations. This law was enacted in 1898, but up to the present time no dividends in excess of 8 per cent have been paid. The law has not, therefore, been productive of revenue, nor does it seem to be regarded as of practical benefit to the public revenues.

In Rhode Island the law provides for a division of dividends by street railway companies in excess of 8 per cent, without the allowance of a preliminary payment averaging 6 per cent, as in Massachusetts. This payment is exacted in addition to a tax of 1 per cent upon gross earnings. The provisions of the law apply to companies organized under the laws of Rhode Island and to lessees of roads, the lessors being exempt. It is, moreover, applicable only to companies accepting its provisions, and such companies if operating under limited franchises have the limitation removed.

The law went into effect in 1898 and from that year until 1903 no tax was paid except the 1 per cent upon gross earnings. In the year 1903 the Rhode Island Company, having leased the Union Company, the Pawtucket Company and the Rhode Island Suburban Railway Company, paid a tax of 1 per cent on gross earnings, and one-half of 1 per cent on dividends in excess of 8 per cent. In 1904 the same amount was paid. In 1905 ¾ per cent was paid, and in 1906 this was increased to 1 per cent.

The total amount collected was less than would have been obtained under a gross earnings tax equal to that levied last year upon street railway companies in New Jersey, and it would seem that the payment of the excess dividend tax might be evaded by a slight increase of capitalization by an operating company.

THE PROBLEM OF CAPITALIZATION

The consideration of a plan providing for a division of dividends, in excess of a reasonable amount, declared by public utility corporations, is closely related necessarily to the problem of their capitalization. It is generally believed that these corporations are often capitalized beyond the amount at which their properties could be physically replaced to-day, and this belief is unquestionably correct.

This excess capital has been regarded by some persons as entirely unworthy of consideration, and it is contended that the State would be justified in destroying its value arbitrarily by refusing to allow the payment of dividends upon an amount greater than would be required to reproduce merely the tangible property of the corporations. It seems to your commission, however, that the existence of a capitalization beyond an amount which would be required to replace the property is due to a combination of several causes, which should not be overlooked. The first of these is the new condition brought about by the adoption of electricity for the propulsion of street cars and for lighting, which, during the past fifteen years, has completely changed the physical characteristics of those industries. The whole equipment of the horse railways has been literally wiped out of existence. Power houses have been built, wires strung along the streets and highways, heavier rails have been laid and cars designed specially for electrical operation purchased. These expensive changes came so quickly, it is agreed they could not possibly have been provided for out of current earnings, and the capital of the companies has been necessarily increased to meet them.

The first electrical machinery, while crude, was very costly, and as the economic feasibility of electric railways had not been demonstrated, there existed grave skepticism among investors as to the value of the new securities thus created. To meet this condition bonds and stock were issued in larger volume and with less conservatism than would now be considered proper and advisable.

EFFECT OF MERGERS

Another contributing cause to increased capitalization has been the merger of different utilities in a common ownership, or under common control. When street railways were operated by animal power and confined entirely to cities, there was no obvious advantage in having all the railways of a municipality under the management of a single company. When, however, the motive power comes from a single source, and the powerhouse and the poles and wires are a necessary and expensive incident of operation, it is apparent that a strong incentive exists to prevent unnecessary duplication of equipment. If to this be added the fact that the same kind of energy that propels the street car, also generates the light used by the municipality in its streets, and the power utilized by the people in their factories and stores, the tendency is natural, indeed inevitable, to merge railway and lighting companies under a common control. Such mergers have been effected everywhere throughout the civilized world. While this process would tend to increase capitalization above the tangible property value of the corporations, it is undoubtedly true that stock has sometimes been issued in excess of an amount which would have been reasonable and conservative, to take advantage adequately of the changed conditions.

EFFECT ON SMALL INVESTORS

As a result there exists a large capitalization upon which no dividends are now paid, and the enactment of legislation providing for the division of dividends beyond a certain rate would not affect the companies which have issued these securities. Moreover, since all these non-earning securities have been widely distributed in good faith by those who believe in the stability of our laws, it does not seem to your commission that the State would be justified in arbitrarily destroying their value in the hope of obtaining a share of the dividends declared upon the residue. Such a course would not injure those responsible for the issue, who have long since parted with their holdings, and it is doubtful if the public would obtain any considerable advantage from an attempted confiscation of capital value. The smaller holders would sacrifice their investments, and their securities would gradually pass into the hands of those financially stronger, who would find it easier than ever to control the corporation, and might discover obscure channels for the diversion of profits to their own advantage, without being productive of any gain to the people at large. The rate of dividend is, however, so intimately related to the capitalization that, with varying amounts of capital representing tangible property and earning capacity of equal value, it would seem that the enactment of a law allowing only a fixed dividend rate and requiring an equal division of all profits in excess would be unjust to companies which have been comparatively conservative in their capitalization and as a consequence are able to pay dividends, as well as to companies earning better returns from skilful management and good service.

The State should carefully consider whether under its policy against over-capitalization, with a stringent law recently enacted to prevent it in the future, there would not be danger of punishing those who have been free from offense in the past. No legislation should penalize the effort after improvement, whether manifested by an individual or by a corporation.

HOLDING COMPANIES

There would be further complication with respect to the dividends of companies leased and operated by a holding company. Many of these companies have, as a condition of their leases, agreements on the part of the lessee to pay dividends upon their stock. With respect to two companies, the guaranteed dividend is in excess of 8 per cent. These companies seem to have been able to keep their capital account at a very low figure compared with the others. Aside from the exceptions noted, the guaranteed dividends of the leased companies run from 4 to 8 per cent. It is evident that if a law similar to that of Rhode Island or Massachusetts were enacted in New Jersey, requiring a division of dividends beyond 8 per cent, the leased companies, with two exceptions, would not be affected, and no return would come from the dividends declared on their capital stock. If the legal rate were made low enough to include all of these companies, the dividend would have to be placed at 3 per cent, which, as a rule of general application, could scarcely be considered reasonable. If, however, the lessors were made exempt and the tax collected from the excess dividends of the lessee, there would be no return whatever from the largest holding company in the State, the Public Service Corporation, as no dividends are paid upon its stock.

THE VOORHEES TAX LAW

The State could, instead of attempting to obtain a large proportion of a high dividend rate, impose a small tax upon low rates. This plan is open to the objection which applies to the other plan of profit-sharing, that it would tend to penalize the corporation with a fair and conservative capitalization. Such a method has already been tried in New Jersey, with respect to gas and electric light companies and was discarded.

Before the enactment of the Voorhees tax law, these companies were required to pay a tax of 5 per cent on dividends over 4 per cent. This was in addition to a tax of one-half of 1 per cent on gross earnings. In 1900, the last year of the application of this method, the total revenue from the above assessments was $37,459. Of this amount $9,114 only came from the dividend tax. Had the Voorhees act requiring a payment of 2 per cent upon gross earnings been in effect in 1900, the companies would have paid $113,375, or more than three times as much as the total amount collected from the tax of ½ per cent on gross earnings and the dividend tax combined, or more than twelve times the amount collected from the dividend tax alone. In 1905 the 2 per cent tax upon gross earnings of gas and electric light companies resulted in a payment of $205,013.

EFFECT ON LIMITED FRANCHISES

Any proposition to limit the dividends of public utility corporations must necessarily be considered with respect to the effect of the policy upon companies to be incorporated hereafter, as well as those already in existence. Most of the companies now in operation have franchises which have been granted in perpetuity. As all franchises granted hereafter must be for a limited term of years, and as the demand for public utilities will come from the more sparsely settled communities rather than from the large cities where the privileges of any value have already been disposed of, it would seem that any fiscal limitation now placed upon dividends would, unless the permitted rate is very high, prevent effectually the investment of capital in desirable new enterprises.

SCOPE OF THE PROBLEM

It will be seen from this brief discussion by your commission of some aspects of the problem, that it has simply outlined the innumerable methods and conditions that are involved in the essentially modern principle of intrusting to private corporations the supply of many of the necessities of existence. Few questions have more engaged the attention of legislatures and the thoughts of political economists in the last century than those connected with the fiscal regulation of this machinery of civilization, for the supply of comforts and necessities of recent creation; and even a superficial study of the laws, ordinances, inquiries, suggestions, schemes and treatises on the subject is an exhaustive task. In the foregoing discussion your commission has applied itself strictly to a categorical treatment of the recommendation dealing with a single point, but even this effort was found to involve a research into the whole body of fiscal laws as related to corporations and the communities they serve.

While this work has been conducted in the hope that some plan of profit-sharing could be devised which might be presented to the legislature as giving reasonable assurance of public benefit, the commission is of the opinion that the enactment of legislation along the line suggested would be inexpedient. Aside from the fact that no revenue has been obtained in Massachusetts from such a law; that in Rhode Island the payments have been small, and by a single company, which is otherwise taxed much less than are similar companies in New Jersey, fundamental objections to the proposed plan seem to be as follows:

1. Owing to different degrees of capitalization representing property values and affecting dividend rates, the law would be unequal as a rule of taxation.

2. It would not be productive of revenue, except in isolated cases, unless the rate of dividend allowed the corporation be placed below that at which money is ordinarily invested without risk.

3. It would place at a disadvantage independent companies as compared with those leased and operated by holding companies.

4. It would, except in populous centers and in its application to very valuable grants, prevent a sufficient return to attract the investment of capital in limited franchises and tend to give monopolies to corporations now holding franchises granted in perpetuity.

TAX ON GROSS EARNINGS

Your commission is strongly inclined to believe that the method of taxing the gross earnings, as employed in this State, should be maintained and continued with as much freedom as possible from complication. This method is entirely free from the effect of different degrees of capitalization, and quite independent of the dividend-paying capacity of the corporations.

The question of the taxation of public utility corporations, however, is but one phase of their many-sided relations to the public. It should be recognized that, after all, the public is the sole customer of public utility corporations, and that the revenue to meet expenses of operation and necessary renewal or equipment, as well as taxes, must come from the charge made to the public for service.

THE PUBLIC NECESSITIES

The function of public utility corporations in the opinion of your commission, is not so much that of an agent of the municipality employed for the purpose of increasing its revenue, as it

is a servant of the public to which certain functions have been relegated, and thus existing for the purpose of supplying needed service as efficiently and cheaply as possible.

It is the conviction of your commission that the great body of the public is primarily and vitally interested in the quality of the service given, and that this service should be adequate, quite irrespective of the dividends paid by the corporations or of the fiscal receipts of the municipalities.

An abundant supply of cheap, pure water, adequate trolley service, with cars running frequently in congested districts and extended to join urban and rural communities; gas and electric light supplied at fair prices, of proper quantity and quality to meet the public needs—these are matters of daily concern to the people.

While these features of the public utility problem suggest themselves as worthy of serious consideration, the necessity of reporting to the present legislature has prevented the commission going beyond the duty directly imposed upon it. It is believed, however, that the important question of improving and developing the service given by the public utility corporations might properly be made a subject of study and investigation to the benefit of the people.

Respectfully submitted,

JAMES H. MCGRAW, Chairman,
A. B. LEACH,
A. N. BARBER.

GASOLINE TOWER WAGON

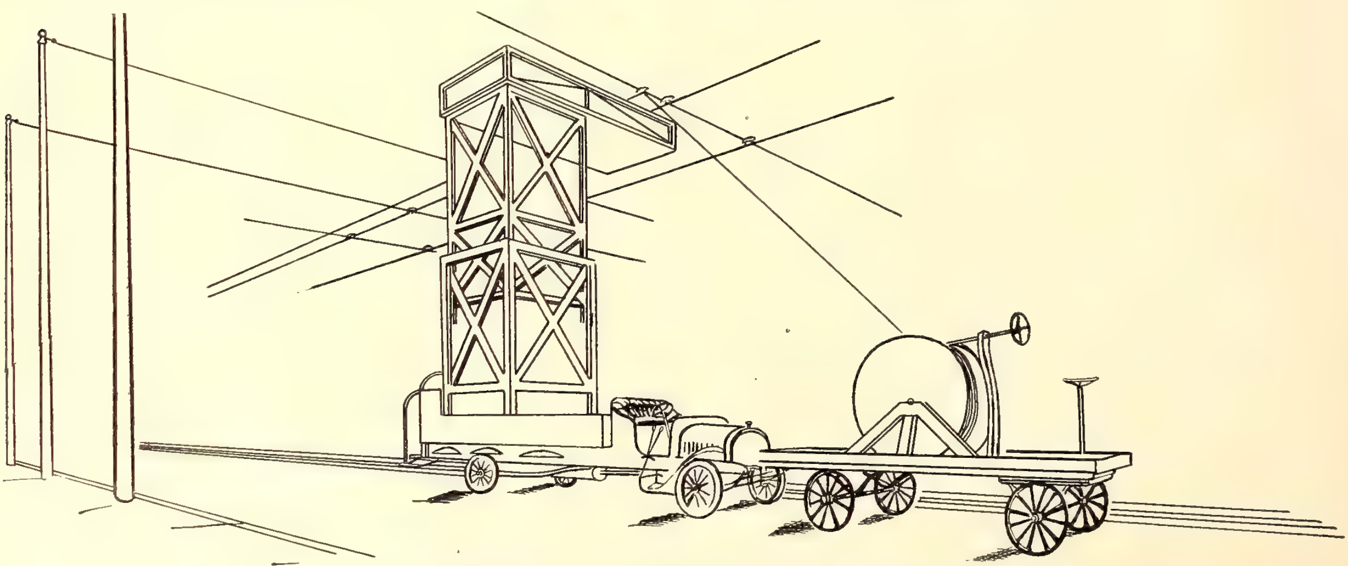
BY A. M. GRANTHAM
Superintendent of Construction and Purchasing Agent, Toronto Ry. Co.

The Toronto Railway Company has recently put into commission a gasoline-driven automobile type of tower wagon for overhead construction and repair work. The special advantages of a motor truck of this description are speed, steadiness in starting up, ease of motion, dispatch in retrograde movement, ability to keep to a straight line in forward or reverse direction, as well as the desirability of being independent of horse flesh, and the ability to keep a wagon in commission continuously.

In point of economy, a comparison between a horse-driven vehicle and a gasoline motor would be somewhat as follows:

HORSE-DRIVEN VEHICLE			GASOLINE WAGON		
Original cost of three horses (team and one spare), say		$750			
Original cost of one wagon and tower		500			
Total first cost.......		$1,250	Total first cost...........		$3,600
Annual depreciation on horses, say.....	$100		Annual repairs to outfit, including tires, etc.	$300	
Annual depreciation and repairs to wagon	200		Depreciation, allowing for new outfit in seven years.....	500	
Annual keep of horses	500		Gasoline and oil consumption	150	
Harness, etc.	50				
	$850			$950	
Capitalized at 5 per cent..		$17,000	Capitalized at 5 per cent..		$19,000
		$18,250			$22,600

TORONTO GASOLINE TOWER WAGON



GASOLINE TOWER EQUIPMENT IN SERVICE WITH REEL WAGON

As two gasoline wagons should easily do the work of three horse wagons, there is probably an actual saving financially to be shown in favor of the power outfit, not to mention the convenience in operating and handling and space saved in stabling horses.

For use in stringing trolley wire the Toronto Railway Company has devised a reel truck with steering handle that may be either pushed ahead or behind by the motor. The wire from the reel leads up over the tower, where it is fastened to the span. While there may be some difficulties to be overcome in the operation of this truck, it should work out ultimately a most expeditious and economical manner of doing work. The body and tower of the motor were built by the Toronto Railway Company to designs which were considered best adapted to the conditions. A sketch plan of the arrangement is shown herewith, and also a photograph of the motor.

The details of the motor chassis imported by the Dominion Automobile Company, of Canada, from Switzerland, are as follows:

TYPE H 20-HP TRUCK

Motor (foreign rating.—Two separately cast cylinders, 120 x 150 mm., 16 hp. when running at 900 revolutions, valves interchangeable and mechanically operated. Patented device for operating admission and exhaust. Minimum revolutions 200, maximum 1400 revolutions per minute. All working machinery protected from dust. The crank shaft made from the very best chrome nickel steel.

Carburettor.—Mechanically operated and hot-water jacketed.

Transmission.—Selective type; four speeds ahead and one reverse; direct drive on high speed. All gears made of very best chroma-nickel steel.

Brakes.—Three, working independently. One hand-lever brake, working directly on the hubs of the hind wheels. The second, a ratchet brake, working by pedal on differential. There is a third brake which works very regularly on the motor by means of closing the inlet valves.

Drive.—Bevel gear with spur gears and interior teeth on brake drums.

Radiator.—Honeycomb, Mercedes type.

Axles.—Both front and rear forged from solid steel.

Ignition (double).—By high-tension magneto and commutator.

Pump.—Gear driven.

Wheels.—Artillery type with solid rubber tires.

Chassis.—Channel steel.

Wheel Base.—3 1/5 meters.

Steering.—By irreversible worm and sector.

Tank.—20 gals. Capacity. Red copper, riveted and brazed.

Weight.—3200 lbs.

Load.—2½ tons.

Speed.—3, 6, 10 and 18 m. p. h.

NEW YORK CITY STATISTICS

The Railroad Commissioners of New York State have issued a summary of the cash fares, transfers and car-mileage of the surface, elevated and subway lines in the five boroughs of New York City for the year ending Dec 31, 1905 and 1906. These statistics are given below:

	Cash Fares		Transfers		Car Mileage	
	1905	1906	1905	1906	1905	1906
Manhattan	745,896,116	811,477,337	166,125,312	191,350,671	149,334,212	154,217,602
Brooklyn	372,584,004	409,596,164	85,225,129	134,694,923	67,943,149	73,504,028
Bronx	25,002,165	34,813,555	15,356,061	15,371,827	6,403,478	8,182,551
Queens	19,493,173	23,444,906	3,695,954	4,627,586	4,244,982	4,979,005
Richmond	8,176,240	9,763,012	792,968	1,287,274	2,323,634	2,631,218
	1,171,151,698	1,289,094,974	271,195,424	347,332,281	230,249,455	243,514,404
Increase		117,943,276	....	76,136,857	....	13,264,949

RESULTS IN MARSEILLES

When the city of Marseilles contracted with the Compagnie Génerale Française de Tramways for the construction of a complete electrical transit system, the terms of the concession attracted considerable attention, as they provided for: First, 2-cent fares (10 centimes); second, an annual minimum payment to the city of $19,300 plus 1 per cent of the annual receipts when such receipts should exceed $1,930,000, this percentage to increase with each million of additional receipts until the total receipts would amount to $2,316,000, at which time the city's share should remain stationary at 3 per cent; third, reversion to the state of all rights and full proprietorship as to tracks, wires, and other material occupying the public thoroughfares, at the expiration of the concessionary period of fifty years.

Year.	Length of Lines in Exploitation.	Number of Employees.	Mileage Traveled.	Number of Passengers.	Gross Receipts.
	Miles.				
1900	44.98	2,196	5,845,152	42,243,060	$876,055
1901	50.39	2,125	6,730,243	48,581,585	1,019,539
1902	62.91	2,047	7,875,289	61,180,191	1,240,995
1903	64.70	1,763	8,387,623	64,605,692	1,317,869
1904	65.56	2,170	9,309,421	70,782,479	1,430,959
1905	73.00	2,400	10,664,306	77,176,908	1,550,183
1906	76.56	2,400	12,016,661	88,943,150	1,781,994

The company possesses similar concessions at Marseilles, Nancy, Havre, Orleans and Tunis, but the Marseilles system is by far the most important. The company, which was capitalized at $4,825,000 in 1891, has now increased its capital to $8,106,000, divided into 84,000 shares of $96.50 each, and has also issued $6,967,300 in 4 per cent bonds and $205,641 in 3 per cent bonds. The 4 per cent bonds are now worth in the open market $95.44 and the 3 per cent bonds $81.44. The shares have paid interest regularly for the past seven years as follows: 1900, $3.86; 1901, $4.34; 1902, $4.34; 1903, $4.82; 1904, $5.31; 1905, $5.31, and 1906, $5.31. There is now some talk of a $5.79 dividend for 1907, but this is hardly likely. The shares are now quoted in the open market at $123.52, which shows that the enterprise has been entirely satisfactory from the investors' point of view.

The results to the public have been these: The city enjoys the use of a street railway system which is probably as complete as any in Europe. The rolling stock is by no means as elegant as in many American cities, but the cars are substantially constructed and answer all practical purposes. The tracks reach out in every direction and converge into the heart of the business district. While no transfers are allowed, the fares are uniformly 2 cents, with the exception of one circular excursion route along the sea front, upon which 3 cents are collected. Very general use is made of the service and owing to the low fares cars are taken for distances so short that otherwise they would be covered on foot. Electricity replaced horse cars and omnibuses in 1900, but the new system was not completed until 1902. A table of statistics is published showing the length of the lines, number of employees, mileage traveled, number of passengers carried and the gross receipts since 1900, when the 2-cent service was partially inaugurated.

INTERPOLE MOTORS FOR BOSTON

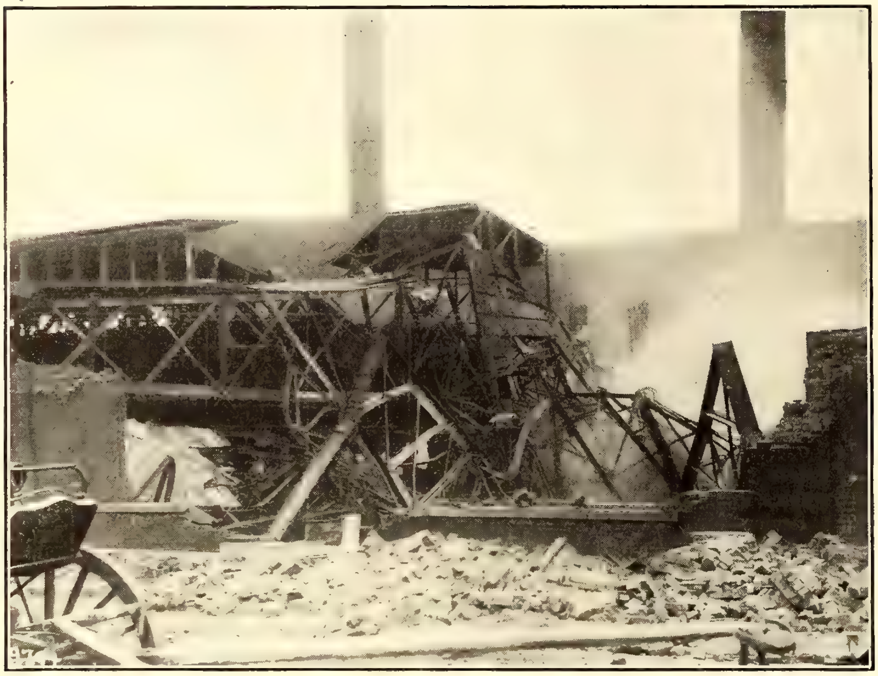
The Boston Elevated Railway Company, which has been a pioneer in so many departments of the transportation business, will be the first to employ on a large scale interpole railway motors. The company has recently ordered from the General Electric Company 100 quadruple car equipments for its surface cars. Each car will be equipped with four GE 202 motors with type M control. Each motor is rated at 50 hp, and is designed to operate at 600 volts; is provided with interpole field windings, and is fitted with steel gear and pinion with a gearing ratio of 71:15. The armatures will be of the drum type with three turns per segment. The weight of each motor is 2700 lbs. These motors are purchased under three guarantees, namely, (1) that they shall commutate successfully in operation; (2) that they are to commutate successfully with a full-load current on a stand test at 750 volts; (3) that when running on the stand test at 750 volts they are to withstand interruption and reapplication of the full-load current without flashing over or serious arcing, the duration of the break to be 1 to 5 seconds..

The practical results in operation with these motors on the surface system in Boston will be watched with interest by electric railway engineers throughout the United States.

The new cars of the Ohio River Railway Company and the Youngstown & Ohio River Railway Company are being fitted with mail compartments.

DISASTROUS CAR HOUSE FIRE IN NEW YORK

Fire, which broke out at 2 o'clock a. m., Monday, April 8, in the combined power and car houses of the New York Railway Company, at Seventh Avenue and 145th Street, completely destroyed the structure and its contents. The fire started in the end of the building used for the storage of cars at Lenox Avenue. In the Seventh Avenue end of the building was the power plant.



A PICTURE TAKEN AT CLOSE RANGE, SHOWING THE DAMAGE DONE

It was by far the most disastrous fire and heaviest loss the company has ever suffered. The north and west wings of the plant, which occupied the entire square block bounded by 145th and 146th Streets, Lenox and Seventh Avenues, with the exception of a strip 100 ft. deep on Seventh Avenue, are completely wrecked. General Manager Root, after a careful examination of the ruins, ordered the power plant shut down, and power was supplied from the company's other houses. Two large cracks were found in the north wall of the dynamo room, and it was feared that if the machinery was kept in motion it might cause the wall to collapse. The work of shoring the wall up with timbers was begun immediately after the flames were quenched.

Some of the records of the company were destroyed in the fire, but an inventory of the damage places the total loss to stock and building at $1,500,000. So far as the company has been able to learn, a total of 317 cars was destroyed. Included among them were 156 box cars, 74 combination, 61 open, 14 sweepers and 5 plows. Seven miscellaneous freight and other cars also were burned.

THE SITE OF THE FIRE IN NEW YORK AFTER THE WALLS FELL

The pictures show very clearly the havoc wrought by the flames, which spread with great rapidity. A particularly

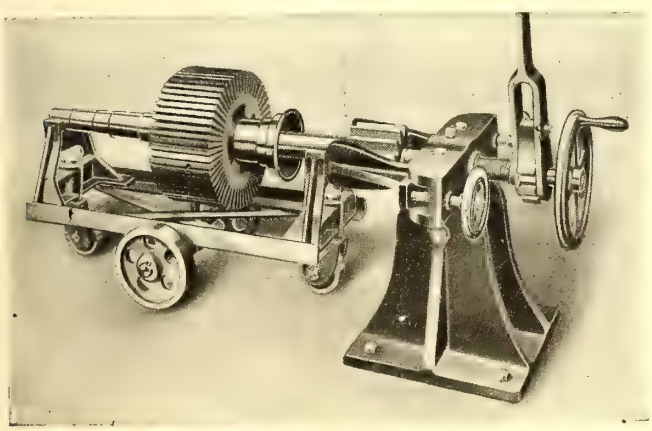
A VIEW OF THE DESTROYED NEW YORK CAR HOUSE BEFORE THE FIRE WAS OUT

distressing feature of the fire was the loss of a fire chief, who was buried in the ruins of a falling wall.

AN EFFECTIVE PINION PULLER

The Columbia Machine Works & Malleable Iron Company, of Brooklyn, New York, has recently added to its long list of railway shop appliances a small but powerful pinion puller. This device was first shown at the Columbus convention of the American Street and Interurban Railway Association, where it created such a favorable impression that the manufacturer received quite a number of unsolicited orders before beginning to push the sale of this puller.

As shown in the accompanying cut, the mounted armature and pinion are brought to the machine on an armature buggy. The pinion is then arranged to come between a pair of grippers, each of which is controlled separately by a small hand wheel to permit adjustment for any size of pinion or wiping ring. Injury to the armature shaft center is prevented by the loose steel center of the screw shaft, which is adjusted by the large hand wheel. As soon as the pinion has been properly gripped a ratchet lever about 4 ft. 6 ins. long is applied on the main screw shaft by two men. The leverage thus secured approximates a pressure of 60 tons, which should be sufficient to remove any pinion within a minute.



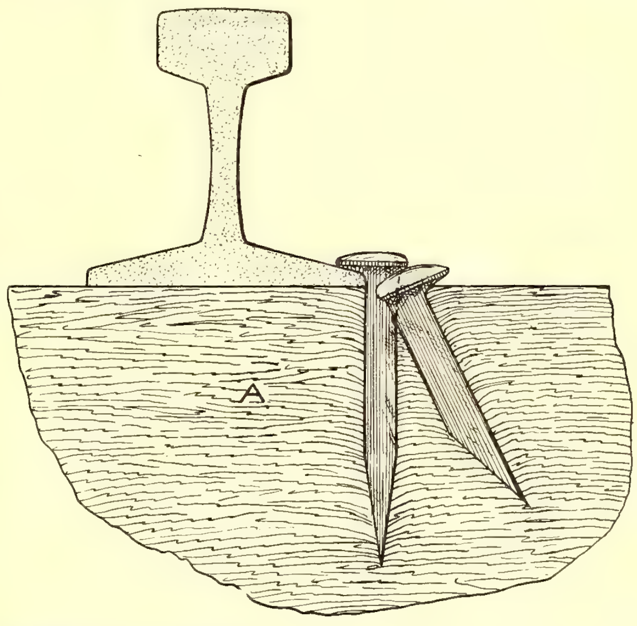
AUTOMATIC TRUCK AND PINION PULLER

In general, this tool is substantially built with due regard to the strains it must endure in service. The main screw is built of 2-in. steel with a 4-in. phosphor bronze nut as end bearing. The grippers and yoke are of crucible steel.

THE SPIKE STRUT RAIL FASTENER

The Maryland Railway Supply Company, of Baltimore, has devised a new rail fastening called the spike strut, which consists of a spike with a recessed head and a bevel to permit it to take an angle when drven in the tie. Assuming that the rails have been laid to gage, this spike strut is placed in the tie about the width of a spike from the base of the rail, and is driven straight until the head is within an inch of the top, after which the bevel will cause the spike strut to take the proper angle. The regular track spike is then inserted through the recess in the strut and driven until the two heads come in contact. Upon this both heads are driven together until the track spike firmly overlaps the base of the rail. The spike strut should be placed on the outside of both rails and about three to the rail, on the inside.

It will be seen from the foregoing description that this strut is intended to fulfil the function of a tie-plate or rail brace. The maker asserts that it will keep the track to gage just as effectively for one-fourth the average cost of the plates or braces. The spike strut should hold the track absolutely to gage, because it shores up the head of the regular track spike. The tendency of the rail to move outward under the wheel pressure causes the upper end of the rail spike, which overlaps the base of the rail, to tilt backward. This tendency naturally will work the spike loose in time and render it useless. In addition to this upward movement, the vertical pressure on the rail and tie simultaneously causes both to be depressed, but as the rail is more resilient than the tie, there results an upward pull on the spike head. The spike strut prevents the loosening of the spike as it holds up the spike head in the same manner as an inclined prop shores up the top of a post.

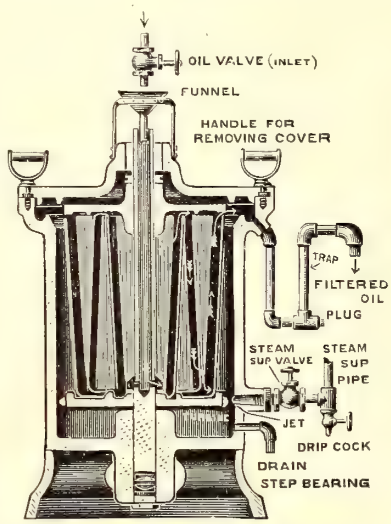


SPIKE STRUT, SHOWING UP HEAD OF REGULAR RAIL SPIKE

The application of a strut of this kind would seem particularly desirable on curves or at other points, such as rail joints, frogs and switches, where the track undergoes great strains.

A TURBINE CENTRIFUGAL OIL FILTER

The Oil & Waste Saving Machine Company, of Philadelphia, has brought out a novel centrifugal oil filter which is operated on the steam turbine principle and requires no care except to turn the steam on and off. The oil is run into the filter through the shaft of the turbine while in operation. It is then sprayed on to the filtering cloth and filter paper, which is revolved by the turbine. The centrifugal force carries the oil through the filtering materials over the cones to the outlet.



TURBINE CENTRIFUGAL OIL FILTER

The oil continually passes through clean filtering material, because as soon as the filtering materials become dirty or dammed up at the point where the first material is exposed, or near the spray, it takes a new course through the clean filtering materials. This is a great advantage over other filtering processes, as in them the filtering materials are all exposed at once to the dirt in the oil.

The filter can be taken apart in a few minutes and the filtering materials cleaned and reused continually excepting the paper through which the oil passes. This paper is so cheap it is hardly worth using again.

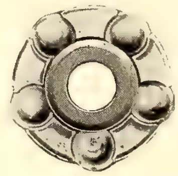
THERMIT WELDING FOR REPAIR WORK

The Goldschmidt Thermit Company has recently issued a handsome pamphlet descriptive of its thermit welding process for repair work and other uses than rail welding. The first portion of the publication is devoted to the application of thermit to welding broken shafts, stern frames and propeller bearings of steamships. For this purpose the material has been extensively applied both abroad and in this country. Views are given of both before and after welding of broken parts of the steamships Frederich der Grosse, Sevilla, Apache and other ships to which the process has been applied. In all cases a very great saving of time over other methods was secured.

The concluding portion of the book relates to steam railroad repairs. Since the introduction of the process in this country it has been employed very extensively for welding broken locomotive frames and locomotive rods. Among the large railroad companies of the country which are using it for this purpose are the Atlantic Coast Line, Southern Pacific, New York, Ontario & Western, Central Railroad of New Jersey, Pere Marquette, Chesapeake & Ohio, Seaboard Air Line, Denver & Rio Grande, and Long Island Railroad. The book contains testimonials as to the value of thermit for repair work from superintendents of motive power or master mechanics of each of these companies, as well as views showing different stages of the work. The pamphlet also announces that after May 1 the New York office of the Goldschmidt Thermit Company will be at No. 90 Wall Street, New York City.

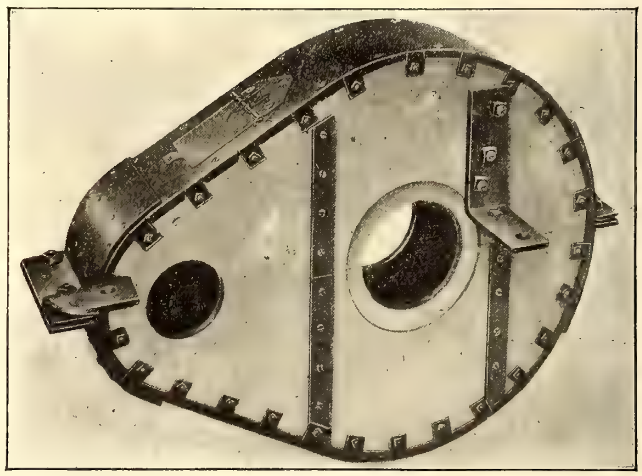
BALL BEARING SKATES WITH SPECIAL RETAINERS

A line of roller skates intended primarily for rink use has been developed by Barney & Berry, of Springfield, Mass. In their design strength was the main consideration, and the frame is formed of two pieces of special cold-rolled sheet steel, so placed as to take the greatest strain edgewise. Top plates of special cold rolled steel in various forms are so attached to the plates as to give additional strength. A brace supports the end of the toe-plate and insures against weakness. The ball cups are of carbonized steel of special pattern, attached to the rolls, but readily removable. The balls, of ¼ in., are set in a special retainer which increases their durability. In fact, the cones of carbonized steel to which the balls are connected by means of the retainers make a convenient self-contained outfit which outlives numerous rolls. There is no losing of balls with this arrangement; neither is there any need for frequent adjusting.


BALL-BEARING RETAINER

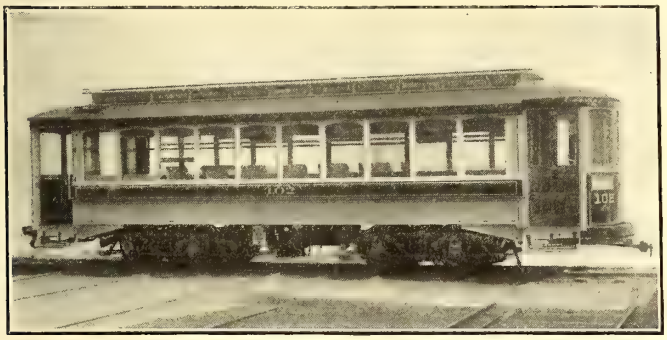
COMBINATION STEEL AND WOOD GEAR CASE

As a manufacturer of a wide line of railway specialties, the Columbia Machine Works & Malleable Iron Company, of Brooklyn, N. Y., has kept in close touch with the experiences of many electric railways which have tried to lower their gear-case account by using either wood or combination cases. The result of this observation has led the company to design an exceptionally strong gear case. The body of the case is made of a light but strong, well-seasoned wood; the back, which conforms to the shape of the gear and pinion, is made from pressed sheet steel flanged over the edges, thus making the case dust, oil and water-tight. The connection between the flanging and the wood is supplemented by bolted side lugs in addition to the screws around the edge of the wood. The sides are stiffened by extra iron straps, while each end of the case carries an extra reinforcing plate as shown. The hangers are made of wrought iron and are attached to distribute the weight with the least strain to the case. Other features of this gear case are its horizontal division and the top door which permits easy access to, and lubrication of, the gears.


WOODEN GEAR CASE REINFORCED WITH IRON

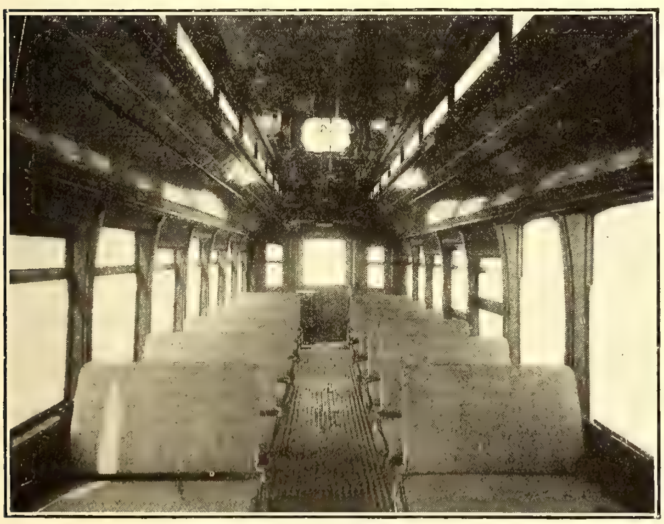
SEMI-CONVERTIBLE CARS FOR ORANGE COUNTY TRACTION COMPANY

The Orange County Traction Company, at Newburg, N. Y., has received from the J. G. Brill Company some groove-less-post semi-convertible cars for operation on the inter-urban branch of the system connecting Newburg and Orange Lake Park, a distance of 6 miles. This park, while very well endowed by nature, has not heretofore been developed by the company to any great extent, but it is now the scene of considerable activity. Visitors there this summer will find a fine, commodious theater in connection with which some first-class engagements have been booked, and a number of other amusement features. The boating and bathing facilities, which have always been good, will be better than ever this year. During the winter the company made good use of the park by building a toboggan slide which carried "passengers" over a stretch of ice half a mile in length. The venture proved a great success, the sport being indulged in by thousands.



EXTERIOR OF NEWBURG CAR

The car illustrated is one of the four double-truck cars which the traction company has just unloaded. The main exterior features are familiar to readers of the Street Railway Journal. The window system permits of a seat 36 ins. in length and aisle space 22 ins. The rattan seats, which are of Brill make, have corner grab handles and adjacent arm rests. The seats in the corners run longitudinally, each occupying the space of two windows. The lighting system calls for two rows of lights down the ceiling. The interiors are of cherry, ceilings of birch. In addition to these double-truck cars the company has received ten 20-ft. 8-in. cars mounted on single trucks of the 21-E type. These are of precisely the same type as the larger cars, and the specifications called for the same finish and equipment. Thirty-eight cars in all are now operated. They include standard open and convertible cars in addition to the semi-convertibles. The chief dimensions of the double-truck cars follow: Length over end panels, 28 ft.; over crown pieces, 37 ft. 5 ins.; width over sills, including sheathing, 7 ft. $10\frac{1}{2}$ ins.; size of side sills, 4 ins. x $7\frac{3}{4}$ ins.; end sills, $5\frac{1}{4}$ ins. x $6\frac{7}{8}$ ins.; sill plates, 12 ins. x $\frac{3}{8}$ ins. The specialties of car builder common to both lots of cars are the sand boxes, angle-iron bumpers, gongs, signal bells, steps, etc.



INTERIOR OF NEWBURG CAR

IMPROVED LAMP GUARD

W. N. Matthews & Bro., manuacturers of the hold-fast lamp guard illustrated on page 484 of the Street Railway Journal for Sept. 29, 1906, have made an improvement in this guard by using No. 14 B. W. G. wire in the spiral to hold the lamp in place. This spiral holds the lamp flexibly and prevents it from being broken when it is hit against the wall or any other object. The manufacturers state that they are supplying these holders in large quantities to the Public Service Corporation, of Newark, N. J.; the International Railway Company, of Buffalo, N. Y.; the United Railways Company, of St. Louis, and several other important companies, who find this heavy-weight guard more serviceable than the standard weight formerly used.

NEW CARS FOR WICHITA, KAN.

The Wichita Railroad & Light Company placed in operation a few weeks ago six new cars which were ordered from the American Car Company. The new cars, one of which is shown in the illustration, contain a new feature for Wichita in the way of "Detroit" platforms at the rear end; the front platforms are paneled around to the car body with windows at side of the drop sash type. The same window system is employed throughout the cars. The interiors are of cherry and contain Brill seats of rattan with push-over backs and corner grab handles; push buttons are placed at each post. The 21-E truck employed has a wheel base of 8 ft. Two

NEW DETROIT TYPE OF CAR FOR WICHITA

motors of 25-hp capacity each were installed on each car. A number of the car builders' specialties will be found on the cars, namely: sand boxes, gongs, signal bells, angle-iron bumpers, etc. The chief dimensions follow: Length over end panels, 20 ft. 8 ins.; over crown pieces, 31 ft. $\frac{1}{2}$ in.; width over sills, including panels, 7 ft. $9\frac{1}{2}$ ins.; over posts at belt, 8 ft. 2 ins. The framing consists of side sills 5 ins. x $3\frac{3}{8}$ ins. with $3\frac{1}{2}$-in. x $\frac{3}{8}$-in. x 6-in. angle iron; end sills, $3\frac{1}{2}$ ins. x $8\frac{5}{8}$ ins.; length of front platform, 4 ft. $8\frac{1}{2}$ ins.; rear platform, 5 ft. 8 ins.

LEGAL DEPARTMENT*

IMPUTED NEGLIGENCE

The Legal Department of this journal for April 2, 1904, contained an article on this topic, and the subject is now returned to because of a recent decision by the Supreme Judicial Court of Massachusetts in which the opinion minutely explains the duties and obligations of different parties concerned in a case where formerly the doctrine of imputed negligence was applicable. That doctrine was that when a person is riding in a vehicle driven by another and an accident occurs in whole or in part through the driver's fault, it is imputed to the passenger as contributory negligence, in like manner as if it had been his own act or omission. This was the principle of the old English case of Thorogood vs. Bryan (8 C. B., 115), and it may be said that it has now been almost universally repudiated by the courts of this country.

In Schultz vs. Old Colony St. Ry. (79 N. E. 873) the Massachusetts court radically and finally discarded Thorogood vs. Bryan as the law of that State, and formulated the status and responsibilities of all parties in the following language:

The rule fairly deducible from our own cases, and supported by the great weight of authority by courts of other jurisdictions, is that where an adult person, possessing all his faculties and personally in the exercise of that degree of care which common prudence requires under all the surrounding circumstances, is injured through the negligence of some third person and the concurring negligence of one with whom the plaintiff is riding as guest or companion, between whom and the plaintiff the relation of master and servant or principal and agent, or mutual responsibility in a common enterprise, does not in fact exist, the plaintiff being at the time in no position to exercise authority or control over the driver, then the negligence of the driver is not imputable to the injured person, but the latter is entitled to recover against the one but for whose wrong his injuries would not have been sustained. Disregarding the passenger's own due care, the test whether the negligence of the driver is to be imputed to the one riding depends upon the latter's control or right of control of the actions of the driver, so as to constitute in fact the relation of principal and agent or master and servant, or his voluntary, unconstrained, non-contractural surrender of all care for himself to the caution of the driver.

Applying this statement of the law to the present case, the result is that the plaintiff would not be entitled to recover if in the exercise of common prudence she ought to have given some warning to the driver of carelessness on his part which she observed or might have observed in exercising due care for her own safety, nor if she negligently abandoned the exercise of her own faculties and trusted entirely to the vigilance and care of the driver. She cannot hide behind the fact that another is driving the vehicle in which she is riding, and thus relieve herself of her own negligence. What degree of care she should have exercised in accepting the invitation to ride, or in observing and calling to the attention of the driver, perils unnoticed by him, depends upon the circumstances at the time of the injury. On the other hand, she would be permitted to recover if, in entering and continuing in the conveyance, she acted with reasonable caution, and had no ground to suspect incompetency and no cause to anticipate negligence on the part of the driver, and if the impending danger, although in part produced by the driver, was so sudden or of such a character as not to permit or require her to do any act for her own protection.

That a person being driven in his own vehicle by his own employee may be precluded from recovery against third persons by the imputation to him as contributory negligence of the servant's negligence was illustrated by a recent New York case (Kerin vs. United Traction Co., 102 N. Y. Supp., 423). It appeared that the plaintiff was injured while being driven by his servant by a car of the defendant coming from behind and striking the wagon. Although the Court charged the jury that the driver was the agent of the plaintiff and that if he (the driver) saw the approaching car his knowledge was imputable to the plaintiff, the Appellate Court held that error was committed in refusing further to charge that if the jury found that the driver saw the car approaching it was unimportant if the bell was not sounded. This ruling very decisively charges the master with any information or observation of the driver and with any neglect of the latter in not taking precautions thereby suggested.

The law is not settled as to the bearing of the negligence of the driver of a public hack or a vehicle hired from a livery stable, as between the passenger and the owner of the vehicle. There are cases holding that if the proprietor of a livery stable exercise due care in the selection of his drivers, he is exonerated from liability for any acts of negligence of which they may be guilty. It is believed that this is contrary to legitimate legal analogies, and the later cases seem to be tending toward the logical view that the servant of a livery stable keeper is on a par with the servant of anybody else; that the rule *respondeat superior* applies and therefore a passenger may recover against the proprietor for injuries received through the driver's negligence. Such doctrine has recently been aided by holding the owner of an automobile responsible for negligence of his chauffeur through which the plaintiff, a guest of the hirers of the vehicle, with its operator, was injured. (Routledge vs. Rambler Automobile Co. [Texas], 95 S. W., 749.) No good reason can be assigned for the distinction between the chauffeur of an automobile and the driver of horses hired out, with a wagon, from the owner of a livery stable. Certainly the negligence of a chauffeur or driver of a hired vehicle, who was not especially designated or selected by a passenger, cannot be imputed to the passenger as contributory negligence in a suit by him against a street car company for its negligence which in part caused a collision. (Cotton vs. Willmore, etc. Ry. Co. [Minnesota], 109 N. W. 835.)

CHARTERS, ORDINANCES, FRANCHISES, EJECTMENTS, ETC.

ARKANSAS.—Action—Misjoinder of Causes of Action—Eminent Domain—Compensation—Parties to be Compensated—Lessees—Torts—Joint Tort-Feasors—Rights of Tenant—Damages—Consequences Avoidable by Care of Person Injured.

1. Where a complaint alleged that plaintiff was in the possession of certain lands as tenant, and that defendant railroad company acquired a right of way over the lands without plaintiff's consent, and that another defendant, under a contract with the railroad for the construction of the road, entered upon the land and destroyed a portion of plaintiff's crop, there was no misjoinder of causes of action, as the action was not brought in part for damages for taking a right of way, but against defendants as joint tort-feasors for the destruction of the crops.

2. A railroad company, on receiving a deed for a right of way, has no right to enter upon the land until a tenant thereof has been compensated.

3. Where a railroad company, after obtaining a deed to a right of way, directed the one who had the contract for constructing the road to enter on the land without compensation having been made to a tenant thereof, it was liable to the tenant for damages to his crops, etc., as a joint tort-feasor.

4. Where a railroad company obtained a deed to a right of way from a landowner, and filed it for record, a tenant of the land who had not been compensated was entitled to damages, though he planted his crops on the right of way after the filing of the deed.

5. Where one having a contract for the construction of a road committed a trespass on entering on plaintiff's lands and letting down fences, whereby cattle entered and destroyed crops, plaintiff could recover only such damages as he could not have averted by reasonable exertions.—Ft. Smith Suburban Ry. Co. et al. vs. Maledon, 95 S. W. Rep., 472.)

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CONNECTICUT. — Carriers — Defective Transfer Ticket — Right of Passenger—Expulsion of Passenger—Justification—Regulations—Reasonableness.

1. A passenger who is aboard a street car without a proper transfer ticket due to the negligence of the conductor of the car from which he was transferred is entitled to sue for breach of contract for failure to furnish a proper ticket and recover the loss necessarily following therefrom, but he cannot refuse to pay his fare, and to forcibly resist being expelled from the car, and where he does so, and no more force is used than necessary to remove him from the car, he can only recover nominal damages.

2. Where a passenger is aboard a street car, the conductor in charge thereof may refuse to accept the passenger's explanation of the mistake of a conductor in charge of the car from which he was transferred in giving him an erroneous transfer ticket, and require him to pay his fare or leave the car, and after the demands made by the conductor it is the duty of the passenger to either pay the fare or peaceably leave the car.

3. A rule requiring the expulsion from a car of a passenger who refuses to either pay his fare or produce a proper transfer ticket showing his right to ride on the car is a reasonable one.—(Norton vs. Consolidated Ry. Co., 63 Atl. Rep., 1087.)

KENTUCKY. — Trial — Opening and Closing — Burden of Proof—Appeal—Waiver of Objections—Instructions—Carriers—Passengers on Street Car—Right to be Carried to Destination.

1. Under Civ. Code Prac. Sec. 526, declaring the burden of proof to be on the party who would be defeated if no evidence were given, plaintiff has the burden, and consequently the opening and closing; the petition alleging he was a passenger on defendant's street car, had paid his fare to the end of the line, and was, without fault on his part, wantonly assaulted and ejected by those in charge of the car, and the answer denying every allegation of the petition, except that it admitted his ejection, and pleading that the conductor, in striking him, acted only in self-defense; as, if plaintiff was not a passenger, he might be ejected, no more force than necessary being used.

2. One may not complain of the giving of an instruction where the same view is presented in an instruction given at its request.

3. While a street railway company is not obliged to run its cars so as to make a continuous passage, a passenger may not be put off before his destination on the line is reached, without a transfer being furnished, the company's franchise authorizing it to charge only one fare from one part of the city to another, merely because it is desired to send the car for a crowd, which is waiting to get into the center of the city.—Frankfort & Versailles Traction Co. vs. Marshall, 98 S. W. Rep., 1035.)

MICHIGAN.—Highways—Abatement—Estoppel—Parties Who May be Estopped.

1. Comp. Laws, Sec. 433, provides that the Circuit Court of Chancery shall have jurisdiction to determine all cases of encroachments on public highways. Sections 4121-4126 point out proceedings at law to be taken for the removal of any encroachment on a highway. Held that, where a street railroad company laid its tracks in a highway without obtaining authority from the township, as required by the statute, the township was entitled to maintain a bill in chancery to compel the removal of the tracks as a nuisance.

2. The fact that township officers made no objection to the laying of the tracks of a street railway in a highway, though no authority had been obtained as required by the statute, did not estop the township from maintaining proceedings to compel the removal of the tracks.—(Bangor Tp. et al. vs. Bay City Traction & Electric Co., 110 N. W. Rep., 490.)

MISSOURI.—False Imprisonment—Arrest of Passenger—Authority of Servant—Trial—Instructions—Assumptions as to Fact—Carriers—Injuries to Passenger—Action—Separate Causes of Action—Damages—Punitive Damages—Question for Jury—Assault—Civil Action—Damages—Pain and Mental Anguish—Ejection of Passenger—Duty of Carrier—Applicability to Evedence.

1. A street railway company is liable for the arrest of a passenger caused by its road officer, who was the superior officer of the conductor of the car on which the passenger was arrested, and had the right to take charge of the car at any point on the road.

2. In an action for ejection and arrest of a passenger, an instruction directing an award of damages if the alleged acts subjected the plaintiff to pain was not objectionable as assuming that plaintiff suffered pain.

3. Evidence that a road officer of a street railroad company threatened a passenger with the controller handle of the car, and that the passenger was forcibly removed from a seat near the front of the car to the back platform, was sufficient to justify an instruction as to the company's liability if its servants threatened and put the plaintiff in peril of his life, and of great bodily harm, and compelled him to leave the car.

4. The arrest of a passenger at the request of the road officer of a street railway company, following his assault and ejection from the car by the servants of the company, constituted a separate cause of action from the assault and ejection.

5. In an action for ejection of a passenger from a car, an instruction that the jury "should" find exemplary damages if they found the objection willful, was erroneous, the question of exemplary damages being wholly for the jury.

6. Where plaintiff's evidence tended to show that an assault on him was accompanied by circumstances of malice and oppression, and that his life or great bodily harm was threatened, it was proper to submit to the jury the element of pain and mental anguish in estimating his damages, though he suffered no physical injury.

7. Where a street car passenger paid his fare and received a transfer, and on boarding another car presented the transfer unmutilated, entitling him to ride as a passenger to his destination, the carrier and its servants were bound to safely carry him to his destination if they could do so by the exercise of the high degree of care of careful railroad employees under the same or like circumstnces.

8. In an action for ejection and arrest of a passenger, the modification of a requested instruction that the plaintiff must show by a preponderance of the evidence that the carrier had expressly authorized its agent or agents to cause the arrest, by adding the words "or impliedly" after the word "expressly" was not prejudicial to the carrier.

9. Where a passenger presents a transfer entitling him to passage, which is refused, and on his refusal to pay fare he is ejected from the car, he is not limited to a recovery of the amount of the fare demanded, but is entitled to have considered as an element of damages his shame and mortification from a public expulsion from the car.

10. In an action for ejection of a passenger on refusal to pay fare, an instruction that, if he refused to pay the fare demanded for the purpose of being put off, that he might make the expulsion the basis of a suit for damages, he could not recover anything more than actual compensatory damages for his loss of time, was properly refused where there was no evidence to support it aside from the suspicion of the carrier's road officer.—(Carmody vs. St. Louis Transit Co., 99 S. W. Rep., 495.)

NEW JERSEY.—Street Railways—Location of Road—Erection of Poles—Remedy of Landowner.

1. When a trolley company has laid down its railway in the streets of a city, and has obtained by petition from the governing body an ordinance granting such a right and fixing the route of the road and the places where the poles are to be located according to a map accompanying said petition, pursuant to the street railway act of April 21, 1906, it cannot afterwards lawfully place or erect its poles at places in the street different from those so designated.

2. If it locate one of its said poles in the street at a place upon land not thus fixed and designated, and without the authority of the owner of the fee thereof, it becomes a trespasser, and the owner may have relief by an action of ejectment to recover possession of the land thus occupied by the pole, such possession to be afterwards held subject to the public easement. (Moore et al vs. Camden & T. Ry. Co., 64 Atl. Rep., 116.)

NEW JERSEY — Eminent Domain—Remedies of Property Owners — Injunction — Jurisdiction—Legal Right of Complainant — Evidence — Sufficiency — Elevated Railroads — Grounds for Injunction.

1. Equity has no jurisdiction of a suit by an owner of property in a block through which an elevated railroad was about to be constructed, crossing and vacating a street on which complainant's property abutted, to enjoin its construction, unless complainant, by the undisputed facts of the case, and according to the established law of the State, established his legal private right in that part of the street which would be vacated by the construction of the road.

2. In a suit to enjoin the construction of an elevated railway, and the vacation of a certain street therefor, the fact that the legal right on which complainant founded his claim was wholly settled was not shown, where it did not appear that his predecessor in title purchased by reference to the street, the vacation of which was sought to be enjoined, at any time prior to its becoming a public street, though it was alleged that complainant's predecessor in title and the other owners on that street widened it, by vacating 10 ft. of their respective fronts, thus making the several properties more valuable, and increasing the price the complainant was obliged to pay for his property.

3. Nothing short of threatened destruction of property of great value, by acts of wanton lawlessness, inflicting injuries which, if not prevented, must result in irreparable damages, will justify the granting of an injunction staying an important public work, such as the construction of an elevated railroad and the vacation of a street therefor. (Roberts vs. West Jersey & S. Ry. Co., 65 Atl. Rep., 460.)

NEW YORK — Carriers — Street Railroads — Regulation — Fares — Leased Lines — Continuous Passage.

Laws 1890, p. 1113, c. 565, art. 4, entitled "Street Surface Railroads," Sec. 101, provides that "no corporation constructing and operating a railroad under the provisions of this article or of chapter 252, page 309, of the Laws of 1884" (relating to street surface roads) shall charge any passenger more than 5 cents for one continuous ride from any point on its road, or on any road, line, or branch operated by it, or under its control, to any other point thereof, or any connecting branch thereof within the limits of any incorporated city, or more than one fare within the limits of any such city for passage over its main line and any branch or extension thereof, if the right to construct such branch or extension was acquired under the provisions of such chapter or this article. Section 104 requires the issuance of transfers to any point on any railroad operated by it. Held, that a road incorporated as a street surface railroad which leases and operates connecting elevated and steam surface railroads does so under article 3, Sec. 78, which applies to all railroads, and it may charge more than one fare for a continuous passage over its road and the elevated and steam surface roads, as it operates such roads under their respective charters, and its right in this respect is not changed by changing its motive power from steam to electricity.—People vs. Brooklyn Heights Ry. Co., 79 N. E. Rep., 838.)

NEW YORK — Eminent Domain—Elevated Railroads—Remedies of Abutting Owners — Condemnation Proceedings — Easements.

1. The defendant erected in 1894, in good faith but without legislative authority or municipal consent, and has since maintained and operated without such authority or consent, a third elevated railway track in front of plaintiff's premises, involving a substantial depreciation in the value of her property. It was shown that defendant had spent over $800,000 in acquiring the easements of abutting owners along the line of the third track, and that the third track constitutes a great public benefit. Held, that plaintiff had not the absolute right to compel defendant to remove the third track, and that the Appellate Divi ion properly exercised its discretion, when it awarded plaintiff a money judgment and an injunction against the maintenance or using of the third track in front of her premises, unless within sixty days defendant should pay the sum awarded.

2. Where the defendant constructed a third track without legislative authority, it could not institute condemnation proceedings to acquire property rights, but it might be considered as a corporation acting in good faith, acquiring easements in aid of the construction of its track by entering into contracts with abutting owners. (Knoth vs. Manhattan Ry. Co., 79 N. E. Rep., 1015.)

NEW YORK — Eminent Domain — Appropriating Land for Canal—Injunction—Right of Lessee Against Trespasser.

1. Laws 1903, p. 337, c. 147, Sec. 4, provides that the State engineer may enter on and take possession of and use lands the appropriation of which, for improvement of State canals, shall in his judgment be necessary; that he shall make a survey and map of such lands, and certify that they have been appropriated for such use; that the map, survey, and certificate shall be filed in his office, and duplicates in the office of the superintendent of public works; that such superintendent shall then serve on the owner of the land so appropriated notice of such filing; that from the time of the service of such notice the entry on and appropriation by the State of such land for such improvement shall be deemed complete, and such notice shall be conclusive evidence of such entry and appropriation; and that the Court of Claims shall have jurisdiction to determine the amount of compensation for the land appropriated. Held, that the filing of the map, survey, and certificate, and the giving of such notice, are essential for an appropriation which will authorize the land to be entered on and used for the canal.

2. The lessee of the structures, rights, and franchises of a street railroad, being liable to the lessor for injury thereof, may, even if his interest be only personality, maintain injunction against an unauthorized entry on the land and injury of the structures. (United Traction Co. vs. Ferguson Contracting Co. et al., 102 N. Y. Sup., 190.)

NEW YORK — Railroads—Right of Way—Use of Highways—Terms of Grant—Condition as to Bond—Waiver.

1. Heydecker's Gen. Laws. p. 3312, c. 39, Sec. 93, provides that the local authorities may make their consent to the building of a railroad depend on any conditions respecting security suitable to secure the construction "of the railroad within any time not exceeding the period prescribed in this article." Held, that the provision applies to towns and villages, and local authorities may impose a shorter term for the construction of a road upon a street than that provided by the general law, and may require a bond as a condition precedent, and on failure to comply with such condition may grant the right to build on the street to another road.

2. The resolution of highway commissioners extending the time for the construction on a railroad on a street is not a waiver of a provision in the original franchise requiring the giving of a bond. (South Shore Traction Co. vs. Town of Brookhaven et al., 102 N. Y., Sup. 75).

OHIO.—Street Railway—Franchise — Construction — Term — Title to Property After Expiration of Franchise—Constitutional Law—Due Process of Law.

1. Municipal grants of street railway franchises must be strictly construed.

2. Municipal ordinances extending the life of the franchise of the Euclid Avenue or main line of the Cleveland street railway system will not be construed as applicable to a road with a separate route and a different term of life, known as the Garden Street branch, on the theory that the latter road became a part of the main line because it was permitted to run in connection with such main line, and to use a portion of that line to reach a public square.

3. The words "main line" in municipal ordinances granting respectively the right to construct a small extension to the Garden Street branch of the Cleveland street railway system and the right to lay a second track on a portion of that branch, to terminate with the expiration of the grant for the main line, must be deemed to refer to the rest of the Garden Street branch, and not to the Euclid Avenue line.

4. A street railway franchise made to terminate with the grant to the main line is to be measured by the grant as it then exists, and not by any subsequent extension of the term which may be granted.

5. A grant of a street railway franchise by the Cleveland Common Council, to be valid "until the expiration of the grants for said company's tracks on said Quincy Street east of Lincoln Avenue, to wit: July 13, 1913,"—is not a grant extending to that date, where the Quincy Street grants were then in fact to terminate at an earlier date.

6. An extension of the time for the termination of the franchise of the Garden Street branch of the Cleveland street railway system to the date set for the termination of the Euclid Avenue or main line was not effected by a municipal ordinance consenting to a consolidation of several street railroads, including the Euclid Avenue and Garden Street lines, on condition that but one fare should be charged for a continuous ride.

7. The title to the rails, poles, and other appliances for operating the Garden Street branch of the Cleveland street railway system remaining in the various streets at the expiration of its franchise is in the railway company which has been operating the road.

8. The right to take possession of the property of a street railway company remaining in the streets at the expiration of its franchise cannot, consistently with due process of law, be conferred by municipal ordinance upon another street railway company. (Cleveland Electric Railway Company, Appt., vs. City of Cleveland and Forest City Railway Company, 197; City

of Cleveland and Forest City Railway Company, Appls., vs. Cleveland Electric Railway Company, 321; 27 Cup. Ct. Rep., 202.)

TEXAS—Carriers — Street Railroads — Conductors — Insulting Conduct — Pleading — Issues and Proof — Evidence— Appeal — Bill of Exceptions — Rulings on Evidence — Review — Exclusion of Evidence — Prejudice — Trial—Legal Decisions — Reading to Court — Presence of Jury—Knowledge of Custom — Misconduct of Counsel — Argument — Instructions — Negligence.

1. Where a street car conductor was guilty of insulting conduct toward a passenger while engaged in operating the car in the furtherance of the street car company's business, it was liable therefor.

2. Where, in an action against a street car company for insulting conduct by one of defendant's conductors toward plaintiff, the petition attempted to allege a number of circumstances, each forming part of a series of insults offered by the conductor to plaintiff, an allegation that the conductor failed and refused to stop the car at a certain point to allow plaintiff to alight in accordance with her request was proper, as part of the conductor's misconduct.

3. Where, in an action for insulting conduct offered by a street car conductor toward plaintiff, a passenger, the petition alleged that a certain conversation occurred between plaintiff and the conductor, evidence as to such conversation, which occurred between the conductor and another passenger, was inadmissible.

4. In an action for insulting conduct offered by a street car conductor toward plaintiff, a passenger, it was proper to permit proof of the presence of others on the car at the time.

5. In an action for alleged insulting conduct by a street car conductor toward plaintiff, evidence that the conductor was standing in the presence of negroes on the platform at the time it was claimed the insulting remarks were made by him was admissible though not pleaded.

6. Where the bill of exceptions failed to disclose the objections made to the evidence in question, the rulings could not be considered on appeal.

7. Where, in an action for insults offered to plaintiff by defendant's street car conductor, the conductor testified that he did not know that a certain sign "For Negroes," which was the cause of the altercation, had been moved by the passengers; that he was not angry when he returned the sign to its usual place, and that he told plaintiff and her companions that he had no intention to insult them, defendant was not prejudiced by the exclusion of a question as to what the conductor's intentions were toward plaintiff and her companions when he moved the sign in front of them.

8. In an action for injuries, it was improper for the court to permit plaintiff's counsel to read from decisions in similar cases in the presence of the jury, ostensibly for the purpose of arguing the law to the court but in fact for the benefit of the jury.

9. Where, in an action for alleged insults to passengers on a street car, growing out of plaintiff's change of a negro sign in the car, it appeared that defendant had no rule governing the placing of such signs in the cars, and certain conductors offered as witnesses stated that they did not know what the general custom was, such witnesses were incompetent to testify as to the customary location of the signs in the cars.

10. In an action against a street car company for insults offered by one of its conductors to certain lady passengers, it was improper for plaintiff's counsel to argue to the jury that the conductor was a Northern man and that the ladies were from the South.

11. In an action for damages, it was error for plaintiff's counsel to state to the jury that a member of the Court of Civil Appeals would approve a verdict in double the amount sued for because he was a Confederate soldier.

12. In an action for insults to a female passenger on a street car by the conductor of the car, an instruction that plaintiff and her companions willfully insulted the conductor, and such insults provoked the acts and language of the conductor, such fact might be considered in mitigation of damages, was promptly refused for failure to confine the matter to language or conduct of the conductor which arose from insults first given to him by the passengers which was in immediate response to such insults.

13. The gist of an action against a street car company for insults offered by a conductor to a female passenger is the wrongful act of the conductor independent of negligence.—(San Antonio Traction Co. vs. Lambkin, 99 S. W. Rep., 574.)

LIABILITY FOR NEGLIGENCE.

ALABAMA.—Carriers—Existence of Relation of Carrier and Passenger—Pleading—Wanton Injury—Appeal—Review— Discretion—Competency of Young Witness—Trial—Motion to Exclude Evidence—Damages—Right to Punitive Damages—Instructions.

1. A complaint, aside from its express averment that plaintiff and her children were defendant's passengers, and that it was its duty to carry them on its car from G. to B., shows such relation by the allegations that defendant was a common carrier of passengers by means of an electric car running from G. to B.; that plaintiff, with her children with her, was at G., at the proper place used by defendant for receiving passengers on the car, for the purpose of boarding said car and being carried thereon as defendant's passengers from G. to B.; that the car stopped at said place for the purpose of receiving passengers, but that she did not board it by reason of the servant in charge of the car negligently failing to allow her a reasonable time or opportunity to do so.

2. The averment of the complaint that defendant's servant, in charge of its car, while acting in the line and scope of his authority as such servant, wantonly or intentionally prevented plaintiff from boarding said car as aforesaid, and thereby wantonly or intentionally caused plaintiff to suffer said injuries, it being theretofore alleged that said servant failed to allow plaintiff a reasonable time or opportunity to board said car, is sufficient as against a demurrer that it does not show that the injury was wantonly or unintentionally inflicted.

3. The discretion in holding competent a witness of tender years is not reviewable, unless it clearly appears that it was improperly exercised.

4. A motion to exclude relevant evidence introduced by plaintiff is too late; there having been no objection to the questions or answers, and not having been made till the close of defendant's evidence.

5. An instruction authorizing punitive damages if a thing was done "negligently, intentionally, or wantonly" is erroneous; such damages not being recoverable for simple negligence.—(Birmingham Ry., Light & Power Co. vs. Wise, 42 C. Rep., 821.)

ALABAMA. — Negligence — Actions — Pleadings — Characterization of Act—Willful or Wanton Injury—Appeal— Harmless Error—Erroneous Ruling on Demurrer—Trial— Instructions—Withdrawal of Evidence—Street Railroads— Collisions—Actions—Defenses—Care Required of Company—Instructions—Evidence to Sustain—Assumption of Fact—Injuries to Traveler—Contributory Negligence—Applicability to Pleadings.

1. A complaint, in an action against a street railway company for injuries in a collision with a car, which alleges that the company's servants, while running a car "recklessly and wantonly or intentionally," ran it against the wagon on which plaintiff was driving, is not demurrable on the grounds that it is uncertain whether simple or wanton negligence is charged and that it joins disjunctively in the same count simple negligence and wanton negligence.

2. Where, in an action against a street railway company for injuries in a collision with a car, the evidence without conflict showed that there was no defect in the car or its equipment, the error in sustaining a demurrer to the complaint, alleging negligence in failing to properly equip the car, was harmless.

3. An instruction, in an action against a street railway company for injuries in a collision with a car, that, if plaintiff was guilty of negligence that contributed approximately to the injury, he could not recover unless the company was guilty of subsequent negligence that proximately contributed to the injury, was erroneous, as pretermitting reference to willfulness or wantonness on the part of the company, charged in the complaint.

4. A plea, in an action against a street railway company for injuries in a collision with a car, which alleges that plaintiff was guilty of negligence contributing to the injury, in that he was riding in a covered wagon and attempted to cross the track in front of an approaching car without stopping, looking, and listening for the approach of the car, is not demurrable on the ground that it alleges that plaintiff did not stop, look, and listen, whereas, the law does not require him to listen, in addition to stopping and looking, unless the circumstances at the time and place make stopping and looking ineffective, which is not shown.

5. An instruction, in an action against a street railway com-

pany for injuries in a collision with a car, that it was the duty of the motorman to keep such control of his car so to be able to bring it to a safe stop before striking one in the act of crossing the track, was properly refused, because imposing on the motorman the duty of stopping his car, without regard to the suddenness with which a person came on the track.

6. Where, in an action against a street railway company for injuries in a collision with a car, there was no evidence that, after the wagon which plaintiff was driving was on the track, there was time to do anything which could have checked the speed of the car more than it was checked, an instruction that, if the motorman saw the danger in time to avoid the injury by reducing the rate of speed of the car, plaintiff was entitled to recover, was properly refused, because misleading.

7. An instruction that a party, admitting the written showing as to what an absent witness would testify, if present, does not admit thereby that the written showing is true, is properly refused, as leading the jury to believe that they were not to consider the written showing.

8. Where, in an action against a street railway company for injuries in a collision with a car, the evidence as to whether or not the car came in contact with plaintiff was in conflict, an instruction which assumed that the car injured plaintiff was properly refused.

9. An instruction, in an action against a street railway company for injuries in a collision with a car, that the company is seeking to escape liability for injuries alleged to have been negligently inflicted by setting up contributory negligence, is properly refused, as assuming that there was a liability on the company which it was attempting to escape.

10. Where, in an action against a street railway company for injuries in a collision with a car, it was, under the evidence, for the jury to determine whether the motorman saw that plaintiff was about to cross the track and whether the motorman's failure thereafter to stop the car was willful or wanton, it was error to charge that there was no evidence of any willful intent to injure plaintiff.

11. Where a traveler, injured in a collision with a street car, was guilty of contributory negligence, the company was liable only on proof showing either that it was guilty of willful or wanton conduct or of negligence after discovering the peril of the traveler.

12. An instruction, in an action against a street railway company for injuries in a collision, which does not follow the description of the willfulness complained of in the pleadings, is erroneous.—(Garth vs. North Alabama Traction Co., 42 S. Rep., 627.)

ARKANSAS.—Street Railroads—Actions for Injuries—Persons on Track—Question for Jury—Liability for Injuries—Trial — Argument of Counsel — Statements not Within Issues.

1. Where, in an action for injuries inflicted by a street car striking plaintiff, there was conflicting testimony as to whether or not plaintiff could have avoided the collision, the issue as to his negligence should have been submitted to the jury.

2. Where one received injuries by being struck by a street car through his own negligence, he cannot recover, unless the motorman in charge of the car discovers plaintiff's peril in time to prevent injury and negligently fails to do so.

3. In an action for injuries to plaintiff by collision with a street car, it was reversible error to overrule an objection to a statement by plaintiff's counsel in his closing argument that defendant was liable because it permitted an inexperienced motorman to operate the car, where there was testimony tending to show that another motorman was in charge of the car, that he was experienced, and that the two motormen reversed the car and applied the brake quicker than one could have done it; and the main issue submitted to the jury was whether proper effort had been made to stop the car after discovering plaintiff's peril.—(Ft. Smith Light & Traction Co. vs. Flint, 99 S. W. Rep., 79.)

CONNECTICUT. — Evidence — Production of Documents — Statutes—Trial—Instruction—Credibility of Witnesses—Invading Province of Jury.

1. Gen. St. 1902, Sec. 710, providing that a party to a civil action may compel the adverse party to testify as a witness in his behalf, subject to the rules governing other witnesses, places parties on the same footing as others in respect to their duty to become witnesses, makes them subject to the proceedings for obtaining the benefit of evidence witnesses may have in their possession, and authorizes the court on a trial, on motion of a party, to order the adverse party or his counsel to produce to the court, for such use in the progress of the trial as it may authorize, any document claimed to be relevant which is then in court and in the possession of the person to whom the order is addressed.

2. In an action against a street railway company for injuries to a passenger, the conductor, on cross-examination, testified that he had made a report of the accident to the company. Thereupon plaintiff's counsel turned to defendant's counsel and asked, "Will you let me have it?" The answer was, "No, sir." the court then said, "I think you should supply it." Exception was then taken. The report was produced and by plaintiff offered the evidence without further objection. Held, that the order to produce the report was subject to the safeguards of defendant's rights, and on defendant complying therewith, without further objection, it waived any rights in that regard which it might have asserted.

3. The power of the court to compel the production of a document on a trial in possession of a party thereto is not regulated by Gen. St. 1902, Sec. 732, authorizing the filing of a motion praying for the production of papers within the possession of the adverse party, but the right arises from the inherent power of courts in connection with Sec. 710, authorizing a party to compel the adverse party to testify as a witness in his behalf.

4. The question presented to the court in an action against a street railway company for injuries to a passenger on plaintiff requesting the adverse party to produce the report of the accident made by the conductor to the company is not as to the admissibility of the report, but as to plaintiff's ability through the intervention of the court to obtain possession of the report for evidential use.

5. Where a boy nine years old, testifying with respect to an accident occurring a year before, stated that he had talked the matter over with his mother, that she had told him what happened at the time of the accident, and what he saw, an instruction directing the jury to give such weight to the testimony of the boy as in their judgment it was worth, and that they should recall his youth and liability to repeat what he had heard if he had been talked to, was not erroneous as invading the province of the jury.—(Banks vs. Connecticut Ry. & Lighting Co., 64 Atl. Rep., 14.)

DELAWARE.—Street Railways—Injuries to Pedestrians—Negligence—Contributory Negligence.

1. Where, in an action for the death of plaintiff's intestate in a collision with a street car, there was uncontradicted evidence by two of plaintiff's witnesses that the motorman, as soon as he discovered intestate in a dangerous position, applied the brake and did all that he could to stop the car and avoid injuring intestate, there was no sufficient evidence of negligence, though it also appeared that the car was not stopped within a distance certain expert witnesses testified it could have been stopped.

2. Where intestate deliberately stepped in front of defendant's street car when it was very close to him, running at a moderate speed, and after the gong had been sounded in due time, and the interval between his stepping on the track and the time he was struck was very brief, his negligence was part of a continuous transaction that terminated in his death, and precluded a recovery.—(Davis vs. People's Ry. Co., 64 Atl. Rep., 70.)

INDIANA. — Appeal — Verdict — Conclusiveness — Carriers—Passengers—Failure to Pay Fare—Effect.

1. The Supreme Court will not disturb a verdict merely on the weight of the evidence, and it is only when there is no evidence on a material point that the court can interfere on the ground of the insufficiency of the evidence.

2. A street railway company offered the free use of three of its cars to take members of a women's convention for a ride about the city. The offer was accepted, and during the progress of the ride a collision occurred between two of the cars, by which one of the women was injured. The cars were operated by regular employees of the company. Held, that the women were passengers, and the one injured was entitled to recover on showing that the collision was occasioned by the negligence of the employees in charge of the car; there being no contract relieving the company of risk of personal injury from the negligence of its employees.—(Indianapolis Traction & Terminal Co. vs. Klentschy, 79 N. E. Rep., 908.)

FINANCIAL INTELLIGENCE

Wall Street, April 10, 1907.

The Money Market

Increasing ease characterized the local money market in all its branches during the past week. The heavy gains in cash, resulting almost entirely from the relief measures put into effect by the Secretary of the Treasury, have materially strengthened the position of the local banks, and the general situation at the close was clearer than at any previous time in months. The inactivity in the security market was also an important factor, as it lessened to a great extent the requirements for speculative purposes. The accumulation of funds here caused more or less pressure upon the market, and, despite the extraordinary demands upon the banks, such as the payment of $24,000,000 on account of the Great Northern Railway new stock, lenders were compelled to make sharp reductions in rates for all classes of accommodation. Money on call was offered liberally at rates ranging from 4 to 1½ per cent, while for time loans asking rates fell 1 and 1½ per cent from the high level prevailing at the close of the month of March. Sixty-day money was obtainable in quantity at 4½ per cent, as against 6½ per cent asked a fortnight ago, while funds for five and six months were offered liberally at 5 and 5¼ per cent. The volume of business, however, was extremely light, even at the lower rate, borrowers generally being disposed to avail themselves of the low rates prevailing for demand money rather than to enter into contracts for fixed periods. One result of the easier conditions has been the growing demand for fresh capital on the part of corporations. During the last half of March some of the railroads found it impossible to negotiate short-time notes upon a satisfactory basis, but the developments of the past week or ten days have been such as to bring several of the railroads into the market. During the week the Erie was successful in disposing of $5,500,000 one-year notes, and the Wabash has placed an issue of $6,160,000 three-year notes, the proceeds of which will be used to retire a like amount of 5 per cent notes maturing on May 10 next. Several other loans of similar character have been negotiated, and rumors of further note issues are current. The Buffalo, Rochester & Pittsburg Railroad has placed an issue of $35,000,000 fifty-year bonds, the proceeds to be used for various purposes. A feature of the week has been the pronounced strength in foreign exchange, rates for sterling rising to a point which eliminates all possibility of imports of gold from Europe. As a matter of fact, $2,250,000 gold, which had been engaged in London for import, was resold in that market, the advance in exchange here making such transactions unprofitable. The foreign situation also improved considerably, money and discount rates ruling lower than for some time past. In well-informed quarters it is thought that, with New York bankers out of the market for gold, the governors of the Bank of England will adopt a more liberal policy in the matter of loans, and that possibly a reduction in the official discount rate will be made in the near future. At this time there is nothing in the situation or outlook calculated to disturb the present easy conditions. Reports from Washington of a change in the Treasury policy in the matter of relief measures have been officially denied, while the financing of the contemplated note or bond issues will be made in such a way as not to materially disturb existing conditions.

The bank statement was a remarkably favorable one, the cash holdings having been increased by $10,533,900, while the increase in the legal reserve was $4,223,950, thus resulting in an increase of $6,309,950 in the surplus reserve. The latter now stands at $19,441,225, comparing with a deficit of $2,560,625 in the corresponding week of 1906, surplus of $8,682,525 in 1905, $22,916,400 in 1904, $3,741,300 in 1903, $4,571,750 in 1902, $5,817,975 in 1901, and $7,904,800 in 1900.

The Stock Market

The stock market during the week experienced decided improvement in speculative sentiment, and confidence has been restored to a considerable degree. This is indicated by the large improvement in prices from the low level recorded in the recent slump in values, and although there have been a few sharp recessions, these represented simply profit-taking selling on the part of interests who bought heavily when the market was very much lower. There has been a radical change in conditions having direct relation to prices and values, and chief of these is the decline in money rates and the easier condition of the money market. On the present basis of time money the dividend-paying stocks return a larger yield to the investor than could be obtained by placing the money in the loan market. This gives a good margin for further improvement in prices for securities and leaves the market on a decidedly sound basis. The heavy liquidation during the month of March brought investors into the market, and the buying for this account was of a volume to materially reduce the floating supply of all of the active shares, and, although the short interest has been very much reduced, it is understood that there is still a very considerable outstanding account for the fall, which alone will furnish a measure of support on any temporary drive that may be made. For the first time in months there is practical evidence of active interest on the part of the so-called public, which is reflected in the larger volume of business by commission houses. The improvement in the foreign situation has been an influential factor in the betterment here. The London settlement passed over in a satisfactory manner, and foreigners have been favorably impressed by the action of the New York bankers in refraining from withdrawing gold from the other side, and in the selling there the amount of the metal which had actually been obtained. Home developments have all been favorable. The settlement of the threatened labor troubles removed what might have been a serious menace to market stability. The increase in the Atchison dividend came at a time when its influence was most beneficial, and there is talk of like action on the part of other companies. The very favorable bank statement was largely the result of the relief measures by the Treasury Department, but these have done much to restore confidence and to remove timidity on the part of capital. Corporations now find it easier to sell short-time notes and also long-time bonds on a more satisfactory basis, and this will make it possible for them to carry out the contemplated improvements, which, a short time ago, was thought might have to be abandoned. The crop reports now coming to hand are of a highly favorable character, and these will become more of an influence during the next few weeks.

The traction stocks made decided improvement, in sympathy with the general market. Reports of probable competitive bidding for contracts for the proposed new subways were without any adverse influence, and more attention is being paid to expected large increases in earnings of these companies during the summer, which will result from the material addition to equipment made during the winter.

Philadelphia

Greater interest was manifested in the local traction issues during the past week. There were indications of returning confidence in these shares, and, while the dealings were not large, they were accompanied by a higher level of prices. Philadelphia Rapid Transit was again the leader of the group in point of activity, and, notwithstanding the action of the directors in levying an assessment of $5 per share, the stock held firm. The assessment is payable on May 6, and makes the stock $35 paid in. Opening at 16½, the price rose 1¼, but later lost part of the improvement on profit-taking sales. Philadelphia Company rose sharply to 44¾, on light transactions, and the preferred advanced to 45½. Philadelphia Traction moved up from 92¾ to 95 on the purchase of odd amounts, and Consolidated Traction of New Jersey brought 71½ for several hundred shares. Union Traction advanced from 55½ to 58 and closed near the top. Other transactions included American Railways at 49½, United Companies of New Jersey at 245, Union Traction of Pittsburg, preferred, at 47, and Lehigh Valley Transportation, preferred, at 22 and 23.

Chicago

The result of the election on April 2, at which the traction ordinances were ratified by the voters, was reflected in a more active and decidedly stronger market for the traction issues during the past week. Practically all of the stocks of the various companies were dealt in at substantially higher prices. It is understood that the rehabilitation of the properties will be pushed from now on. It was rumored that the City Railway Company was negotiating the sale of a block of bonds, but this report was subsequently denied. At the close of last week City Railway stock was 150 bid, from which the price rose to 205, on the purchase of comparatively small amounts, a total gain for the week of 55 points. North Chicago rose from 25 bid to 43, at which price transactions were reported, while West moved up from 25 bid to 50, with sales at the high figure. Union Traction, after selling at 6⅛, eased off to 4⅞, and the preferred brought 18½. Other sales were: Chicago & Oak Park, preferred, at 15; Metropolitan Elevated, preferred, at 64½ and 65, and South Side Elevated at 83.

Other Traction Securities

Interest in the Baltimore market again centered in the issues of the United Railway Company, all of which were animated and decidedly firm. The free stock was unusually active, at prices ranging from 11⅞ to 13⅝. The 4 per cent bonds advanced from 87 to 88, while the incomes rose 2¾ to 56½ on moderate purchases. The refunding 5s were quiet, at from 83 to 84. Charleston Railway & Electric 5s sold at 92. In the Boston market trading was quiet and prices displayed considerable irregularity. Boston Elevated sold at 153½ and 154. Massachusetts declined from 19 to 18, and the preferred, after advancing from 60 to 61, lost all the improvement. Boston & Worcester sold at 23¾ and 23½, West End common at 91 and 90, and the preferred at 106.

The principal interest on the Cleveland Stock Exchange the past week, so far as tractions are concerned, was with the Cleveland Electric, as a result of the refusal to accept the city's offer to take the property over on a leasing arrangement. The stock declined two points on the afternoon of the day the refusal was made, but the asked price remained at 60 at the close. Forest City Railway stock did not show any perceptible change, and both stand about the same as they have in the past. There has been a demand for Aurora, Elgin & Chicago stock, but the change in quotations has been slight.

Security Quotations

The following table shows the present bid quotations for the leading traction stocks, and the active bonds, as compared with last week:

	April 3	April 10
American Railways	49½	49½
Boston Elevated	143	143
Brooklyn Rapid Transit	62	61½
Chicago City	160	a200
Chicago Union Traction (common)	5½	4½
Chicago Union Traction (preferred)	17½	15¾
Cleveland Electric	—	58⅛
Consolidated Traction of New Jersey	71	72
Detroit United	72¾	75½
Interborough-Metropolitan	26¾	26¼
Interborough-Metropolitan (preferred)	62	60
International Traction (common)	—	45
International Traction (preferred), 4s	—	72
Manhattan Railway	137½	137
Massachusetts Elec. Cos. (common)	18¼	18
Massachusetts Electric Cos. (preferred)	61½	60
Metropolitan Elevated, Chicago (common)	23	25
Metropolitan Elevated, Chicago (preferred)	64	65
Metropolitan Street	90	94
North American	73¼	75
North Jersey Street Railway	40	40
Philadelphia Company (common)	44½	45
Philadelphia Rapid Transit	18	16¾
Philadelphia Traction	93	94
Public Service Corporation certificates	—	64
Public Service Corporation 5 per cent notes	—	93
South Side Elevated (Chicago)	82	80
Third Avenue	110	110
Twin City, Minneapolis (common)	97	96
Union Traction (Philadelphia)	57½	57½

Metals

The iron and steel trades continue active and firm. According to the "Iron Trade Review," there is increased confidence in the soundness of condition. The determined stand taken some time ago by large independent steel-making concerns that they would not buy pig iron for the last half of the year at more than $20 per ton furnace has been abandoned. Sales aggregating 250,000 tons at $21, furnace, have been made. There is still an active demand for iron in the English markets. The United States Steel Corporation has made sales of steel rails for delivery in 1908, at $28 per ton, the current price.

Copper metal is firm at 25½c. for Lake, and 25¼c. for electrolytic.

SEATTLE MUNICIPAL ROAD SOLD

The Seattle Electric Company has taken over the municipal street railroad owned by West Seattle. The negotiations for the sale of the road were finished some time ago, and Judge Albertson entered a judgment directing the sale. The road is a mile and a half long and was sold for $30,000. The Seattle Electric Company is building an extension of its Youngstown branch to connect with the West Seattle line, which will be finished in about sixty days. The line will be continued from its connection with the West Seattle line around Alki Point. The company will also build along California Avenue from South Street to Ninth Street. The West Seattle road will practically be rebuilt by the company.

THE HEARING ON THE BOSTON & EASTERN

The Railroad Commissioners again considered, on Thursday, April 4, the petition of the Boston & Eastern Electric Railroad Company for a certificate that public convenience and necessity require the construction of the proposed road. The chief witness in favor of the road was William H. Treen, president of the Lynn Board of Trade. Mr. Treen said that Lynn was desirous of securing additional rapid transit facilities to Boston. The present mode of travel was slow and uncertain. He believed that the time had come when a road such as proposed would be of greater advantage to the city than either railroad. He contended that the present opposition to the road in Lynn was due largely to influence brought to bear by outsiders. S. B. Armstrong, W. A. Robinson and J. J. Couhig, all of Lynn, were also witnesses, each appearing in favor of the petition, claiming that the city would benefit more than it would lose by permitting this railway to secure location within its limits. The Boston & Maine and the Boston & Northern Railroads are later to be heard in opposition, and it was announced that a large delegation of Lynn people would be present at the next hearing to object to the proposed route through the city.

FINANCIAL STATEMENT OF THE UNITED RAILWAYS OF SAN FRANCISCO

The following statement gives the combined earning of the United Railroads of San Francisco and the Philadelphia Company for the year ended Dec. 31:

Gross receipts	$24,533,603	Inc.	$304,541
Operating expenses and taxes	12,746,041	Inc.	210,538
Net earnings	$11,787,562	Inc.	$94,003
Fixed charges	6,202,315	Inc.	318,215
Balance	$5,585,247	Inc.	$224,212
Sinking funds, dividend on Philadelphia Company and other stocks	647,235	Dec.	82,954
Surplus	$4,938,012	Dec.	$141,258

The above statement includes the business done with the public by every company connected with the Philadelphia Company. They do not include inter-company business, except to the extent of a number of small transactions, which, however, if eliminated, would not affect the surplus as shown.

THE SITUATION IN CLEVELAND

At a public meeting in the Council Chamber, Cleveland, Friday, April 5, a communication was read from the Cleveland Electric Railway Company, which not only absolutely refused to accept the plan offered by the city for a holding company, but stated that no negotiations would be entered into again with a holding company. As the company has contended that a railway system cannot be operated properly on a 3-cent fare, the communication asserted that it is the duty of members of the Council to give attention to the best offer that can be made—seven tickets for a quarter—rather than take up an untried plan and experiment with it at the expense of the public.

Mayor Johnson evidently had expected a different reply. When the reading was completed he arose and said that he thought he would be able to take care of the personal charges in the communication, and that the other matters would be left with the Council. He denied that he had not at all times done all that he had promised to do, and said that he had never known of any act of the City Council that could be construed as persecution. The company has a perfect right, he said, to withdraw the seven tickets for a quarter, which it had been giving the people for the past three or four months. He asserted that he did not think seven tickets for a quarter a good proposition, and that he would resist any action to give the company a franchise on that basis. The Mayor and a number of the Councilmen objected to the holding company being called irresponsible, on the ground that the granting of franchises to operate a complete system in the city would be worth millions of dollars if it had nothing else. The Cleveland Electric Railway Company, they said, would be amply protected by the security franchise that, in case of the failure of the holding company, would give it a right to operate for twenty years at the rate of seven tickets for a quarter.

President Andrews said that he had always understood before that the security franchise was to be based upon six tickets for a quarter and a 5-cent fare, and that this was the first time he had heard seven tickets mentioned. Mr. Andrews said, further, that the rate of interest, 3 per cent for the remainder of this year, 4 per cent for the second year, and 5 per cent for the third year, was not satisfactory. It should be 6 per cent from the start. He said that there were other things in the plan that were not satisfactory, although they had not been mentioned.

One of the surprises of the meeting was the statement of Mayor Johnson that he would recede from his original position and agree that a clause should be inserted in the leasing contract with the Cleveland Electric to the effect that the holding company should not charge more than 3 cents within the city, nor more than 5 cents on the lines outside. This was to be conditioned upon the fact that no unforeseen events, such as great conflagrations, earthquakes or anything of the kind occurred. In such cases the Council would have power to set aside this clause in the contract temporarily. The Mayor did not make this announcement until after the letter from the company had been read, and did it then, perhaps, for the effect it would have. The company in a measure put the responsibility of the failure of negotiations upon the Mayor, and he endeavored to put it back upon the company. But the fact that the company declared its willingness to submit to arbitration offset anything of the kind that could be done.

The committee asked until Monday, at 10 o'clock, to formulate an answer to the communication of the Cleveland Electric. This meeting was largely devoid of interest and few persons other than Councilmen attended. The officers of the Cleveland Electric Railway Company were absent, and there were few if any of the directors there. The report of the committee, read by City Solicitor Baker, stated that it is in answer to the charges made in the communication of the company read last Friday, regarding the motives of some of the city officers. The public is not interested, it said, in the motives of the officers, but in getting a street railway system at the lowest possible fare. It is denied that the Council attempted to force the holding plan upon the company, or had taken any action in that direction. Nothing is said, however, of what the Mayor has done in that line of action.

The concluding clause is to the effect that the Council stands ready to consult with the company and to award grants on unoccupied streets and those on which franchises have expired to the company making the best offer as to fare and conditions. Council is willing to submit the best offers of two companies to the people and let them be the judges as to the company they desire to operate on the streets. This report was adopted by the City Council, and binds it to the referendum vote, if the companies so desire.

The fight against the Cleveland Electric was begun by the City Council, Monday evening, when ordinances were introduced with the purpose of compelling the company to exchange transfers with the Municipal Traction Company, especially on the cars that reach the Union Station. Other ordinances provide for grants to the Low Fare Railway Company on Woodland Avenue southeast, Kinsman Road southeast, Lorain Avenue, Madison Avenue southwest, and Detroit Avenue northwest. On all these streets the franchises of the Cleveland electric expire on Feb. 10, 1908. It seems to be the desire of the Council to get this agitation started at an early date, and Mayor Johnson said he felt that it is none too early, since a new company would have to have power houses and all equipment ready when the franchises expire. The Low Fare Railway Company was perhaps chosen to take these grants because of the fear that the financial interest of the Mayor in the Forest City Railway Company would operate against it. Ordinances were introduced providing grants for the same company for a so-called cross-town line beginning at Fifty-Fifth Street and Euclid Avenue and ending with West Fifty-Eighth Street and Detroit Avenue, crossing the Central Viaduct. In reality this is not a cross-town line, although it is called that in this case in order to come under the free territory rule. At the Council meeting it developed that W. B. Colver had succeeded Carlos E. Moore as president of the Low Fare Railway Company, the change having been made several months ago. A mass meeting will be held late in the week to talk over the subject of financing the Low Fare Railway Company. It is said that the Mayor's plans contemplate a regular campaign, with addresses in various parts of the city, urging people to invest their money in the company with the idea of owning their own roads.

RECONSTRUCTION WORK IN ST. LOUIS

The United Railways Company, of St. Louis, Mo., has started its reconstruction work for this year. During the season at least 20 miles of new track will be laid in new roadbed. At present work of this kind is in progress on Plymouth and Etzel Avenues. The construction of the line on Olive Street, between Boyle and Taylor Avenues, has also been started. While the work is in progress the westbound McPherson and Delmar cars, which run straight out Olive Street to Taylor Avenue, will turn south on Boyle Avenue to Maryland Avenue, and will run out Maryland Avenue to Euclid Avenue, where they will take the regular route. There is no change in the operation of the eastbound McPherson and Delmar cars. General Manager McCulloch says that the plans for reconstruction will depend on the city's arrangements for street building.

RAPID TRANSIT MATTERS IN NEW YORK

Bids for the subway loop between the three East River bridges will be opened by the members of the board on Thursday. There will probably be six or eight bids. No question of operation enters into the bidding. Some of the firms which are bidding on the building of the loop are also expected to bid on the Lexington and Seventh and Eighth Avenue subways. At the meeting of the Rapid Transit Commission, Controller Metz will probably submit a plan, devised by one of his engineers, to obviate the congestion at Ninety-Sixth Street in the subway, instead of installing the three additional tracks suggested by the Interborough. The Finance Department plan contemplates the running of all local trains past the Ninety-Sixth Street station without a stop. Whatever switching is necessary for southbound Lenox Avenue locals would be done south of the station, and northbound Broadway expresses would also be switched before they reached the station.

What has been termed the Poulsen plan for relieving the Brooklyn Bridge crush has been revived, and it has been decided to try the plan in operation at the Coney Island terminal of the Brooklyn Rapid Transit elevated lines, where a set of tracks exactly resembling the track layout at the Manhattan terminal of the bridge will be put in place. The trial will be made at the expense of Mr. Poulsen, and will be supervised by Chief Engineer Lewis of the board.

ANNUAL MEETING OF THE METROPOLITAN WEST SIDE COMPANY

The annual meeting of the Metropolitan West Side Elevated Railway Company was held on Thursday, April 4. The directors were re-elected and they in turn re-elected the officers. President Howard G. Hetzler, in submitting the report to the stockholders, announced that it covered the period between March 1 and Dec. 31, 1906, inclusive, the fiscal year having been changed to end Dec. 31, in place of Feb. 28, as formerly. The statement for ten months shows gross earnings of $2,226,878, being $185,574 more than those of the preceding year. Expenses increased $117,928 and net earnings increased $67,646. The surplus stands at $816,910, an increase of $56,638, equal to 3.83 earned on the preferred stock. For twelve months ended Feb. 28, 1907, the surplus, after all charges, is $404,455, a gain of $81,823, and are equal to 4.71 per cent on the outstanding preferred stock—$8,707,900.

INCOME ACCOUNT

For Year Ending Feb. 28

	1907	1906
Total passenger earnings	$2,604,365	$2,360,256
Advertising earnings	58,366	60,955
Rent earnings	15,909	14,419
Miscellaneous earnings	18,598	16,697
Gross earnings	$2,697,238	$2,452,327
Expenses		
Maintenance of way and structure	$111,430	$114,963
Maintenance of equipment	211,216	202,220
Conducting transportation	792,815	692,316
General expenses	78,422	76,692
Loop expenses	118,272	86,239
Total operating expenses	$1,312,155	$1,172,430
Net earnings from operation	1,385,082	1,279,896
Proportion of total operating expenses to gross earnings, loop expenses excluded	44.26	44.29
Proportion of total operating expenses to gross earnings	48.64	47.81
Proportion of total operating expenses and taxes to gross earnings	54.44	54.12
Income		
Net earnings from operation, as above	$1,385,082	$1,279,896
Interest and exchange	3,223	4,998
Rental of outside property	4,666	3,108
Other income	1,767	4,531
Gross income	$1,394,738	$1,292,533
Interest, first-mortgage bonds	399,189	392,150
Interest, extension mortgage bonds	120,000	120,000
Interest, collateral loan	34,275	43,635
Interest, equipment trust notes	5,205	......
Rental, Illinois Trust and Savings Bank, trustee	4,797	4,797
Rental, Pennsylvania Company	11,900	11,900
Rental, Union Consolidated Elevated Railroad	20,353	20,351
Rental, Union Elevated Railroad (Loop)	238,227	222,277
Taxes, car license and special assessments	156,337	154,791
Total charges	$990,283	$969,901
Surplus	404,454	322,631

TRAFFIC STATISTICS	Total Passengers	Daily Average
March, 1906	4,283,240	138,169
April, 1906	4,124,304	137,477
May, 1906	4,238,778	136,735
June, 1906	4,019,222	133,974
July, 1906	3,824,479	123,370
August, 1906	3,828,880	123,512
September, 1906	3,809,244	126,975
October, 1906	4,422,792	142,671
November, 1906	4,574,127	152,471
December, 1906	4,829,475	155,790
	41,954,541	137,106

Passengers carried March 1 to Dec. 31, 1905	28,369,482
Daily average	125,390
Increase per day, 1906 over 1905	11,716
Passengers carried, calendar year 1906	49,771,812
Daily average	136,361
Passengers carried, calendar year 1905	45,358,843
Daily average	124,271
Daily average increase, 1906 over 1905	12,090
Per cent of increase	9.72

BALANCE SHEET AS OF DEC. 31

Assets	1906	1905
Cost of road, equipment and property	$30,652,567	$29,843,591
Construction advances	981,709	791,030
Capital stock in treasury, preferred	292,100	291,900
Capital stock in treasury, common	35,900	35,600
First-mortgage bonds in treasury	......	194,000
Extension mortgage bonds in treasury	1,422,000	1,500,000
Cash on hand and in banks	220,449	281,512
Material and supplies	62,123	38,234
Accounts receivable	20,882	23,736
Prepaid insurance	16,190	21,330
Advances, Union Consolidated Elevated Railroad.	43,559	43,559
Unadjusted accounts	43,201	22,520
Total	$33,790,680	$33,087,012
Liabilities		
Capital stock, preferred	$9,000,000	$9,000,000
Capital stock, common	7,500,000	7,500,000
First-mortgage bonds (4 per cent)	10,000,000	10,000,000
Extension mortgage bonds (4 per cent)	4,500,000	4,500,000
Collateral trust notes	600,000	800,000
Equipment trust notes	400,965	......
Unpaid vouchers, pay-rolls and accounts	227,210	120,240
Interest coupons due and not presented	5,320	6,060
Interest due Jan. 1	61,560	60,000
Interest accrued, not due	175,320	172,383
Rentals accrued, not due	8,749	8,749
Taxes accrued, not due	101,872	95,365
Depreciation reserve	85,251	79,054
Balance surplus	1,124,433	745,162
Total	$33,790,680	$33,087,012

PRESIDENT HETZLER'S STATEMENT

Owing to the greatly increased traffic of the past year, fifty new motor cars of our standard vestibule type were purchased and put into service during November and December, with the result that the operation has been satisfactory to both our patrons and the company. Twenty motor cars of the same type have been ordered for delivery during the months of October and November, 1907.

Rotary converters were installed and ready for use at the Robey Street and Forty-Sixth Avenue sub-stations during the month of October. Since that time power has been purchased from the Commonwealth Electric Company, making it possible to handle the heavy loads of the morning and evening rush hours in an efficient manner, and at the same time relieving the power house during the night hours and allowing necessary repairs to be made without interfering with the service.

Arc lights have been installed at the intersection of our structure with public streets, in accordance with the city requirements.

A sidetrack connection has been built between the tracks of the Aurora, Elgin & Chicago Railroad and the Chicago Terminal Transfer Railroad, a short distance west of Fifty-Second Avenue, enabling your company to effect quite a saving and convenience in the handling of material in carload lots.

A loop has been installed at Desplaines Avenue, and the handling of trains at that point greatly facilitated. Fifth Avenue trains on the Garfield Park branch are now running through to Desplaines Avenue during the morning and evening rush hours, and an all-night schedule is maintained on this part of the system.

On account of the elevation of the Burlington, Northwestern & Terminal Transfer Railways at Sixteenth Street on the Douglas Park branch, the tracks of your company have been raised approximately 14 ft. without interruption to the service.

The extension of the Douglas Park branch to the Western Electric Company at Forty-Sixth Avenue has been practically completed, and will be ready for operation about May 1, 1907. The elevated storage yard at Forty-Sixth Avenue, Garfield Park branch, has been abandoned, and a new yard of greater capacity has been built on the surface at Fifty-Second Avenue.

The increased earnings and satisfactory physical condition, together with a healthy growth in the volume of business, warranted your directors at their January meeting in placing your preferred capital stock on a 3 per cent dividend basis.

The equipment, structure, track and buildings have been maintained in good condition, and all requirements for safety have received careful attention.

LEGISLATION TO DATE IN PENNSYLVANIA

With final adjournment but six weeks distant—May 16—the Pennsylvania Legislature will be required to dispose of no end of business to enact all the various reform measures pledged to the people by all the leading parties in last fall's campaign. One of these measures—the 2-cent railroad fare bill—has already been signed by the Governor; another, the Railroad Commission bill, passed the House last week, with a unanimous vote, as did also the bill giving electric railway companies the right to carry light freight, which now goes to the Senate. The bill granting the right of eminent domain under certain restrictions to electric railway companies, which was recommitted for the purpose of considering amendments proposed by members from rural constituencies, will be reported on favorably in a few days, and will undoubtedly pass the House. The five Reynolds bills, enforcing the provisions of the State Constitution in relation to railroads and other common carriers and their officials and directors, have been at last favorably reported from the judiciary general committee of the House and placed on the second reading calendar. Their passage is assured.

The bill allowing the city of Philadelphia to enter into a contract with the Rapid Transit Company for a division of street railway profits and the restoration of the company's franchises to the city at the end of fifty years has been passed by the Senate and sent to the Governor. The companion measure, requiring traction companies to secure franchise ordinances from local authorities before a charter is granted by the State, is on the postponed calendar.

A bill affecting the granting of future trolley franchises, by establishing the system of initiative and referendum in cities and boroughs of the State, went through the House without debate or amendment last week. This bill puts large powers into the hands of the people. Under its provisions no municipal ordinance can be passed, save emergency measures of limited extent, unless the people assent. After passage by Councils, franchise ordinances must lie over for thirty days, during which period 5 per cent of the voters can, by petition, compel the ordinances to be submitted to a vote of the people for approval or disapproval. Ten per cent of the voters can ask Councils to pass an ordinance of their own framing, and this must be enacted without change or the law-making authority must propose a competing measure, which, if passed, must then be submitted to the people for approval.

When a referendum vote is demanded, the question must come up at the next election, provided the petition is filed thirty days before election. Municipal executives will have no veto power over measures proposed by the people, or over any measure which has been approved by the people at the polls.

The Housher bill, conferring upon trolley companies the right to carry light freight and express matter, passed the House by a vote of 180 to 0, and without debate, a most remarkable occurrence. Local authorities are empowered to lay down reasonable regulations governing the condition under which street railways may carry on this business, and the question of reasonableness is one the Common Pleas Courts may pass upon.

When this bill came up for second reading, Democratic Floor Leader Creasy fought hard to get an amendment compelling the trolleys to carry freight, instead of giving them the mere right to do so if they wished. He declared the State Grange demanded this provision, and lost only after a sharp contest.

As it stands, the bill meets the views of the united trolley companies of the State, who favored it before committee through their counsel, former Attorney-General Hampton L. Carson. The measure was drawn up at the instance of Speaker McClain, who took the floor and avowed its parentage when Creasy, in the second-reading debate, said it was drawn to meet the views of the steam roads.

A determined effort will be made by the representatives from the third-class cities of the State to secure the passage of the Beidleman bill, providing for the taxation of real estate of public service corporations for local purposes. The passage of this bill would mean an additional annual revenue of about $75,000 to the city of Harrisburg from the steam and electric railways, gas, telephone, electric light, heat and power companies, all of which corporations are fighting the bill.

Other measures affecting trolley companies now in various stages of progress in the Legislature are the following:

Authorizing street railway companies to issue bonds, payable at such times as may seem best to the directors.

Granting to railroad companies the right to connect their terminal by tunnel beneath Valley Forge Park.

Making it unlawful for a trolley company to charge more than 5 cents for a continuous trip within any city's limit.

Providing that electric railways may become common carriers of freight.

Providing that trolley companies, in lieu of all other State taxation, shall pay the State 5 per cent on the gross receipts.

Annulling and abrogating charters granted under any pre-existing laws or any law now in force or which may hereafter be enacted to any railroad company or corporation of any kind or charter which have not been constructed or are not now in the course of construction or authorizing the Governor to issue charters to other corporations covering the same lines or rights of way as that had by the charter of franchises annulled.

A bill to overcome the legal obstacles to the crossing of a steam railroad by a trolley at grade.

A bill to raise the State tax on corporation capital stock from 5 to 10 mills.

A bill to tax stock transfers at the rate of 2 cents per $100 through a stamp system.

The Hall bill, forbidding the acquisition of trolley securities by railroad companies, and prescribing three years in jail or a $500 fine for offending agent or employees, has passed the House.

The bill authorizing cities, boroughs or townships to contract with street railway companies to operate their lines is in the hands of the Governor.

DETAILS OF THE CINCINNATI, NEWPORT & COVINGTON LEASE

The details of the lease of the property of the Cincinnati, Newport & Covington Light & Traction Company to the Columbia Gas & Electric Company have all been arranged with the exception of a few minor changes that may be made in the printed form. As at present arranged the lease dates from April 1, 1907, and the stockholders of the Cincinnati, Newport & Covington will receive their first dividend from the Columbia Gas & Electric Company in July, a little sooner than was at first expected, and more satisfactory than if the dividend period dated from the time of acceptance, which may be within thirty days. As a guaranty of good faith the Columbia Gas & Electric Company must put up $1,250,000 in cash. Of this $1,000,000 is to be spent in extensions and betterments to the property, while the remaining $250,000 is to be deposited with a trust company, as trustee, as a guarantee for the faithful performance of the contract. Under this division of the original fund the Cincinnati, Newport & Covington property will receive the benefit of the $1,000,000, while the $250,000 is considered ample to secure the performance of the terms of the contract.

McKINLEY LINES SECURE ST. LOUIS TERMINAL RIGHTS

The Mayor of St. Louis signed the bill which grants a franchise to the St. Louis Electric Terminal Railway Company, known as the McKinley system, to operate a line over certain streets of St. Louis for a period of fifty years, Saturday, April 6. The route of the line is from the river front at Salisbury Street to Ninth Street over private property, between Farrar and Salisbury Streets, south on Ninth Street to Branch Street, and thence to Twelfth Street and south on Twelfth to Lucas Avenue, where the terminus of the road will be. The McKinley system is to construct a bridge over the river from Salisbury Street to Venice, Ill., the cost of the bridge to be about $2,500,000. It is reported in St. Louis that Vice-President Smith, of the company, will leave in a few days for New York to meet Congressman McKinley, president of the system, and other stockholders, for the purpose of deciding upon plans for the bridge and lines and terminal facilities in St. Louis, and that it is probable contracts for the construction will be let by the company in New York. The McKinley system promises under the franchises to carry express at freight rates and to reduce freight 40 per cent. The fare across the bridge from St. Louis to Granite City is to be 5 cents. The fare for foot passage over the bridge is to be 3 cents. In consideration of the franchise the company is to pay into the city treasury $5,000 annually for the first five years, $7,500 annually for the next ten years, and $10,000 annually for the remainder of the life of the franchise.

CHANGE IN OWNERSHIP OF SOUTHERN PROPERTIES

E. W. Robertson and William Elliott, Jr., who are at the head of the Columbia Electric Street Railway, Light & Power Company, of Columbia, S. C., which operates the local street railways and the gas, electric light and power services, are now also in control of the Anderson Traction Company, which owns the electric railway system in Anderson. Mr. Robertson has been elected president and treasurer and Mr. Elliott vice-president and general manager of the Anderson Company. J. A. Brock, of Anderson, who organized the Anderson company and has been its president, voluntarily retires in order to devote more time to his cotton mill interests. He is president of the Anderson Cotton Mills and the Brogon Mills, of Anderson.

AN ENGINEERS' CONTRACT BOOK

The Goheen Manufacturing Company, of Canton, Ohio, manufacturer of oxidized carbon cement carbonizing coating, Galvanum and other protective coatings for metal work, issues an engineers' contract book which ought to prove very handy in preparing standard paint specifications for the complete presentation of steel railway bridges and other metal structural work where absolute freedom from rust and corrosion is essential. In addition to this, the book contains a series of large data sheets useful in making up and keeping track of contract work for sidewalks, paving, sewers, piping, conduits, power equipment, rolling stock, and other departments of electric railway work. This publication is 18 ins. x 23 ins. in size, and is known as "Zevy's Engineers Contract Book." Railway engineers can secure a complimentary copy on application to the Goheen Manufacturing Company.

KALAMAZOO STRIKE ENDED

The employees of the Michigan United Railways Company, of Kalamazoo, Mich., returned to work Wednesday, April 10, after being on strike since April 2. The settlement resulted in a decided victory for the company. There will be an open shop and the union is not recognized. The strike was originally declared because the company flatly refused to consider the demands of the men for recognition of the union and to arbitrate the entire agreement existing between the company and the men. It was proposed by the men that four arbitrators be named, the company to name two and the men two, and the four to name a fifth arbitrator, but the company declined to consider the proposition. The company already had offered to increase the wages of the men one cent an hour. The strike, while it was on, affected the lines in Kalamazoo and the interurban lines extending out of the city. The company had fortified itself against the walking out of its men, and was able to operate continuously almost the complete complement of cars.

RECEIVER APPOINTED FOR INTERURBAN LINE

On application of Frank M. Dell, as trustee, Judge McMaster has appointed W. M. Self, of Syracuse, Ind., tentative receiver for the Indianapolis, Huntington, Columbia City & Northwestern Traction Company. The promoters of the interurban road, it is said, failed to finance it. The complaint shows that $1,500,000 in bonds were issued and that a large number of bonds were sold, but says that there are $30,000 in claims against the company aside from the bonds, and that it has no funds. The concern built 5 miles of track near Syracuse and did considerably more grading.

ANNUAL REPORT OF THE NEW ORLEANS RAILWAY & LIGHT COMPANY FOR 1906

The annual report of the New Orleans Railway & Light Company for 1906, issued under date of April 8, shows that the gross earnings of all properties were $5,773,190.13, an increase of $679,480.34, or 13.3 per cent. With an increase of 13 per cent in passengers paying fare, the average fare paid on the railway was .045 cents per passenger. Statistics show that 9.8 per cent. of passengers paying fare took advantage of transfers. The total operating expenses were $3,074,015.09, an increase of $402,554.74, or 15 per cent. This increase is due largely to an increase of 5 per cent to employees and to the increased volume of business, necessitating more cars and labor to conduct operations, and also to the increased cost of material used in making ordinary repairs. The net income for the year was $798,274.27. The surplus for the year, after paying $500,000 in dividends to the preferred stockholders, is $298,274.27. President E. C. Foster, in presenting the report, said, in part:

"During the year we have expended for construction, betterments and improvements $2,497,822.79, the larger portion of this amount having been expended on power stations, sub-stations, purchase of real estate for power purposes, transformers, motors, cars, equipment, etc.

"The extension of the Claiborne Avenue line to Poland Street was built and operated, and the extension of the Levee and Barracks line is being completed and will very soon be in operation.

"During the year 1906 we have expended for underground construction in the electric light and power department $18,941.83, which consisted in installing additional new feeders in the direct current district, together with the extension of our underground mains and services to reach the more important customers.

"For electric light and power line construction, the sum of $52,113.06 was expended the past year for new overhead feed lines and for the wire used in the extension of our street mains to reach new customers.

"In the gas department we expended during the past year $78,842.04 for new mains and new services in this city, including Algiers, for the purpose of developing new territory and reinforcing existing mains.

"We erected in Algiers a complete gas plant, with a daily generating capacity of 125,000 cu. ft.

"The expenditures on the properties in the way of maintenance I believe to have been sufficient to maintain the property in its present serviceable condition, having expended for:

"Maintenance of track, roadway and paving, $957.95 per mile for the year.

"Maintenance of electric line, $261.10 per mile for the year.

"Maintenance of electric cars, $207.36 per car for the year.

"Maintenance of electric equipment of cars, $164.14 per car for the year."

The income account and operating statistics for the year ending Dec. 31, 1906, are herewith presented.

INCOME ACCOUNT

For the Year Ending Dec. 31, 1906

Income	1906	1905
Railroad department earnings	$3,724,272	$3,291,961
Electric and gas department earnings	1,875,400	1,705,807
Miscellaneous earnings	173,518	95,941
Total earnings	$5,773,190	$5,093,710
Expenses		
Railroad department, operating	$2,225,580	$1,901,084
Electric and gas department, operating	848,435	770,376
Total operating expenses	$3,074,015	$2,671,460
Net earnings from operation	$2,699,175	$2,422,249
Interest on funded debt, taxes and miscellaneous	1,900,901	1,784,226
Net income	$798,274	$638,023
Dividends on preferred stock	*500,000	125,000
Surplus	$298,274	$513,023
Percentage of operating expenses to earnings	53.2	52.2

* The dividend in 1905 was for three months, at the rate of $1.25 per share of preferred stock, and the dividend in 1906 was for the year, at $5 per share of preferred stock.

STATISTICAL STATEMENT

(Railroad Department)

Total miles of single track	52.36
Total miles of double track	64.83
Total miles special track (sidings)	10.48
Total miles all track, reduced to single	192.50
Total miles of street and right of way occupied by tracks, not including 10.48 miles of sidings	117.19
Gross passenger earnings per mile of single track	$19,346.87

	1906	1905
Revenue passengers carried	73,606,068	65,021,214
Transfers redeemed	7,220,152	6,641,193
Revenue mileage	17,718,107	16,753,874
Eighteen-hour cars	108,637	102,156

THE RELATIONS OF THE UNITED RAILWAYS & ELECTRIC COMPANY AND THE MARYLAND ELECTRIC RAILWAY COMPANY

From time to time a great deal has been said about the situation in Baltimore, more especially as it related to the relations between the United Railways & Electric Company and the Maryland Electric Railway Company, in whose name much of the reconstruction work has been carried out. Even in financial circles the true relations of the companies seem at times not to be generally understood. Because of this seeming lack of knowledge, Hambleton & Company, of Baltimore, under date of April 6, thus lucidly defined the relations of the companies:

Under the mortgages of the United Railways Company it is provided that all properties owned or which may be acquired in the future are pledged for the security of such mortgages. Under this condition it was impossible for the United Railways Company to issue an additional mortgage bond for the purpose of securing funds for the necessary extensions, improvements and betterments, and for the purchase of additional equipment. Therefore, it was decided by those who are not only close to the management, but who are also largely interested in the securities of the United Railways Company, that it was not only desirable, but necessary, that an outside company should be formed to finance the United Railways Company and to furnish it with such funds as were necessary for the building of car barns, the purchase of additional equipment, and such extensions and improvements as seemed desirable. Hence it was that the Maryland Electric Railways Company was formed.

The Maryland Electric Railroad Company held a charter—and a very valuable one—which was amended by the last Legislature, giving it still broader privileges, and this charter was used for the formation of the Maryland Electric Railways Company. As a basis, the Baltimore & Annapolis Short Line Railway was taken over and the stockholders of that company were given for their stock, six shares of Maryland Electric Railways Company stock for one share of Baltimore & Annapolis Short Line Railway Company stock. The par of the Maryland Electric Railways stock being $50 and that of the Baltimore & Annapolis Short Line Railway $100 per share, the effect of this was that the Baltimore & Annapolis Short Line stockholders obtained six shares for one, or 300 per cent of the Maryland Electric Railways stock for 100 per cent of the Baltimore & Annapolis Short Line stock.

It has been stated that the parties who owned the charter of the Maryland Electric Railroad Company—for which it is said they paid $30,000—put their stock in the Maryland Electric Railways Company upon the same terms as did the Baltimore & Annapolis Short Line stockholders. The result of this was the creation of a capital stock of about $1,250,000 for the Maryland Electric Railways Company.

The Maryland Electric Railways Company provided for an issue of $8,000,000 first mortgage 5 per cent bonds. Four million of these bonds were sold to an underwriting syndicate—$2,000,000 having already been delivered, $1,000,000 to be delivered July 1, 1907, and $1,000,000 Jan. 1, 1908, to the underwriting syndicate. A contract was made between the United Railways & Electric Company and the Maryland Electric Railways Company that the former should lease from the latter certain properties—such as car barns, which are now in process of construction; additional power plant, which it is proposed to build; new equipment, which has already been contracted for, or such as may be contracted for in the future; extensions, such as the extension which is now being built from St. Paul Street through the new boulevard to Roland Park, and for other purposes.

The proceeds of the sale of the Maryland Electric Railways Company bonds have been and are to be deposited with the Mercantile Trust & Deposit Company, the trustee. These proceeds are to be invested as provided above, and when so invested the United Railways & Electric Company is to lease the properties on a guaranteed rental of 6 per cent of the cost of such properties and an obligation to provide a sinking fund to retire the Maryland Electric Railways bonds at maturity. The result of such an arrangement is that the United Railways Company is supplied with the funds which it needed—and which it was so essential it should have—upon the very easy terms of a rental of 6 per cent of the actual cost of the properties so acquired and the obligation to retire the principal of the Maryland Electric bonds at maturity, or sooner, at 110 and interest if desirable; the United thereafter to acquire the properties mortgaged. We cannot imagine any arrangement which would be more advantageous than this to the United Railways & Electric Company, and therefore to the holders of its securities.

The United Railways Company was entirely unable in itself to raise the money for betterments and improvements and to purchase new equipment, build car barns, etc., because, as stated above, it could not issue any new securities—even upon properties which should be acquired in the future—which would not be a lien subsequent to the present mortgages.

So far as the stock of the Maryland Electric Railways Company is concerned, it was hardly to be supposed that the owners thereof would present it as a gift to the United Railways & Electric Company. Why should they; and how was it possible for the United Railways Company to acquire the Maryland Electric Railways Company stock either as a gift or by purchase?

The taking over of the Baltimore & Annapolis Short Line Railway had positively nothing to do with the United Railways & Electric Company; but it is an additional security for the bonds of the Maryland Electric Railways Company.

PITTSBURG COMMISSION FAVORS SUBWAYS

The report of the executive committee of the Rapid Transit Commission of Pittsburg Councils was submitted Saturday evening April 6, at a meeting of the Commission. The report favors the subway proposition, rejects the elevated line idea, suggests that the underground system be built by private enterprise, but with privilege for the city to take it over later; limits the franchise to 50 years; provides compensation to the city and regulations for building. The reports will be taken up for consideration at a meeting April 15. Speaking in a general way the Commission recommends the establishing of a system of underground railway, with a central terminal in the heart of the business district, and with straight lines radiating from it in several directions, like the spokes running out from the hub of a wheel. In planning for such a central terminal, the purpose is to provide such a one as will serve for the use of future suburban lines in all directions, and for a terminal for such suburban lines as may be built first. At the same time it is intended to construct such central terminal in such manner that direct lines can be operated through it (as from the East End to Allegheny or from the South Side to Lawrenceville) without transfer.

THE REHABILITATION OF THE CHICAGO SYSTEM TO GO FORWARD AT ONCE

The rehabilitation of the Chicago properties will go forward with all possible speed. On this all the interests involved are agreed. According to report the City Railway Company expects to authorize a bond issue, probably $50,000,000. There is to be issued to the stockholders $24,000,000 of bonds, bearing 5 per cent interest. The bonds will be given to the stockholders free and will capitalize the $21,000,000 of assets which the city agreed to be the value of the City Railway Company's property. The other $3,000,000 of bonds will cover the $3,000,000 of money raised by the City Railway Company on its notes to purchase new equipment. The city of Chicago has agreed to pay 5 per cent on the value of the railway company's assets and this will provide the necessary 5 per cent to pay the interest on the bonds. It is estimated that $18,000,000 more of the $50,000,000 bonds authorized will be sold and the proceeds used to reconstruct and rehabilitate the property. The remainder of the bond issue is to be sold from time to time to meet new construction needs.

As regards the Union Traction Company, it is announced in the East that all arrangements for financing are complete. G. W. Wickersham and L. C. Krauthoff, of New York, trustees under the reorganization agreement, are expected in New York this week to arrange for distribution of the stock of the Chicago General Railways Company. It is proposed to exchange the outstanding bonds for preferred stock of the new company and to exchange the stock of underlying companies, except Consolidated Traction, for common stock of the Chicago General Railways Company at a ratio to be determined by the trustees. If the various interests cannot agree, the new stock will be deposited with the trustees until the court settles the dispute. Chicago General Railways has no bonds outstanding, but can issue bonds immediately for rehabilitation of the properties. The ordinances took effect when the canvassing board announced a majority of referendum votes by the people in their favor.

Thomas E. Mitten, president of the Chicago City Railway Company, who returned from New York on Sunday, said that he would call a meeting of the directors of the company, probably this week, for the purpose of accepting the traction ordinances, and that the work of reconstructing the tracks of his company would commence as soon as rails could be obtained.

"As soon as John P. Wilson, our attorney, returns from Washington, where he is engaged in the tax litigation case, which will probably be some time toward the last of this week, I shall call a meeting of the directors of the Chicago City Railway Company for the purpose of formally accepting the Chicago City Railway ordinances. In the meantime such preliminary work as is possible under the circumstances will be proceeded with."

"We do not want to go to work and lay tracks down town now and then have to tear them all up when we begin the construction of the subways," said Bion J. Arnold. "My report of 1902 on the subway system has met with approval, and I think we have only to wait for the necessary legislation to begin their construction."

Subways will first be built from Twelfth Street to Chicago Avenue, State Street being used on the South Side and Clark Street on the North. Another will run from Halsted Street to Michigan Avenue, probably in Madison Street. Subsequently they will be extended to the outlying districts, ultimately to run from Englewood to the city limits in the North Side.

As a result of the ratification of the ordinances there will go into effect the increase in wages promised to Chicago City Railway trainmen by President Mitten, of the company, the increase dating from April 1. The official bulletin announcing this increase is appended:

To All Trainmen, Chicago City Railway Company:

Immediately after the ratification of the settlement ordinances April 2, and without awaiting the termination of the present contract expiring July 31, 1907, the company stands ready to enter into a new contract with Division 260 at the following advanced rate, to become effective April 1, 1907:

PROPOSED CONTRACT RATE

First three months' service	23c. per hour
Following nine months' service	25c. per hour
Thereafter	27c. per hour

PRESENT CONTRACT RATE

First six months' service	19c. per hour
Following six months' service	24c. per hour
Thereafter	25c. per hour

For some months past the management has had this increase in contemplation in order to secure the co-operation of conductors and motormen necessary to enable it to supply the excellent service required by the settlement ordinances, and makes the announcement at this time in order to contradict statements now being circulated to the effect that a reduction in wages of conductors and motormen would follow the ratification of the settlement ordinances at the polls.

Chicago, March 28, 1907. T. E. MITTEN, President.

DECISION IN ROCHESTER PAVING CASE

In a decision recently handed down by the United States Supreme Court, it is held that the Rochester Railway Company is liable for the paving between its tracks and for 2 feet on either side in the cases up for review, Park Avenue and St. Paul Street. Affected by the same decision, it is unofficially reported, are a number of lines, which will make the aggregate of paving charges of the company about $100,000. The case was tried before Justice Nash in December, 1903, and decided against the city. Nov. 15, 1904, the decision received the unanimous affirmation of the Appellate Division. It was then reversed by the Court of Appeals of the State, June 6, 1905, and judgment was ordered for the city. In this decision the Court of Appeals was divided. Justices Cullen, Haight, Vann and Werner stood for the reversal of the decision and judgment in favor of the city, and Justice Gray wrote the dissenting opinion, which was concurred in by Justices O'Brien and Bartlett. Motion for reargument was made before the Court of Appeals, Oct. 16, 1905, and was denied the next day, Oct. 17. The case was then taken to the Supreme Court of the United States and argued there Jan. 14 and 15. 1907.

AMENDING THE PUBLIC SERVICE BILL

Senator Page and Assemblyman Merritt are preparing a number of minor amendments to the public utilities bill, which were practically agreed upon at the public hearings before the Senate judiciary committee and the railroads committee of the Assembly last week. Many of these amendments are of a purely technical nature. One is a provision to make the salary of the proposed Commissioners $17,500 instead of $10,000, as the bill at present provides. Another is a provision to divide the cost for the maintenance of the metropolitan commission between the city and the State. The bill now provides that the city of New York must bear alone all the expense of the proposed commission for the metropolitan district, while all fines and forfeitures incurred by local transit companies for violations of the proposed public service law would be payable into the State Treasury. A third is a provision modifying the clause prohibiting railroads from investing in the stock of other railroad companies operating in this State to the extent of more than 10 per cent of their capital stock. The amendment will permit unlimited investment in the stock of railroad companies whose lines may serve as feeders and extensions. The bill will be taken up for consideration in executive session by the two committees having it in hand Wednesday, April 10. Up to that time briefs and suggestions for amendments will be received.

SUPPLY MEN'S COMMITTEE FOR CENTRAL ELECTRIC RAILWAY ASSOCIATION

President Nicholl has appointed the following supply men's committee: John F. Ohmer, Dayton Ohio, chairman; L. J. Drake, Indianapolis, treasurer; S. D. Hutchins, Columbus, Ohio; Wm. Bloss, Indianapolis, Ind.; R. W. Palmer, Cincinnati, Ohio.

HEARING ON APPLICATION OF CANANDAIGUA & SOUTHERN

On March 27, the first hearing of the application for a certificate of public convenience and necessity, under Section 59 of the State Railroad Laws, was held before the State Railroad Commissioners. George H. Switzer, of Bath, the engineer who secured the right of way and surveyed the route of the proposed road, said that the main line of the road would be 33½ miles long, and would extend from Atlanta northward through North Cohocton, Naples, Bristol Springs, Bristol Center, Vincent, South Bloomfield and Centerfield, entering Canandaigua by way of Western Avenue. He gave the estimated cost of the road at $720,000, and stated that 80 per cent of the necessary right of way has already been secured. The equipment will include six vestibule passenger cars, each of 475-hp motors, two express cars and six freight cars. The company intends using Niagara power, and arrangements have already been made with the Niagara, Lockport & Ontario Company to that end. The hearing was adjourned to a later date.

THE REORGANIZATION OF THE ATLANTIC CITY & SUBURBAN COMPANY

The creditors' committee of the Atlantic City & Suburban Traction Company has issued a readjustment agreement, accompanied by a circular letter, which says, in substance:

"The company defaulted in the interest due Feb. 1, 1907, upon its $750,000 of outstanding bonds. The company has a floating debt of about $100,000; has issued $27,000 of car equipment bonds, $4,000 of which become due in June, 1907, and has entered into a contract, in pursuance of its franchise in Atlantic City, to pave Florida Avenue, at a cost of about $15,000, which will have to be paid during the coming summer.

"On the part of the first mortgage bondholders, the plan contemplates simply deferring the payment of the interest maturing Feb. 1 and Aug. 1, 1907, without any impairment of the lien or relative position with respect to other creditors of the bonds, or of the coupons maturing upon those dates. The refunding mortgage bondholders are asked to agree that the interest for two years upon their bonds shall be deferred upon the same conditions, and also to buy (at par non-cumulative 6 per cent) preferred stock to an amount not exceeding $30,000 (in amounts equal to 12 per cent of their respective holdings of the bonds), to provide for the paving of Florida Avenue, and other pressing obligations. The unsecured creditors are asked to accept preferred stock in full payment of their claims (as of March 1, 1907) amounting to $50 and upwards. The taxes must be paid in cash, as well as odd amounts not equal to $50, the value of a share of preferred stock; but if the plan is to succeed and the property saved from a receivership or foreclosure sale, every unsecured creditor for advances, supplies, machinery, etc., with the limitation just suggested, must accept preferred stock for the amount of his claim.

"The holders of more than a majority of the capital stock have agreed to assign their certificates to this committee, that the committee may control and manage the company. The present officers and directors will resign."

At a meeting of the shareholders, in Atlantic City recently, more than 14,000 shares, it is stated, were voted in favor of issuing the $30,000 preferred stock called for by the plan.

REPORT OF THE PORTLAND RAILWAY

The Portland Railway Company reports for the year ended Dec. 31, 1906, as follows:

Gross receipts		$1,684,156
Operating expenses		974,699
Net earnings		$709,457
All fixed charges, including taxes		436,832
Surplus		$272,625
Dividends—Preferred stock, 5 per cent on $2,500,000	$125,000	
Dividends—Common stock, 2 per cent on $4,000,000	80,000	205,000
Surplus		$67,625

The general balance sheet as of Jan. 31, 1907, follows:

Assets		
Cost of property		$14,139,081
Supplies on hand		141,870
Prepaid and suspense accounts		48,517
Cash	$36,800	
Accounts receivable	195,386	
Bills receivable	282,245	
Total		$14,843,898

Liabilities		
Capital stock:		
Preferred	$2,500,000	
Common	4,000,000	
Portland Railway Company first and refunding mortgage 5 per cent bonds, due Nov. 1, 1930	6,227,000	
Underlying bonds	1,603,000	
Accounts and notes payable		226,106
Accrued liabilities		148,630
Deferred liabilities		20,503
Sinking fund for extraordinary renewals, depreciation, etc.		46,463
Profit and loss		72,197
Total		$14,843,898

NEW CAR BUILDING PLANT AT DANVILLE, ILL.

The Danville Car Company formally opened its new car works at Danville, Ill., on March 16, and is now ready to do business. The company will build street railway cars of every description, for both city and interurban service, as well as steam coaches, freight cars and trucks and locomotives for electric service. It will also make a specialty of repairing steel cars. The works cover 160,000 sq. ft., and were built and completed in a remarkably short period, the site having been converted from a corn field to a modern car building factory in ninety-five working days. The history of the plant can be told in a few words: When H. F. Vogel, formerly vice-president and general manager of the St. Louis Car Company, severed his connection and disposed of his holdings in that company, he organized the Danville Car Company, Inc., under the laws of the State of Illinois with a capital stock of $250,000. A large tract of land was secured on the outskirts of the city of Danville, and ground broken on Nov. 17, 1906, and on March 15 the plant was practically completed.

The erecting shop is 320 ft. x 150 ft., the freight car shop is 320 ft. x 90 ft., the wood working department measures 180 ft. x 60 ft., the cabinet shop 120 ft. x 60 ft., the varnish and trimming shop 120 ft. x 60 ft., the power house 120 ft. x 60 ft., the blacksmith shop (all steel) is 120 ft. x 82 ft. In addition the works include dry kilns, 160 ft. x 18 ft.; truck and machine shops, 120 ft. x 120 ft., and office building, 120 ft. x 30 ft.

The construction work was done by the H. F. Vogel Contracting & Railway Supply Company, of St. Louis, Mo., and is a model of excellence and durability. Due care was taken in the location of the various shops to provide for ample extensions should occasion demand them.

The organization of the company is as follows: H. F. Vogel, president and manager, has associated with him as secretary and treasurer E. H. Gorse, who was formerly secretary of the Missouri-Lincoln Trust Company, of St. Louis; W. L. Primm, formerly general manager of the Merchants' Association, as auditor and purchasing agent; E. J. Lawless, formerly with the American and John Stephenson Companies, as general sales agent; G. A. Moffat, formerly with the Philadelphia Traction and Metropolitan Street Railway Companies, of New York, as general superintendent; H. O. Lapp, formerly of the Chicago & Eastern Illinois Railroad shops at Danville, will be in charge of the freight car shop.

TWO RAILWAYS PROJECTED FROM FRESNO TO THE OCEAN

Two electric railway projects are now on foot for connecting Fresno, Cal., with the Pacific Ocean. The latest projected road is the San Joaquin Valley Western, recently incorporated by influential men who are directly interested in the development of the country through which the road will pass. The men include Senator Thomas Flint, of San Juan Bautista; C. G. MacBride, of San Jose, of the firm of Miller & Lux; Philip McRae, capitalist, of Hanford; C. P. May, president of the Bank of Coalinga; James Shaw Robertson, capitalist; J. O. Hickman, cashier of the First National Bank, Hanford; D. G. Hart, capitalist, Fresno; J. A. McClurg, Jr., Fresno, and William M. Graham, manager of the California Oil Fields, Ltd., Santa Barbara.

The capital stock of the new road is $6,000,000, of which $250,000 has been subscribed. Charles A. Lee is general counsel, and John R. Rogers, chief engineer of the Ocean Shore, has been appointed head of the engineering staff.

The San Joaquin Valley Western is to start at a point in the city of Fresno and run by the most available route to the town of Mendota, thence westerly to the town of Tres Pinos in San Benito County, northerly to the city of Hollister, and continue to the town of Chittenden, Santa Cruz County; thence westerly to the city of Watsonville, a total distance of 140 miles. In addition two branches are contemplated, one 40 miles in length, to the city of Hanford, and a second, also 40 miles long, to Coalinga. The length of main line and branches is to be 220 miles.

The route in general is northwest from Fresno, and will be the most direct line to the sea coast. At Watsonville the new line will meet the Ocean Shore Railway, with which a traffic arrangement will be effected that will allow unbroken connection between Hanford, Fresno, Coalinga and San Francisco.

The incorporators of the San Joaquin Valley Western deny that their project has even the most distant connection with the Monterey, Fresno & Eastern Railway Company.

The new road has already been financed, and will be energetically rushed to completion just as soon as the survey is made. The projectors also assert that electricity will be the motive power of the new line.

The second proposed line is the Monterey, Fresno & Eastern Railroad Company, which has done considerable preliminary work. The company announces that on April 1 it would start a daily steamer service between Monterey Bay points and San Francisco. By that time the company expects to have under construction its wharves at Monterey and Port Watsonville. To connect the latter point with Watsonville the company will use the electric line recently purchased from the Watsonville Transportation Company for carrying freight and passengers. The railway company states that since filing articles of incorporation, Dec. 31, it has acquired franchises and terminal facilities for a standard gage line between Monterey and Fresno, and contracts have been let for a large part of the construction work. Timber has been secured for building 60 per cent of the line. Contracts for steel and other structural material have been placed, delivery to begin in June or July. Sufficient bonds have been sold to afford means for early construction. It is expected that by Sept. 1 cars will be running from the Monterey Bay terminus into Salinas and San Juan.

It is proposed to build the line from Monterey Bay through Salinas, San Juan, Hollister, Tres Pinos and Cleveland, and by way of the Los Aguiloas Pass to Fresno. The company is in no way related to the Monterey & Fresno Railway Company, organized some years ago, or to any other line projected in that section. The directorate includes E. W. Wilson, S. C. Buckbee, L. F. Monteagle, W. H. Chickering and Alfred D. Bowen, all of San Francisco, and William Palmtag, of Hollister.

BIDS RECEIVED FOR BRIDGE LOOP—IN NEW YORK TWO BIDDERS

The New York Rapid Transit Commission met at noon Thursday, April 11, to receive bids for the construction of the first section of the subway loop which is to connect the Williamsburg and Brooklyn bridges. The section for which bids were received is the longest and most important of the five sections. It will extend from Pearl Street to Canal Street and should be finished within twenty-one months. There were only two bids made for the construction work. The bidders were the Degnon Company and the Cranford Company. The Degnon Company offered to construct the section for $2,952,000, and the pipe galleries for $83,000. The Cranford Company made a bid of $3,775,000 and $50,000 for pipe galleries. The Degnon Company did some of the work on the present subway. Vice-President Starin took the bids for examination, to report on them at a full meeting of the board later in the day.

Sixty days after the awarding of the contract, work will begin. It has been estimated that the expense of constructing the entire system, including that portion of it lying in Brooklyn, will be about $15,000,000. It has been planned to have the system ready for operation inside of two years. The expense of construction will be paid for by the city in order that it may have the power to issue operating leases to both Manhattan and Brooklyn companies.

DEDICATORY EXERCISES OF THE ENGINEERING SOCIETIES BUILDING

The Engineering Societies Building at 29 West Thirty-Ninth Street, given by Andrew Carnegie to the three founder engineering societies, the American Institute of Electrical Engineers, the American Society of Mechanical Engineers, and the American Institute of Mining Engineers, will be dedicated April 16 to 19.

The dedicatory exercises proper will take place Tuesday afternoon in the main auditorium. Owing to the limited seating capacity of the hall, admission will be by ticket only. The exercises will be opened by music, and prayer by Rev. Edward Everett Hale, Chaplain United States Senate. Communications from the President of the United States, the president of the Republic of Mexico, and the Governor General of Canada will be read, followed by a historical address by Charles F. Scott. The keys of the building will be accepted by E. E. Olcott, president of the United Engineering Society. Mr. Carnegie will deliver a short address, after which there will be music and an oration by Dr. Arthur Twining Hadley, president of Yale University, on "The Professional Ideals of the Twentieth Century."

A reception will be held for members and ladies Tuesday evening, at which the guests will be received in the main auditorium by the president of the American Institute of Electrical Engineers, Dr. Samuel Sheldon, and Mrs. Sheldon; the president of the American Society of Mechanical Engineers, Dr. Frederick Remson Hutton, and Mrs. Hutton; the president of the American Institute of Mining Engineers, Dr. John Hays Hammond, and Mrs. Hammond; the president of the United Engineering Society, E. E. Olcott, and Mrs. Olcott; the chairman of the reception committee, John W. Lieb, Jr., and Mrs. Lieb. The officers and councils of the societies will receive the members and guests in the rooms of the respective societies.

The second dedicatory exercise will be held on Wednesday afternoon, April 17, at 3 o'clock, when the audience will be addressed by the presidents of the three founder societies. Greetings and felicitations for foreign and national scientific societies and institutions of learning will be read, and the John Fritz Medal will be presented to Alexander Graham Bell by Charles F. Scott, chairman of the John Fritz Medal Board of Award. Presentations of medals for distinguished services will then be made to Ralph W. Pope, secretary of the American Institute of Electrical Engineers; Frederick Remson Hutton, past-secretary of the American Society of Mechanical Engineers, and Rossiter W. Raymond, secretary of the American Institute of Mining Engineers, by A. R. Ledoux, past-president of the United Engineering Society.

In addition to these exercises there will be professional sessions of the three societies. They will commence with a meeting at 8:15 on Monday, April 15, of the American Institute of Electrical Engineers. It will be held in the auditorium, and Sir William Preece, past-president of the Institution of Electrical Engineers, will act as chairman. A paper will be presented by Louis M. Potts, on the Rowland telegraphic system and its apparatus. The professional meeting of the American Institute of Mining Engineers will be held on Thursday afternoon at 2 o'clock, when H. T. Hildage will read a paper on "Mining Engineering Operations in New York City and Vicinity." This paper will describe the excavation and tunnel work now under construction by the transportation companies. The American Society of Mechanical Engineers will hold a session on Thursday evening at 8 o'clock, when William Crozier, Brigadier-General, Chief of Ordinance, U. S. A., will deliver an address on "The Ordinance Department as an Engineering Organization." Friday afternoon will also be devoted to the reading and discussion of professional papers by the American Institute of Mining Engineers.

The functions of the week will terminate with an informal smoker and vaudeville for the members of the founder societies, on Friday evening, at 8 o'clock in the concert hall of Madison Square Garden. For this a subscription fee of $2 is asked from those who expect to attend.

STREET RAILWAY PATENTS

[This department is conducted by Rosenbaum & Stockbridge, patent attorneys, 41 Park Row, New York.]

UNITED STATES PATENTS ISSUED MARCH 26, 1907

848,035. Trolley Wire Sleeve; Charles W. Ketteman, Dayton, Ohio. App. filed Oct. 29, 1906. An emergency connection for broken trolley wires consisting of a sleeve having gripping rollers with serrated edges which engage the ends of the wires.

848,111. Rail-Joint; Francisco F. Martins, Gloucester, Mass. App. filed June 21, 1906. Relates to means for securing a splice-joint.

848,155. Reinforced Concrete Cross-Tie; William A. Bryant, Wetumpka, Ala. App. filed Jan. 14, 1907. A railway tie including a plurality of detachable sections, spaced reinforcing-loops embedded in each section and having their closed ends extended in opposite directions and means for connecting the sections.

848,197. Railway Tie; Parshall D. Nicols, Edgeworth Borough, Pa. Consists of a rail section having one of its members spread laterally to form the base-plate and having portions of its opposite members spread laterally to form seats for the rails.

848,201. Car Seat; Charles K. Pickles, Philadelphia, Pa. App. filed March 17, 1905. Details of construction of a walk-over seat.

848,262. Fare Register; Wilfred I. Omer, David B. Whistler and John E. McAllister, Dayton, Ohio. App. filed Nov. 20, 1906. Details.

848,293. System for Operating Switch Points and Signals; Albert Descubes, Paris, France. App. filed Aug. 27, 1904. Provides an interlocking system for railroad switches and signals adapted to work the switches and signals by means of two levers, each of which corresponds to one of the ends by which a train can enter or leave a protected zone of the road.

848,382. Overhead Trolley; Allen P. Lord & Nathaniel Wilkins, Bradford, Pa. App. filed Oct. 29, 1906. Mounted on the trolley axle is a U-shaped spring the extremities of which extend above the trolley wheel, and are bent horizontally inward to prevent displacement of the wheel. The harp is hollow and wicks conduct the oil through the arms thereof to the bearings of the trolley wheel axle.

848,408. Roundabout or Carousel; James M. Taylor, Omaha, Neb. App. filed Sept. 26, 1906. Provides a passenger-carrying device in which two series of trucks are moved in opposite directions upon sinuous tracks or ways.

848,442. Traction Wheel and Rail; Matt C. Carr and Charley R. Bohannon, Easy Gap, Ky. The wheel has an auxiliary tread consisting of a toothed surface adapted to engage a rack attached to the rail. To be used on up grades.

848,507. Underground Electric Railway; Sylvester M. Sullivan, San Francisco, Cal. App. filed May 7, 1906. Relates to the installation of underground trolleys in the old cable conduit.

848,601. Electric Trolley Retainer; Edward T. Platt, Chicago, Ill. App. filed May 21, 1906. A pair of flaring blades pivoted in the trolley harp and upwardly spring pressed to guide the wheel on the wire and which are depressed in passing hangers, etc.

848,610. Overhead Trolley Frog; Burt Wilbur, Syracuse, N. Y. App. filed July 18, 1905. Comprehends a form of switch point in the frog which is spring pressed to guide the trolley wheel in one branch of the turn-out, so that the wheel always takes the path corresponding to that of the car.

PERSONAL MENTION

MR. M. L. MASELLER has resigned as general freight agent of the Mexico Electric Tramways, Ltd., of Mexico City.

MR. E. P. WETMORE has been appointed general manager of the Augusta Railway & Electric Company, of Augusta, Ga.

MR. JOHN F. RUTHERFORD has been elected president of the Citizens' Light & Transit Company, of Pine Bluff, Ark., to succeed Capt. J. B. York, resigned.

MR. W. K. BALL has resigned as superintendent of shops of the Tacoma Railway & Power Company, of Tacoma, Wash., to enter as a partner the Horton Furniture Company, of Tacoma.

MR. FRANK M. TUCKER, for many years chief inspector of the Louisville Railway Company, has resigned, because of illness, and his former assistant, Mr. A. J. Connelley, has been appointed chief inspector.

MR. CHARLES GREEN, at one time president of the Fourth Street and the Arsenal Railway Companies, of St. Louis, now merged into the United Railways, and who was prominent in business circles in St. Louis, is dead.

MR. P. J. WOOD, formerly master mechanic of the Oneonta & Mohawk Valley Railroad Company, has accepted a position with the Southern Michigan Railway Company, of South Bend, Ind., as superintendent of motive power.

MR. A. H. JONES has resigned as general superintendent of the Greensboro Electric Company, of Greensboro, N. C., to become connected with the Southern Equipment Company. He is succeeded in the Greensboro company by Mr. J. K. Russell.

MR. SAMUEL CROSS, superintendent of repairs and tests of the Interborough Rapid Transit Company, of New York, has recently resigned his position to engage in business for himself. Mr. Cross has organized the Cross-Lachance Electric Company, of which he is president and general manager.

MR. R. V. PARTAIN, former superintendent of the local division of the Public Service Corporation in Perth Amboy, has been appointed assistant division superintendent in Elizabeth. Mr. Partain occupied a similar position in Jersey City three years ago, when he went to work on the main line of the Public Service Corporation, and then at Perth Amboy.

MR. JAMES W. ANDERSON, recently superintendent of the Blackstone Valley Street Railway, has been appointed superintendent of the Worcester & Southbridge Street Railway, with offices in Worcester. This road, with the Worcester Consolidated and the Blackstone Valley Company, is owned by the New England Investment & Securities Company.

MR. E. R. GILBERT, superintendent of the lines of the Consolidated Railway Company between Stamford and New Rochelle, has resigned from the company. Before becoming connected with the Consolidated, Mr. Gilbert was general manager of the Chicago Electric Traction Company, and later was with the Helena Railway Company. At one time he was general manager of the Miami & Erie Canal Transportation Company.

MR. SAMUEL P. HUNT has been appointed assistant to General Manager J. Brodie Smith, of the Manchester Light & Power Company, which operates in Manchester, N. H., and to Nashua, with the title of assistant general manager. Mr. Hunt was born in Manchester and graduated from Dartmouth College, after which he attended the Massachusetts Institute of Technology, graduating in 1896 as an E. E. Immediately after graduation he accepted a position with the American Telephone & Telegraph Company, and later became superintendent of the Binghamton Light, Heat & Power Company. He has recently been employed as an electrical engineer by the Boston & Northern Street Railway Company, with headquarters at Boston.

MR. J. F. HEYWARD has resigned as manager of the Cincinnati Traction Company to become president and general manager of the Citizens' Traction Company, of Oil City and Franklin, Pa. Under the management of Mr. Heyward many improvements were made in the railways at Cincinnati, and President Schoepf expressed regret at his departure. However, he felt that the possibilities of a wider field of action were offered in the position to which he goes.

THE BOSTON ELEVATED RAILWAY COMPANY announces several important changes in its personnel. Mr. George R. Tripp, superintendent of division 6, Charlestown, is appointed superintendent of transportation. Mr. Julius E. Rugg, superintendent of transportation, becomes superintendent of employment and discharge. Mr. Karl S. Barnes, superintendent of employment and discharge, is named as acting superintendent of division 4, East Boston, in place of Mr. H. H. Esty, whose new position is not yet announced. Mr. Lemuel T. James, chief inspector of division 6, will be acting superintendent of the Charlestown division.

MR. HENRY WALTON GOODE, president of the Portland Railway, Light & Power Company, of Portland, Ore., died at Atlantic City, N. J., a few days ago, after a short illness. Mr. Goode was very prominent in business affairs in the West, and was director-general of the Lewis and Clark Fair in 1903, and president of the fair in 1904. Mr. Goode was born in Indianapolis, Ind., Sept. 26, 1862. After being educated in the public and high schools of Indianapolis, he studied electricity, and from 1885 to 1892 he was connected with the Westinghouse Electrical Manufacturing Company, of Pittsburg, and with the General Electric Company, of New York. Mr. Goode was married in 1889 to Miss Edith B. Fairlough, of Chicago. General Manager Fuller is temporarily in charge of the executive affairs of the corporation.

MR. DAVID WILLCOX, for many years identified with the Delaware & Hudson Railroad as counsel, and for the last four years as president, retired from that position Tuesday, April 9, and was succeeded by Mr. L. F. Loree, formerly president of the Baltimore & Ohio. At the same time the resignation was announced of Mr. A. I. Culver, as second vice-president of the company. Both Mr. Wilcox and Mr. Culver have been prominent in electric railway work recently, because they were identified as officers with the electric railway companies under the control of the Delaware & Hudson, acting in this connection in the case of the United Traction Company, of Albany, as president and vice-president, respectively, of the company. Mr. Willcox had only recently been elected president of the Hudson Valley Railway, to succeed Mr. J. H. Caldwell, resigned.

MR. L. L. SMITH has resigned as master mechanic of the Schenectady Railway to accept similar position with the Chicago & Milwaukee Electric Railroad, with headquarters at Highwood, Ill. Mr. Smith has been connected with railways, steam and electric, for the last sixteen years. Upon graduation from Cornell University, in 1890 he entered shops of the Chicago, Burlington & Quincy Railway, at Aurora, Ill., serving for nine years in various capacities from apprentice to general foreman. In 1899 Mr. Smith entered the service of the Chicago Great Western Railway as division master mechanic, and subsequently had charge of the shops at Oelwein, Iowa, for the Chicago Great Western Railway, and at Elizabethport, N. J., for the Central Railroad of New Jersey. Mr. Smith became master mechanic of the Schenectady Railway in November, 1905, having been previously connected with the New Hampshire Electric Railways at Salem, N. H. In going to the Chicago & Milwaukee Electric Railroad, Mr. Smith succeeds Mr. Alex McIver, who has resigned to enter the employ of the Metropolitan Street Railway, of New York City.

MR. EDWIN E. JOHNSON has been appointed by the Georgia Railway & Electric Company, of Atlanta, Ga., to the newly-created position of manager of the publicity department, which the company has decided to establish to handle all matters of advertising connected with the company, all matters of general news interest, as special attractions gotten up by the company and things of similar nature. Mr. Johnson is one of the best-known newspaper men in Atlanta. He began his career on

"The Atlanta Journal" about six years ago. Later he was with "The Constitution," and was for a time city editor of "The Atlanta News." Subsequently Mr. Johnson was connected with the New York "American." When "The Georgian" was launched he returned to Atlanta as city editor, surrendering that position to go into the advertising field.

MR. MASON B. STARRING, formerly vice-president of the Chicago City Railway, has assumed the presidency of the Northwestern Elevated, of Chicago, succeeding Mr. Clarence Buckingham, who resigned to give his attention to other matters. Mr. Buckingham, however, remains in the management as vice-president and director, succeeding Mr. Walter B. Smith as vice-president. Mr. Samuel McRoberts succeeds Mr. Smith as a director and Mr. Starring takes the place on the board formerly held by Mr. C. Ledyard Blair, of New York. Mr. McRoberts represents the Armour and associated interests in the company. Mr. Starring is a native of Chicago, was educated in the public schools and has been in the railway business since early youth. In the beginning of his career he was employed in the operating departments of the Burlington and the Pennsylvania roads. In 1888 he went to the Chicago City Railway Company as a clerk, studied law under Mr. William J. Hynes and Mr. J. S. Grinnell, and advanced until he became vice-president and general solicitor of the company.

MR. F. L. FULLER, general manager of the New York & Queens County Railway Company, has been elected president of the company to succeed Mr. Arthur Turnbull, resigned. Mr. Fuller has been general manager of the company several years, and before taking charge of the property was general manager of the United Power & Transportation Company, which controlled a large number of electric railway and lighting properties in the neighborhood of Philadelphia and Wilmington, Del. Mr. Fuller's connection with street railways dates from January, 1888, when he entered the service of the St. Paul City Railway Company as foreman of the Selby Avenue cable line, just placed in operation. The following year electricity was installed in St. Paul, and Mr. Fuller acted as assistant superintendent. On the consolidation of the St. Paul and Minneapolis systems in 1893, Mr. Fuller became connected with the West Chicago Street Railway Company, of Chicago, as assistant superintendent. The Chicago company's system was then divided between cable and horse lines, and in 1894 the work was begun of equipping the horse lines with electricity, with Mr. Fuller as superintendent. In 1899 Mr. Fuller accepted the position with the United Power & Transportation Company. The New York & Queens County system, now allied in interest with the Interborough Company, operates throughout Queens County, and eventually will operate into New York by tunnel from Long Island City to Forty-Second Street, Manhattan.

MR. J. B. POTTER has been appointed manager of the New York & Stamford Railway Company and the Stamford lines of the Consolidated Railway Company, to succeed Mr. E. R. Gilbert, whose resignation is announced elsewhere in this issue. Mr. Potter comes to Stamford from Putnam, Conn., where he was connected with the local branch of what now is the Consolidated Company. Mr. Potter's first work in the railway field was with the Westinghouse Electric Manufacturing Company, with which he was connected from 1897 to 1898. From the latter date till 1900 he was with Sanderson & Porter, of New York, as constructing engineer, building an electric railway from Central Village, Conn., to Webster, Mass. In November, 1900, Mr. Potter was appointed manager and treasurer of the Webster & Dudley Street Railway Company, at Webster, Mass., and continued in this capacity for two years, when, in addition to the management of the Webster & Dudley property, he was made the manager of the Worcester & Webster Street Railway Company properties. These properties he managed until September, 1903, at which time the Webster & Dudley and the Worcester & Webster Companies were leased to the Worcester & Connecticut Eastern Railway Company, extending from Webster to Moosup, Conn., and Mr. Potter was made general superintendent of the Worcester & Connecticut Eastern Railway Company, afterwards known as the Consolidated Railway Company, Putnam lines. In August, 1905, in addition to the duties of general superintendent of the Putnam lines of the Consolidated Railway Company, Mr. Potter was made general superintendent of the Worcester & Southbridge Street Railway Company, which position he held up to the time of his appointment as manager of the New York & Stamford Street Railway Company and the Stamford lines of the Consolidated Railway Company.

MR. F. H. DEWEY, who, as announced in the STREET RAILWAY JOURNAL of April 6, assumed the presidency of the Worcester Consolidated Street Railway Company, of Worcester, Mass., as successor to Mr. Chas. S. Mellen, has announced a number of changes in the personnel of the companies brought under his jurisdiction. Both the Blackstone Valley and the enlarged Southbridge system will be operated from the Worcester office of the Worcester Consolidated Street Railway Company by General Manager Edward G. Connette. Mr. J. B. Potter, superintendent of the Worcester & Southbridge and Worcester & Webster lines, has been transferred to the superintendency of of the Stamford system, at Stamford, Conn., another New Haven line, and his place will be taken by Mr. J. W. Anderson, superintendent of the Blackstone Valley. Mr. Samuel Anderson, general manager of the New Haven's Eastern Connecticut and Massachusetts lines, has been transferred to Connecticut, and in the future will be connected with the Connecticut end only. Mr. J. B. Gorman, superintendent of division 2 of the Worcester Consolidated, will take charge of the Blackstone Valley in connection with his division 2 work. The Worcester Consolidated Grafton line and its Marlboro & Westboro line will be transferred from division 2 to division 1, under Superintendent Thos. A. Leach, in order to equalize the division. The change will add about 100 miles to the lines operated by the Worcester Consolidated management, and all of these roads will be operated from Worcester by General Manager Edward G. Connette. The Worcester Consolidated, the Blackstone Valley and the Worcester & Southbridge are all owned by the New England Investment & Securities Company, and the Worcester & Webster and the Webster & Dudley by the Consolidated Railway Company of Connecticut. All of the roads in the operative consolidation are controlled by the New York, New Haven & Hartford Railroad, through these two holding companies. Mr. James W. Anderson, who leaves the Blackstone Valley road to take charge of the much larger Southbridge system, went to the Blackstone Valley line in 1900, when the road was taken over by Mr. M. J. Whittall and Mr. Alfred Thomas.

GENERAL EUGENE GRIFFIN, first vice-president of the General Electric Company since its organization in 1892, died suddenly April 10; the cause reported was apoplexy. Gen. Griffin from 1888 to 1891 was second vice-president and general manager of the railway department of the Thomson-Houston Electric Company, and in this capacity had a great deal to do with the commercial establishment of the modern electric railway. It was largely through his initiative that the Thomson-Houston Company secured the patents and services of Mr. Charles J. Van Depoele, and upon this as a basis the Thomson-Houston electric railway system was established. Soon after, the important contract for the equipment with the electric system of a large portion of the West End Street Railways, of Boston, was taken by the Thomson-Houston Company.


GENERAL EUGENE GRIFFIN

Gen. Griffin was born in Ellsworth, Me., Oct. 13, 1855, and was graduated from West Point in 1875. He immediately entered the corps of engineers of the regular army and served on various surveys until 1883, when he was appointed professor of civil and military engineering and the art of war at West Point. In 1885 he was transferred to the staff of Maj. Gen. Hancock, for whom he acted as aide-de-camp. In 1885 and 1886 he also served as chief engineer of Division of the Atlantic and Department of the East, and from 1886 to 1888 was assistant engineer commander of the District of Columbia. On the outbreak of the Spanish War he organized the first regiment of United States volunteer engineers and commanded this organization in the Porto Rico campaign. At the close of the war he was given the title of brigadier-general. He was a member of many clubs and engineering organizations, and was a director in most of the foreign Thomson-Houston companies. He was at the time of his death one of the Governors of the Engineers' Club, of New York.

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Organization Against Copper Thieves

The present high price of copper has, no doubt, been the cause of an unusual amount of stealing of copper from electric railways; at any rate, within the last few months reports of thefts have been very frequent. One interurban road in the Middle West recently had a thousand or more feet of high-tension line taken from the poles soon after it had been installed and before current had been turned on. Several cars of an elevated system were recently robbed of brass fixtures, and the woodwork was badly marred by the thieves in tearing out the brass parts. Numerous companies have been subjected to similar thefts, and there are very few that have not had bonds stolen, although many may not keep close enough track of their bonds to know it. In the past the railroad companies have not been very successful in apprehending thieves, partly, no doubt, owing to a lack of knowledge of the characteristics of the thieves, when they are most likely to act and where they get rid of the stolen property.

Copper thieving might be discouraged to a great extent if the companies were to organize for mutual protection, just as livery stable owners and banks organize. At present, without such an organization, a railway company suffering from a theft of copper to the value of twenty-five or fifty dollars does not feel justified in spending several times this amount in endeavoring to apprehend the thieves. The result is the thieves are encouraged by the seeming indifference of the company, and either this company or others are subjected to consequent thefts.

A great deal of copper stealing is, no doubt, done by a set of men who, to a certain extent, follow it as a business. After heavy thefts in one locality they may make a long jump to another region. Even if the companies suffering were willing to spend time and money in the apprehension of the thieves, they would have much difficulty in locating those of the wandering class.

A well-organized bureau, getting reports from all over the country, would in all probability soon be able to tell, on report of the details of a theft, just how to go after the guilty party. It would be the duty of such an organization to give as much publicity as possible to the apprehension of copper thieves in the newspapers. Such publicity would soon impress those with thieving proclivities that there was a great chance of being caught, and this would do much to lessen their natural tendency. If the detective work were carried on by a central body, the expenses, being borne by several companies, would not be heavy on any one of them. It is no more than right that the expenses should be distributed. A company spending three times the value of the material stolen in apprehending a criminal is not the only one benefited by the efforts. The fact that the efforts result in less likelihood of other companies suffering thefts makes them share in the benefits, although they do not pay for them.

Limiting Shopping Traffic in Rush Hours

The shopping traffic on a large street railway system is one of the most difficult features to handle in the rush-hour business. There is no question that the tendency of women shoppers to prolong their bargain hunting until the hours when regular commutation travel is at its height seriously hampers the free movement of cars, and it has often been pointed out that if the shoppers could be persuaded to leave the business districts a little earlier in the afternoon they would be relieved of much of the crowding to which they object so strenuously later.

Observation of the afternoon traffic in large cities shows a distinct tendency of women shoppers to start homeward before the stores and offices close for the day, but the volume of this movement is as yet small in comparison with the peak load. If women shoppers generally could be induced to leave the business district, say before 4:30 o'clock, it is certain that the business of the transportation companies between 5 and 6 would sensibly be facilitated. The stops at present are lengthened by the difficulty women find in entering or leaving cars promptly, and in the rush hours these delays slow the schedule speed most seriously on account of the close headway of the cars on lines carrying a dense traffic.

It is a question whether there is any method of persuading shoppers to go home before the heaviest rush is on. From some points of view it looks like an impossible task, and no doubt there is a decided limit to the traffic which can be thus accelerated away from the congested district. But the matter is worth considering. It is possible that something could be done by cleverly worded placards in the cars, pointing out the advantages in comfort and running time which an early departure from the business streets makes feasible. Actually, nothing short of a trial could demonstrate the value of any such scheme of attempting to cut off the top notch of the load curve.

Keeping Record of Train Delays

The aggregate amount of delays to trains forms an excellent basis for judging the efficiency of the trainmen, dispatchers, track departments and car maintenance departments of an interurban railway company, yet many systems do not keep a record sufficiently in detail to tell how much trains were delayed during any period or to be able to compare the delays of one period with those of another. Nevertheless, the work does not involve such a great expenditure of time and it could be done in such a manner as to fix the responsibility for the delays upon the department or person at fault.

Records of the amounts of delays with their causes might be kept by both dispatchers and trainmen. At the end of the month, in order to get a comparative statement, the figures could be reduced to a "car-mileage per train-minute delay" basis. This term would serve as a definite means of comparing the delays during one month with those of another. To distribute the delays among the different departments at the end of the month, the total number of minutes delay caused by cutting off the power should be totalized and charged to the power department, and those caused by defective car apparatus to the car maintenance department. In a similar manner, the transportation department and track and overhead departments could be charged with the amounts resulting from their neglect or oversight. The heads of these departments could, of course, charge against each man or each foreman the amount due him. If such a practice were carried out on a system, no doubt everybody connected with the road would appreciate to a greater degree the importance of keeping the cars running on time and would as a result make such efforts as would reduce the delays from month to month. Of course, many delays are caused by conditions outside the control of any one connected with the system. An analysis of the kind mentioned might, however, result in their reduction to some extent. If, for instance, the total delays caused by steam trains blocking the tracks at steam road crossings were kept, they would in many cases be of such magnitude as to warrant complaint to the railroad company or city authorities.

After all, the "car-miles per train-minute delay" is a good indication of the efficiency of every department of the railway, and it stands to reason that it should be kept as accurately as possible.

A Visual Signal on Electric Heater Circuits

There is no excuse for the heaters being left on when cars are left in storage houses or in the yards over night. But trainmen are usually in a hurry to leave their cars when they turn them in, and are always liable to forget either to throw the heaters off or pull down the trolley pole. Of course, if the trolley pole is pulled down, that ends the matter; but this plan is not always followed, and, with the pole up, there is always danger of fire unless the night watchman discovers that the heater switch is on and turns it off. Now if the watchman wishes to find out definitely whether or not the heaters have been left on, he must either examine the switch in the vestibule or enter the car. It is safe to say that with fifty or one hundred cars to be looked after the average man will not always do this. Were it possible to tell from the outside of the car or from a distance whether or not the heaters had been left on, the probabilities are great that the waste of current and the fires attributed to electric heaters would be less frequent. The plan suggests itself to provide a means of doing this by placing an electric light in shunt with one of the heaters. The lamp could be of such a voltage that it would burn very dimly, and its life consequently would be very long. It could be placed in the vestibule or in the interior of the car, and to distinguish its light from that of the other lights a red bulb might be used.

Placing such a lamp in the circuit in this manner would necessitate very little extra wiring. All the addition that would be necessary would be to run an extra wire from the ground side of the first heater in the circuit up to the light, as the lamp in most instances could be placed near the heater switch and the lead for the trolley side of the lamp could be run direct from the switch to the lamp. This plan would enable a watchman to discover at once any one car out of a hundred on which the heaters had been left turned on, and, further, it would enable any one to tell at a mere glance over the storage yard or car house

whether or not the watchman was attending to his duties regarding heaters.

The benefit of this plan would not be confined to the night time. During the day it would enable inspectors to tell without trouble whether or not instructions with regard to heaters were being followed. Inspectors might even appreciate one lamp in shunt with each coil of a double-coil heater, so that the point at which the heaters were being worked could be distinguished. It might in either case be well to provide a fuse in the lamp circuit to prevent it being subject to abnormal voltage in the event of the heater becoming open-circuited.

The Qualifications of a Repair Shop Superintendent

The importance of well-balanced talent in the electric railway repair shop should be fully realized by managers. There is a saying that "a Jack of all trades is master of none," but if there is an exception which proves this rule the proof will be found in the successful director of the electric railway repair shop. Fortunate indeed is the company whose master mechanic possesses the qualifications of the expert as both an electrician and a mechanic. But such men are rare, especially when they combine with this knowledge the requisite executive ability and general capacity for conducting with the best results this important department in the operating organization.

The money expended on the maintenance of electrical equipment of cars, that on trucks and brakes, and that on car bodies and furnishings should nearly balance. The first-class master mechanic, therefore, should represent just as nearly such a balance as regards his knowledge of and ability to care for the equipment. The first-class electrician who is short on experience in car-building methods and machine shop practice will come as near failing in his best efforts to keep up the rolling stock as will the first-class machinist or the first-class car builder to whom the electrical equipment is somewhat of a mystery. Evidences of such unbalanced talent can frequently be noticed by any one who has had opportunity to inspect various repair shops and shop methods, and the most casual observation of the appearance and operation of cars on the road often suggests that such a condition exists. If the property is so extensive that the repair shop work can be divided under a superintendent of rolling stock into sub-divisions of car body, truck, brake and electrical work, each in charge of a sub-head who is an expert in his particular line, the difficulty of proper maintenance is lessened. Even in this case the superintendent of rolling stock must be a man who has ability and experience in all the lines.

But it is on the smaller roads, where such a subdivision is not possible, that the successful Jack of all trades is a necessity in a master mechanic or shop foreman, and too often this necessity to economical operation is lacking. A fairly good electrician may hold the job, and his motors and electrical equipment may be in fairly good shape—his account No. 7 low—but to save his life (or his job) he cannot keep No. 6 down, and some of his cars generally sound as though they might fall to pieces on the street. The management realizes an error, and the next man on the job is a machinist, and a good one. To be sure, he doesn't know much about electricity, but he has lots of good horse sense, and that ought to do. He knows what is expected of him, or thinks he does, and there is a grand overhauling, and things begin to go better—that is, some things do. The trucks at least sound as though they were integral parts of the equipment instead of miscellaneous collections of junk iron, the brake-rods don't break so frequently and the brake-shoes brake more, but once in a while the manager notices a door latch or a window frame that seems to have been repaired with a hack saw and a cold chisel. Finally, when an expert has been called from the electrical manufacturing company to investigate the mysterious trouble in the new motor equipments and advises that the motor leads should be cleated up so that the insulation will not rub entirely off on the motor frames and brake rigging, the following of which learned advice stops the trouble, the management realizes that some sense besides horse sense is occasionally desirable.

The road that cannot afford to maintain an organization containing experts in all departments of rolling stock maintenance generally cannot afford to hire as master mechanic or shop foreman a man who combines all the qualifications ready made—he is too valuable to his present employers. It is then a matter of making a man, and the starting point is generally a person with one kind of ability or experience—electrical, mechanical, or executive. If the man chosen has the proper realization of his deficiencies, and, while exercising his particular ability, takes advantage of every opportunity to improve himself where lacking, he may develop into the all-round man that is required. He must get rid of the idea that his specialty, whatever it is, is the most important feature of the work. If he is an expert in his one line, whatever it is, it would probably be better if he should conduct his department on the theory that that particular line was the least important. Then, if he is willing to learn, if he has the ability to learn, if he will hire some men that possibly know more than he does of the points in which he is lacking, but does not let them know it, and if he will take advantage of every opportunity to learn and compare methods practiced elsewhere, both by personal inspection and through the technical press, he will make the man that is wanted. It costs something to make him, and the manager will show his ability in choosing his material.

A little money spent on the proper installation and maintenance of electrical equipment saves a lot of money in delays and electrical repairs; a little money spent on proper maintenance of trucks and brakes saves a large sum of money in repairs and accident claims; a little money spent on proper maintenance of car bodies saves a great deal of money in repairs and renewals. All these conditions tend to bring about that valuable asset, incapable of being estimated in dollars and cents, the satisfaction of the public. The management must realize, however, that no one of these three portions of the rolling stock equipment is more important to good, economical operation than either of the other two, and that to secure proper maintenance well-balanced talent in the repair shop is absolutely essential.

THE ELEVATED SHOPS AND TERMINALS OF THE BROOKLYN RAPID TRANSIT COMPANY—THE LUTHERAN PLANT AND STORAGE YARD

The opening paragraphs of the first of the four articles published recently on "The Elevated Shops and Terminals of the Brooklyn Rapid Transit Company" (see STREET RAILWAY JOURNAL, Feb. 2, Feb. 9, March 2 and March 9, 1907), stated that all of the elevated work was divided between the East New York and Thirty-Sixth Street shops, Brooklyn. The first is conveniently located for the Broadway, Lexington Avenue and Fulton Street lines, while the second serves the divisions running through South Brooklyn and to Coney Island. The Ridgewood line, however, has had no separate inspection facilities. Owing to the recent extension of this line for nearly 2 miles to Lutheran Cemetery and Metropolitan Avenue, over the right of way of a former steam dummy line, it has begun to carry a much larger traffic. The company, therefore, has found it advisable to build a separate inspection building and storage yard for this branch at a point where inspection could be conveniently carried on during lay-overs.

The new plant which is now under construction is on a plot with a frontage of over 250 ft. on Fresh Pond Road and about 1300 ft. parallel to the right of way. It will be noted from the plan, Fig. 3, that in addition to the inspection building provision is made for a heating plant, trainmen's and service building, passengers' waiting room and an 80-car storage yard with ten tracks spaced 12-ft. centers. Although the track plan shows the Fresh Pond Road trolley tracks connecting with the Ridgewood line, cars will not be operated over this junction except in emergencies. To protect the crossing at Fresh Pond Road and the right of way, an electric interlocking plant has been installed. It might

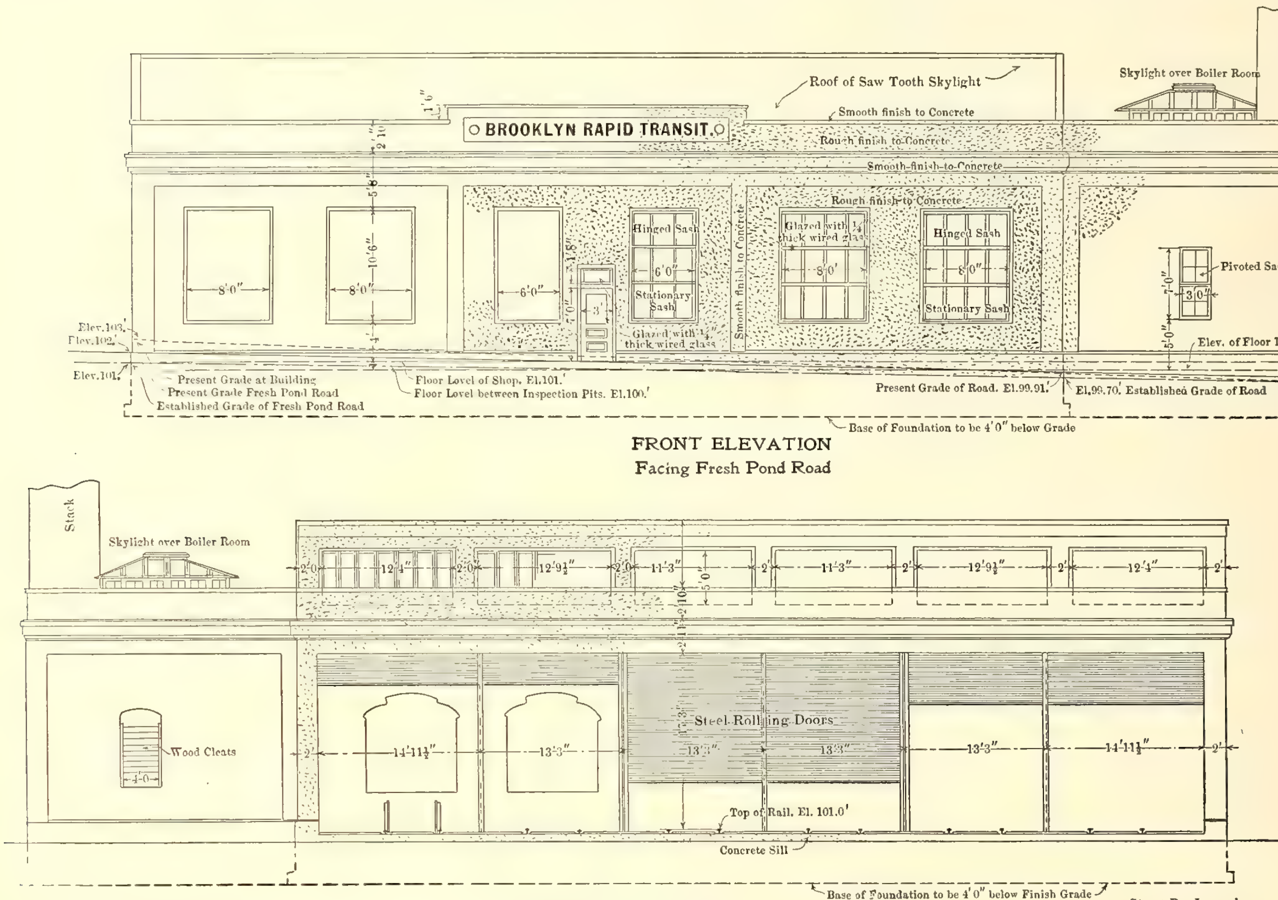


FIG. 1.—REAR AND FRONT ELEVATIONS OF THE LUTHERAN ELEVATED RAILWAY INSPECTION PLANT OF THE BROOKLYN RAPID TRANSIT COMPANY

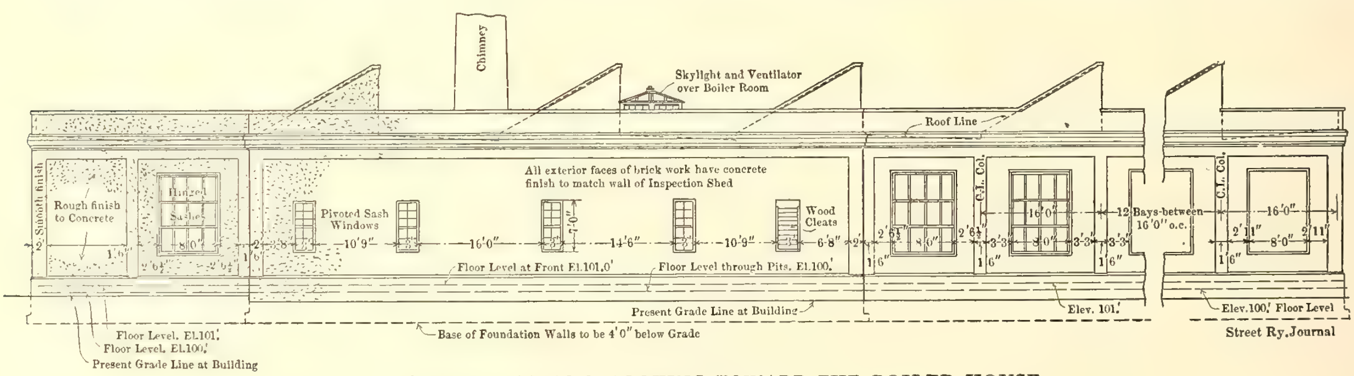


FIG. 2.—SIDE ELEVATION, LOOKING TOWARD THE BOILER HOUSE

be added that the company recently constructed just beyond the Fresh Pond installation a double-track through plate girder bridge to cross the tracks of the Long Island Railroad.

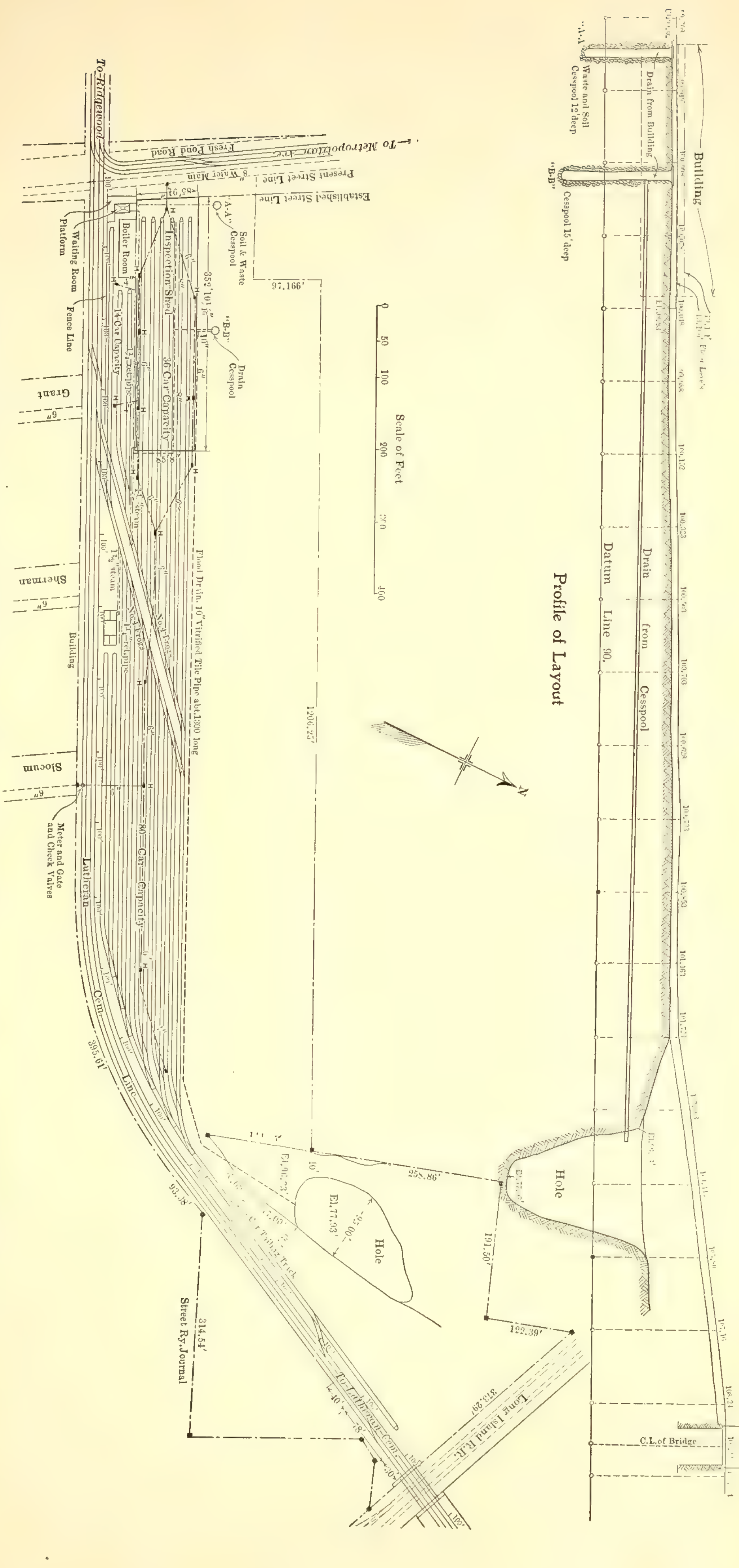
The rear of the inspection shed fronting Fresh Pond Road will serve for a stock room, offices and shop for minor repairs. The shop will contain a 20-hp compressor with air lines to the pits, as described later. The waiting room is shown as a separate structure, 15 ft. x 25 ft., placed at the intersection of Fresh Pond Road and the right of way.

THE INSPECTION SHED

The inspection shed has six tracks with a total capacity of thirty-six elevated cars. It is divided longitudinally into twenty-two bays, twenty-one of which are 16 ft. long; only the remaining one, which faces Fresh Pond Road, is slightly shorter. The side walls of the building consist of heavy iron framework supporting the side lighting, which is of the lever and gearing type used in the other elevated shops of the company. To this angle-iron framing are fastened 1-in. angle-iron studs spaced 2 ft. center to center, and to these in turn are trussed metal lath entirely enclosing all columns. A plastered wall 3 ins. thick will be carried up to the cornice, entirely covering both sides of the lath and around all columns. The columns are solidly encased with concrete to prevent rusting and the possibility of buckling under fire. A pilaster effect is produced on the exterior face of the walls by offsetting the concrete 2 ins. and forming panels, the pilaster being smooth finish and the inside panels having a rough pebble-dash stucco.

The whole roof is divided into 16-ft. bays, every other bay consisting of a 30-deg. saw-tooth built up of 12-in. I-beams at the top and 8 ins. for the intermediate portion. These extend across the full width of the inspection shed, together with 24-in. plate girders supporting each independent saw tooth. The intermediate bays are flat and are pitched away from the corresponding window of the saw-

FIG. 3.—GENERAL PLAN AND PROFILE OF THE LUTHERAN ELEVATED RAILWAY INSPECTION PLANT AND STORAGE YARD



tooth ½ in. to the foot. This construction therefore allows plenty of space for heavy rains, snow, etc. The water is kept away from the main saw-tooth windows, and the leaders are carried down inside the columns in the valleys formed by the pitched flat portions of the roof and the saw-tooth back.

The roof construction consists of 4-in. reinforced concrete slabs which are carried up 4 ins. over the top of the saw-tooth and concrete cornices, and run all around them. The entire concrete roof is covered with Johns-Manville asbestos laid in hot Ajax asphaltum. The roof system is designed to carry 130 lbs. dead and live load. The roof will be flashed and counter-flashed with 16-oz. copper, the flashing extending at least 4½ ins. under the roofing and upon all parapets, copings, etc., to raggles formed to receive the same. The counter-flashing is turned into the brick work or concrete and covered with roofing cement. The windows in the saw-tooth cornices are of the metal type with the A. E. Rendle Company's angle-iron U-bar construction.

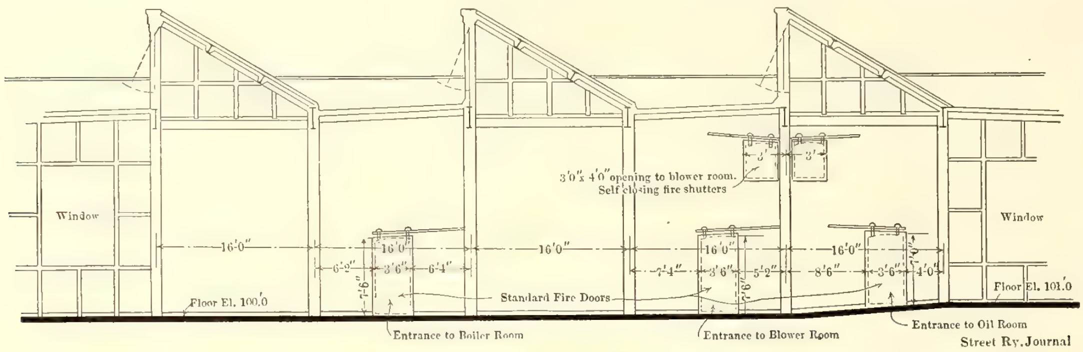


FIG. 4— ELEVATION SHOWING FIRE DOORS AND SHUTTERS, LOOKING AT BOILER HOUSE FROM INSIDE OF INSPECTION SHED

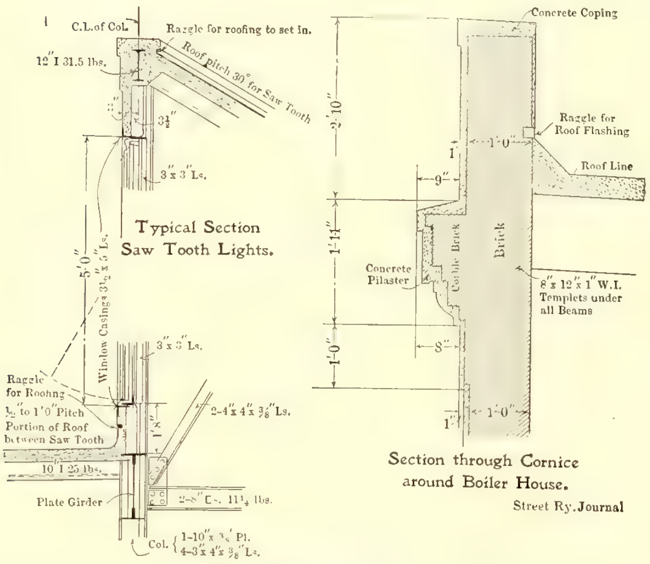


FIG. 5.—SECTIONS THROUGH THE SAW-TOOTH LIGHTS AND CORNICES

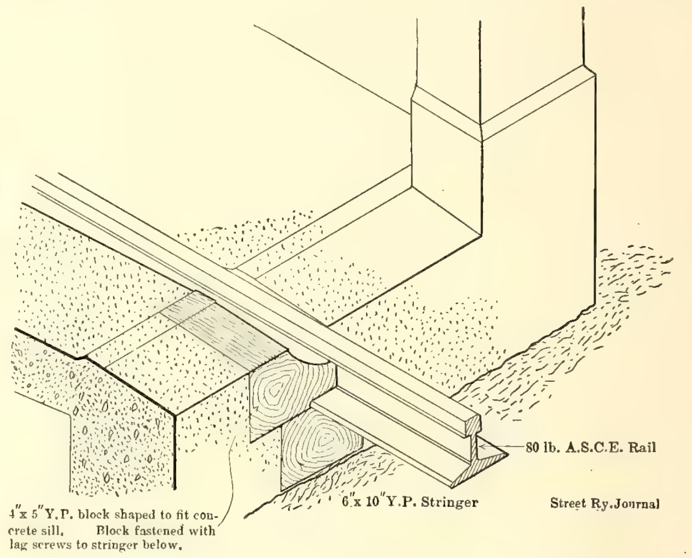


FIG. 6.—SECTION OF FLOOR IN INSPECTION SHED, SHOWING SPECIAL WOOD BLOCKS AT THE ENTRANCES

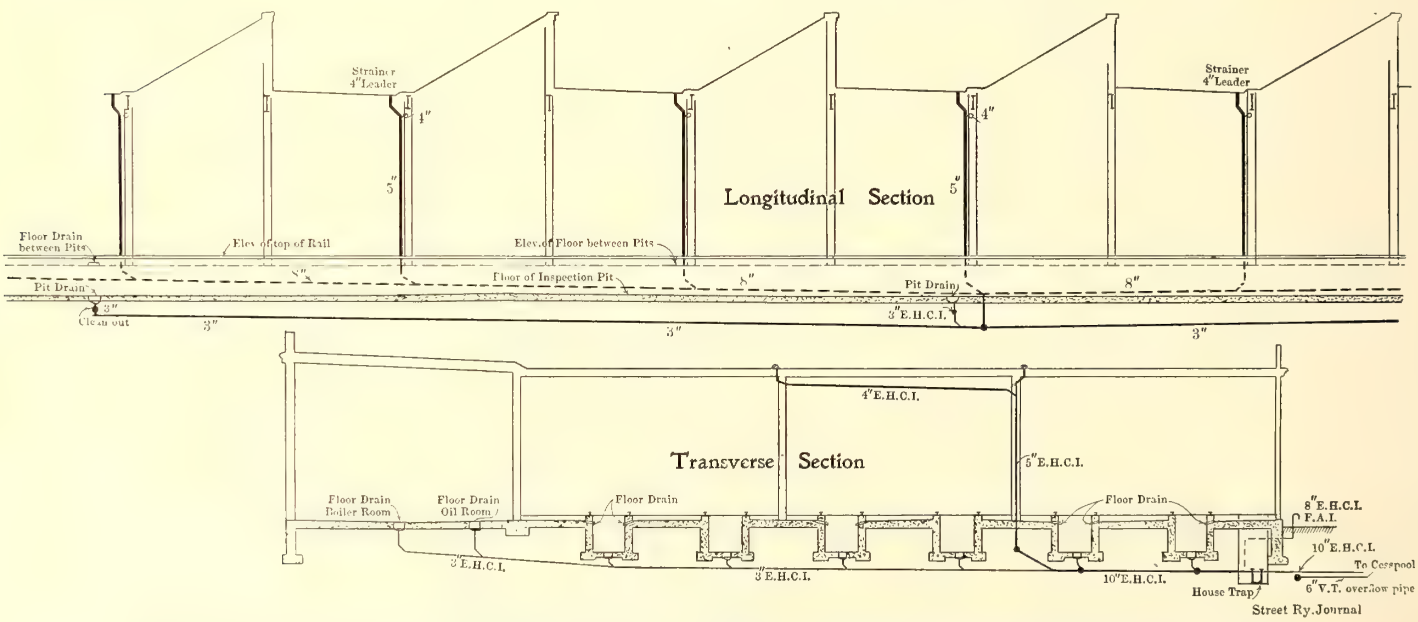


FIG. 7.—LONGITUDINAL AND TRANSVERSE SECTIONS, SHOWING THE DRAINAGE SCHEME AT THE LUTHERAN INSPECTION PLANT

The parapet walls of the inspection shed are reinforced with 1-in. square wrought-iron rods and coped as shown in the details.

The floor of the inspection shed is laid on a bed of cinders and consists of 5-in. concrete with a 1-in. granolithic finish.

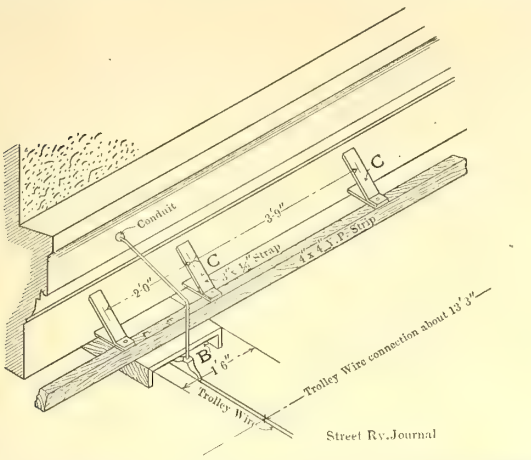


FIG. 8.—ISOMETRIC VIEW OF TROLLEY TROUGH SUSPENSION IN FRONT OF THE SHED

For convenience in drainage the floors are pitched ¼ in. to the foot in the directions indicated in the cross section (Fig. 7). This arrangement, it will be seen, gives one floor drain for two pits. The center of each pit also has a 3-in. drain which, together with the 4-in. leaders from the roof, discharges through a 10-in. pipe leading to the cesspool. The latter was built for use until such time as the municipal system is extended to this district.

Every truck is furnished with a concrete pit running the entire length and having treads at the ends with steel corner molds bonded in concrete. The tracks are 80-lb. T-rails mounted on 6-in. x 10-in. yellow pine stringers. An interesting feature in connection with them is the use of specially-formed yellow pine blocks at the entrances to fit the side of the rail as shown in Fig. 6. The use of these blocks makes it unnecessary to disturb the concrete in case the rails need renewal.

One of the most interesting features of this inspection building is the method devised for entering the shed through the six rolling steel doors. Despite its many valuable points, the rolling steel door has been subject to two troubles: first, that arising from the trolley poles striking it from either side, and second, the possibility of short-circuiting the entire building through the door when multiple-unit trains are used. The engineering department of the Brooklyn Rapid Transit Company therefore has endeavored to overcome these defects by the novel construction shown in Figs. 8 and 9. This scheme requires the bracketing out at the front and hanging on the inside of the car shed continuous 4-in. x 4-in. yellow pine strips. On the inside the trolley trough is suspended from the continuous strap and hangers. The main live trolley trough ends at the inside stringer. On the outside face of the door a short piece of trough is suspended from the outside stringer and from a block supported on the main girder lintel over the door. Inside the trough are

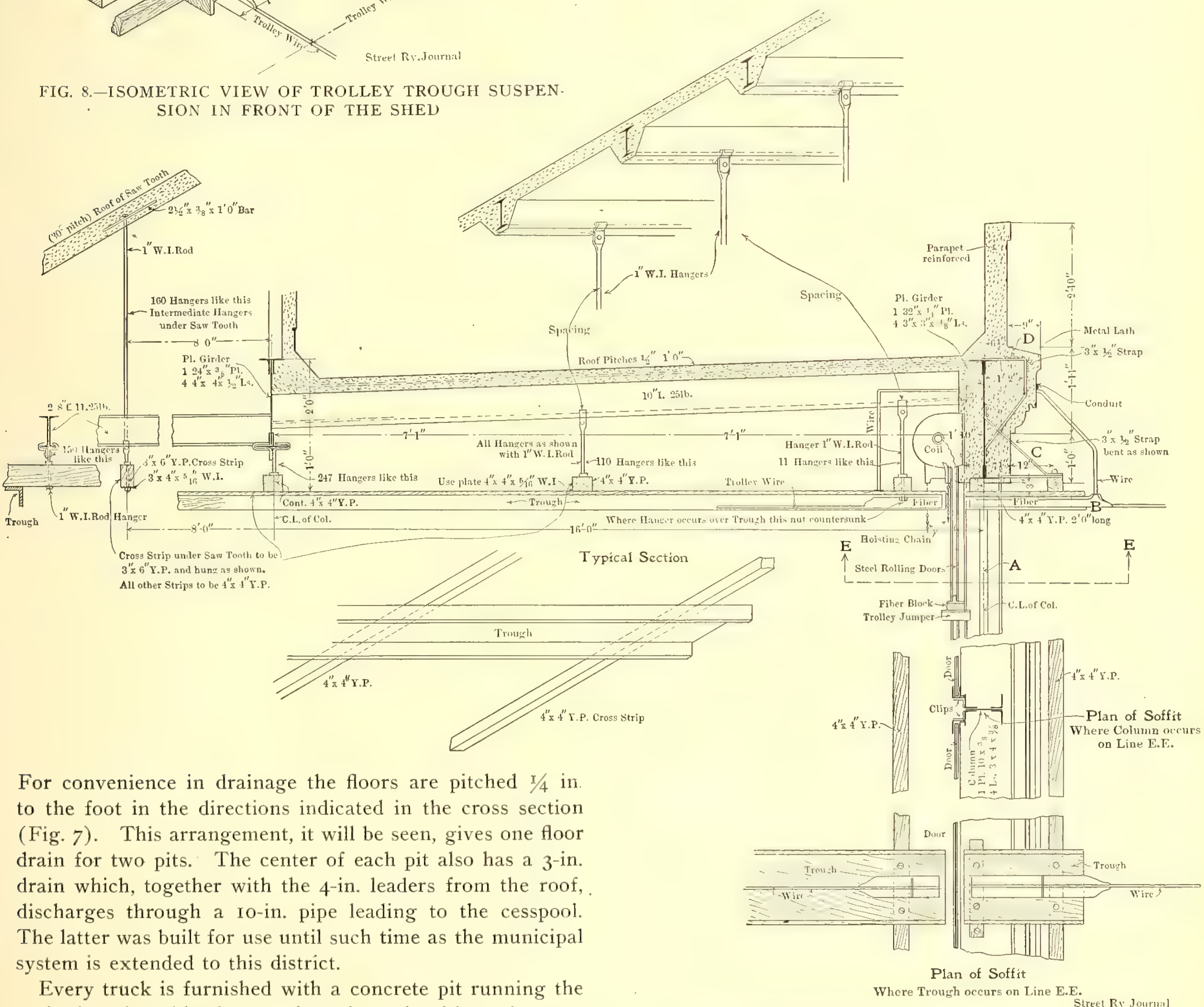


FIG. 9.—CONSTRUCTION DETAILS OF THE TROLLEY TROUGH SUSPENSION ARRANGEMENT FOR THE STEEL ROLLING DOORS

fastened insulating nosings to which the trolley wire is attached. Current from the outside is transmitted through a loricated conduit which pierces the concrete cornice and girder, thence goes down inside the building until it joins the nosing and the main trolley wire. In this way no

current can go through the doors or any other metal parts of the building. When the door rolls up between the two the boiler plant is equipped with standard fire doors and windows, as shown in Fig. 4.

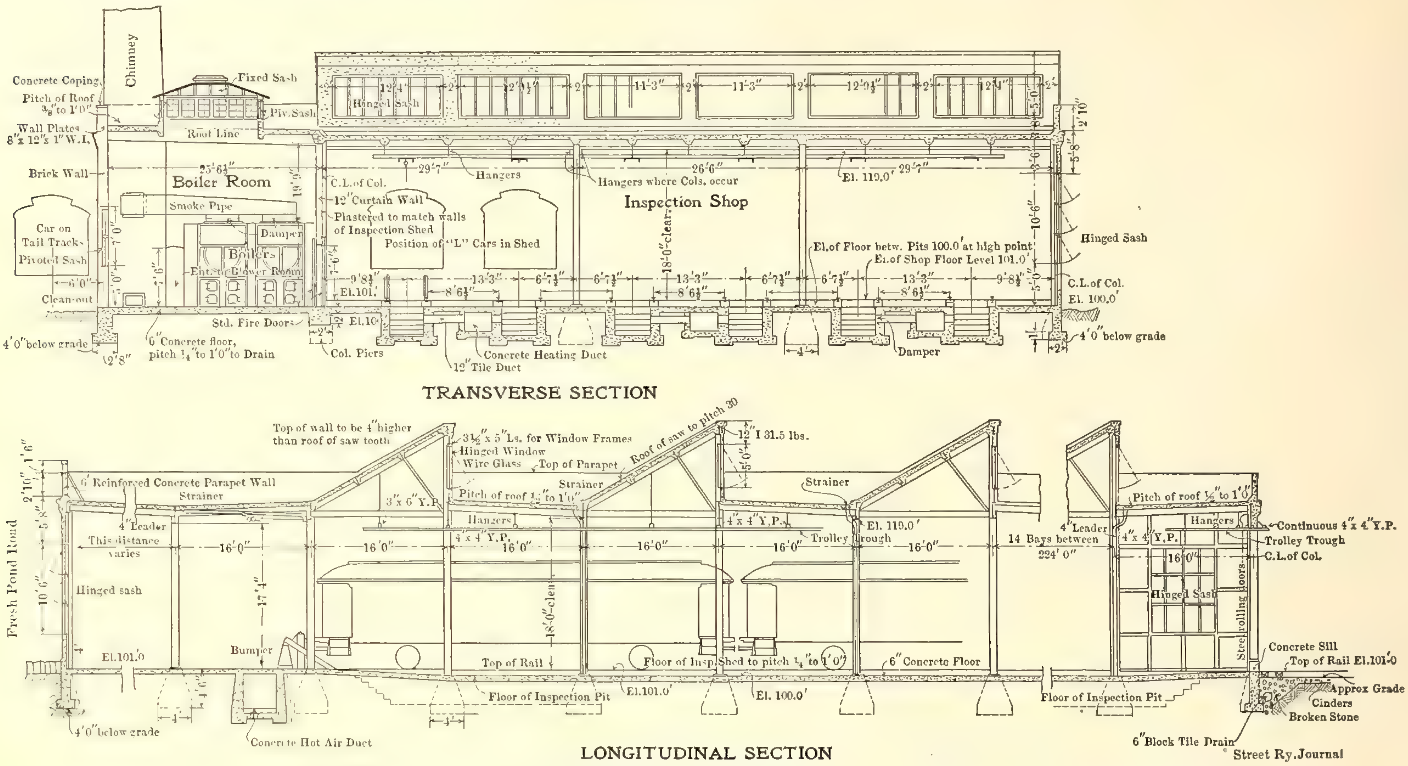


FIG. 10.—TRANSVERSE AND LONGITUDINAL SECTIONS OF THE LUTHERAN INSPECTION SHED

portions of the trolley trough it takes a fiber block jumper of the same section as the fiber nosings on the trough. This perfectly fits the gap in the trough when the door is rolled up, thus forming a continuous insulated path for the trolley wheels as the cars enter or leave the shed.

THE HEATING SYSTEM

The boiler plant is located alongside the upper end of the inspection shed. It is 80 ft. long and 25 ft. 6 ins. wide, with 12-in. brick walls having a concrete pilaster on three sides. The wall of the inspection shed forming the rear of

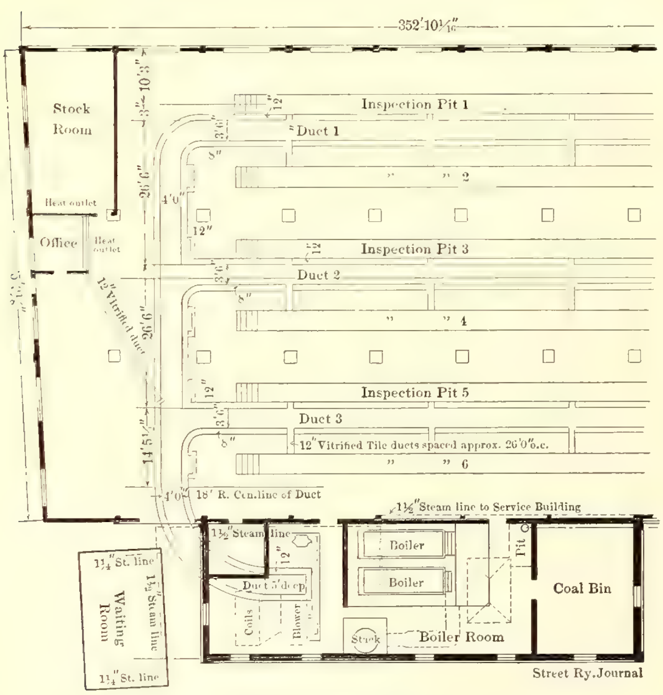


FIG. 12.—LAYOUT OF HEATING CONDUITS AND STEAM LINES

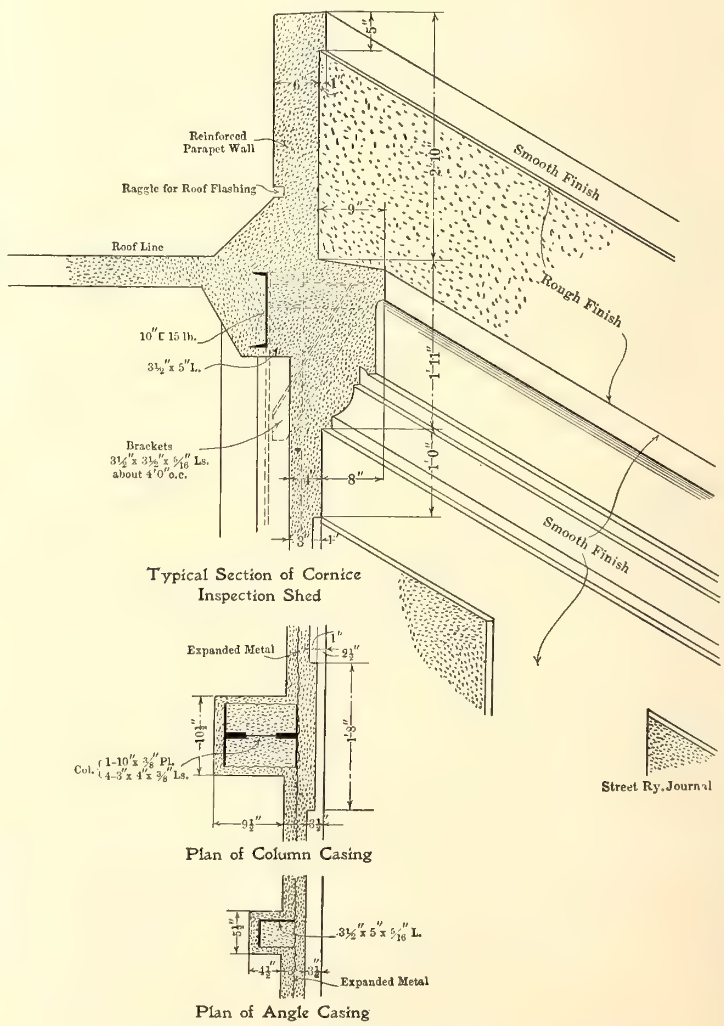


FIG. 11.—SECTIONS THROUGH CORNICES AND COLUMNS, SHOWING STYLE OF CONCRETE WORK

The building is divided into three sections to accommodate the coal storage, boilers, blower and oil department. The coal bin is nearest the storage tracks from which coal can be unloaded conveniently, and in like manner ashes from the boiler room can be carried away on the nearby tail track. The chimney will be of the Custodis hollow brick radial type, 36-in. diameter at the top and 95 ft. above the boiler room floor.

The boiler room will have two horizontal tubular return boilers, 54-in. diameter by 15-ft. length, made up of sixty-four 3-in. tubes. The heating throughout will be of the indirect type except that steam radiators will be used in the passengers' waiting room and the service building. Condensation from the indirect heating system will return by gravity, and from the direct radiation with the assistance of a feed pump.

The longest steam line will be led from the boilers for 500 ft. to the service building following the route indicated in Fig. 3. This will consist of a 1½-in. asbestos-covered steam pipe with a 1¼-in. return pipe laid in an 8-in. x 10-in. duct made of 2-in. spruce. To reduce radiation losses, the duct will follow the inner side of the inspection shed wall as far as possible. A second but much shorter steam line, 1½-in. diameter, leads to the waiting room. Both lines receive steam at a pressure of 40 lbs. per square inch.

The blower outfit, which is to be mounted on a steel platform, will consist of a centrifugal fan with an 8-ft.

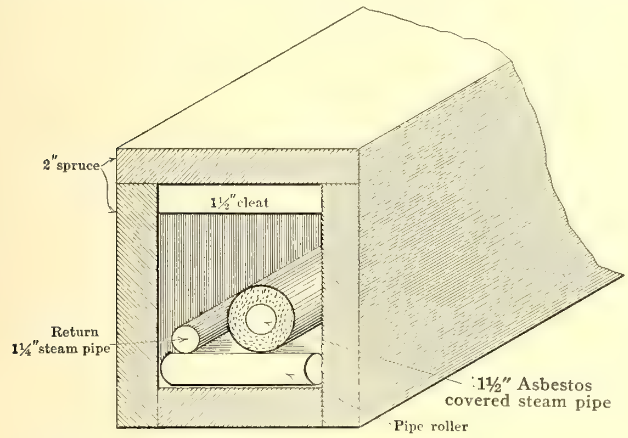


FIG. 13.—SKETCH OF BOX CONTAINING STEAM PIPES

wheel, 4 ft. wide, driven by a 30-hp Northern motor whose speed can be varied from 160 to 205 r. p. m., according to the heating conditions. The heater coils contain 6500 ft. of 1-in. pipe arranged in two sets of coils, equivalent to a total heating surface of about 2242 sq. ft. Each set of coils is enclosed in a separate casing with the steam and return connections so arranged that either set can be cut out for repairs without stopping the fan. Doors are provided to close the passage between the sets of coils and the fan while such repairs are being made.

The heated air is carried from the blower room through a concrete duct 4 ft. wide and 5 ft. deep which runs across the back of the inspection shed. Before turning in between tracks 1 and 2 it is tapped by two 3-ft. 6-in. ducts running between the other pairs of tracks and by a 12-in. vitrified tile duct dividing for a 6-in. outlet in the office and an 8-in. outlet in the stockroom. The ducts running between the sets of tracks are tapped at intervals of about 26 ft. by 12-in. vitrified tile ducts connecting each pair of pits. The heat is regulated by dampers set in the pit walls.

The tops of ducts forming floor areas are reinforced with 1-in. wrought-iron rods and Clinton wire cloth designed to

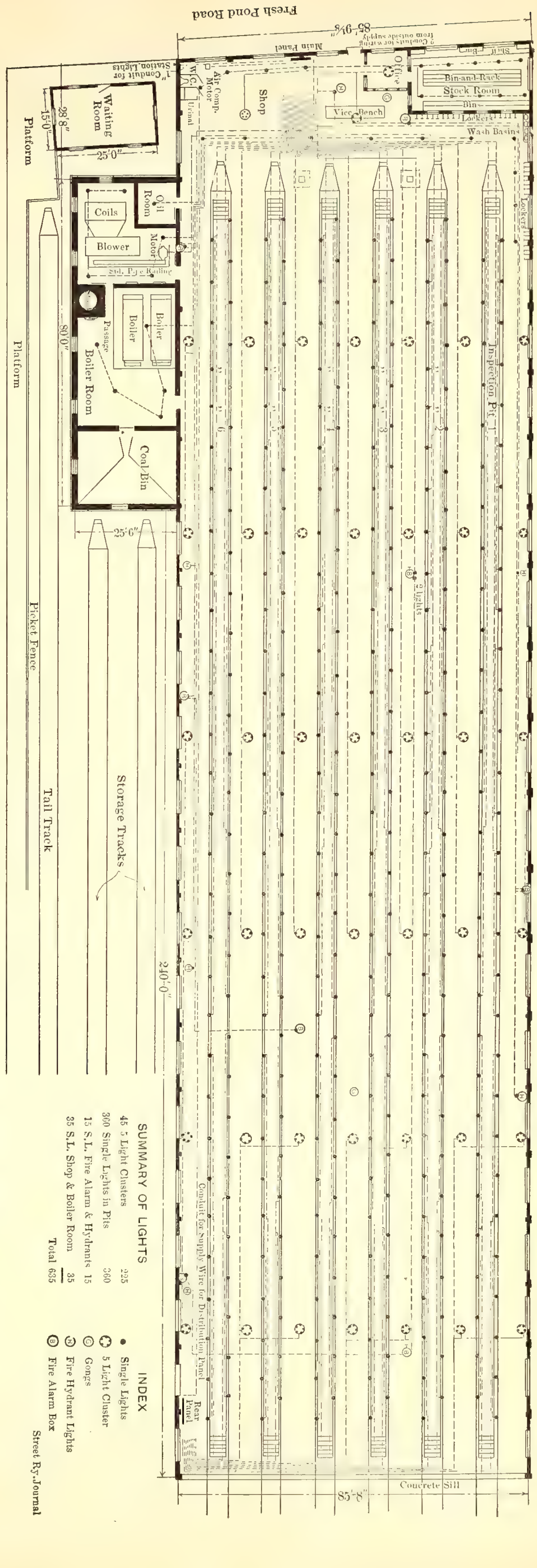


FIG. 14.—PLAN OF THE LUTHERAN SHED, SHOWING THE LOCATION OF THE LIGHTS, WITH KEY TO THEIR USES

carry a live load of 300 lbs. per square foot, except the portion leading to the blower room (designed to carry the walls above) which will be reinforced with 4-in. I-beams, placed about 24 ins. centers, and with wire cloth.

LIGHTING SYSTEM

The lighting arrangement of the main building group is well shown by the symbolic scheme in Fig. 14. It will be seen by this that the lights in the inspection shed will be made up of five-light clusters of incandescent lamps. These clusters will be spaced 26 ft. across the shed and will be attached to the columns between the tracks. The pit lights are in staggered recesses of the type shown in detail on page 234 of the Street Railway Journal for Feb. 9, 1907. The conduits are carried inside and directly under the track stringers.

Groups of five incandescent lamps are also shown in the office and shop portions, but these, like the rest of the installation, also have single lamps. There are extra single lights in connection with the fire-protection system.

FIRE PROTECTION

Effective fire-fighting means are provided both in the storage yard and inspection shed by the installation of R. D. Wood 4-in. fire hydrants with the proper length of fire hose in boxes. These are indicated by the points marked *H* on the plan Fig. 3. On Fig. 14 are indicated the positions of the alarm gongs, fire-hydrant lights and alarm boxes for the main building group. All fire doors and shutters conform to the requirements of the National Board of Fire Underwriters for tin-clad doors and shutters.

AIR PIPE LINE

The air pipes used in connection with the work in the inspection shed run from the air compressor tank to the roof and are then carried over a horizontal line and across the full width of the inspection shed. The main line has four branches which continue below the floor level and run over to the 6-in. x 10-in. yellow pine stringers on which the rails are mounted. The ¾-in. air lines running along these stringers have six ½-in. outlets on each line equipped with stop cocks.

GENERAL

The construction features of the Lutheran as well as the Thirty-Sixth Street and East New York plants were designed and built under the direction of W. S. Menden, chief engineer, and H. J. Kolb, assistant engineer and architect.

USE OF WAX IN THERMIT REPAIR WORK

G. E. Pellissier, of the Goldschmidt Thermit Company, has applied with excellent results to thermit repair welding a very ingenious method of making molds which is used quite generally in making intricate bronzes. In fact, the plan is said to have been employed as early as the sixteenth century by Cellini, the famous Italian goldsmith, but so far as is known it has not been applied before to shop work. In truck repairs it is often difficult and inconvenient to make a very satisfactory wooden pattern for the mold. One reason is that the shape of the parts to be welded is generally different in every case. Again, the pattern has to be so small that it is liable to become misplaced while the sand molds are being fitted around the truck frame. If this occurs the weld will be made at the wrong point.

The improvement consists in using yellow wax as a pattern or matrix for the casting. The parts to be welded are first laid together and a wax pattern of exactly the form desired in the final weld is shaped about them. After this is done the molding sand, which consists of fire clay and sand, is tamped around the matrix in the usual manner except that a small hole is left in the very lowest part of the mold. The pattern for runner and riser are made of wood in the usual manner. When the mold box is completely filled, the runner and riser are withdrawn; then, instead of taking off the mold and drying it, the torch is turned directly on to the green sand. The heat melts the wax, which runs out of the hole at the bottom of the mold, leaving a perfect mold. What little wax soaks into the sand rather improves the mold than otherwise. The wax does not adhere to the metal but leaves it absolutely clean. After the mold is thoroughly dry, the hole at the bottom can be closed up with a sand core. The mold is then ready for casting.

The work can be done much more quickly and cheaply by this method than by the old way. It is, of course, applicable to all kinds of thermit welds, but is especially useful in making welds on motor frames, intricate castings, etc., or in any case where fitting the mold is the hardest part of the job. Mr. Pellissier has found that in doing the work in this way it is necessary to have a good torch, so that the mold can be dried out thoroughly and the interior heated to red heat.

CONDUCTORS' WITNESS CARDS USED BY THE OKLAHOMA CITY RAILWAY

Conductors on the Oklahoma City Railway carry in their pocket a supply of witness cards which, in case of an accident, they distribute among the witnesses for signature. Having the witnesses write their own names reduces the difficulty of reading them, as frequently occurs when the trainmen write them, and also prevents errors in spelling due to misunderstanding the people giving their names. Of course, cards are also more advantageous than one form on which all the names are written, because the necessary number may be distributed and collected signed within a couple of minutes.

WITNESS CARD

Name ______________________

Street ______________________ No. ________

City or Town ______________________

____

Occupation ______________________

Date ______________________ 190 __

PLEASE FILL OUT AND RETURN TO CONDUCTOR

TYPE OF WITNESS CARD DISTRIBUTED BY CONDUCTORS ON THE OKLAHOMA CITY RAILWAY AFTER AN ACCIDENT

It is reported from Montreal that President William Mackenzie, of the Rio de Janeiro Tramway, Light & Power Company, Ltd., who recently went to London, has just sold there and on the Continent the balance (about $4,000,000) of the $25,000,000 bond issue held in the treasury.

NEW POWER STATION AT FORT WAYNE, IND., PUT INTO SERVICE

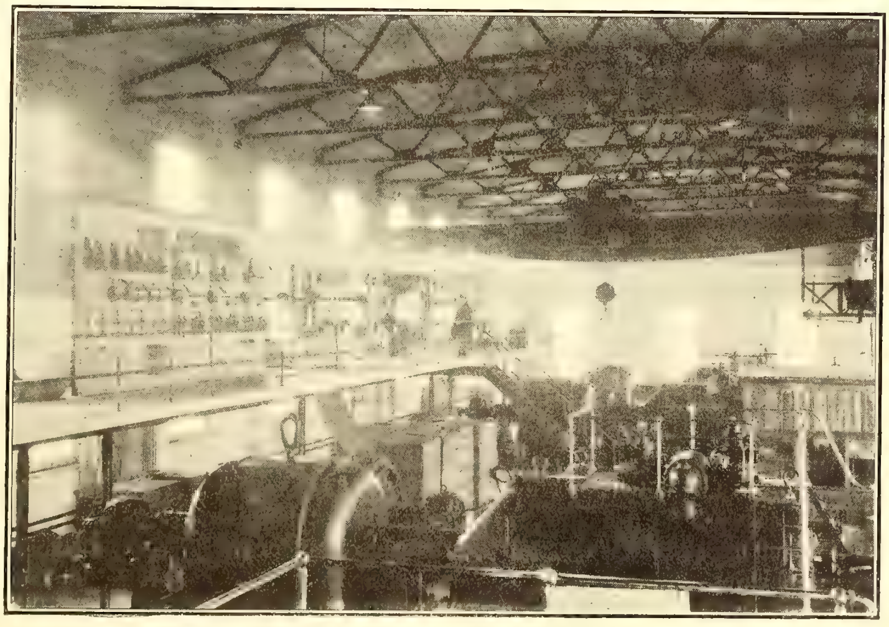
The Spy Run power station of the Fort Wayne & Wabash Valley Traction Company, at Fort Wayne, Ind., which was described at some length in the convention number of the

VIEW OF THE COMPLETED POWER STATION AT FORT WAYNE, TOGETHER WITH THE COAL-HANDLING APPARATUS

Street Railway Journal, Oct. 13, 1906, has been put into operation. Power generated in it is being transmitted to Logansport, 76 miles distant. As was mentioned in the article referred to, the feature of this station is that the Westinghouse turbines are installed on a second floor immediately over the boilers. The station is designed for five 15,000-kw, one 500-kw and one 400-kw Westinghouse turbines. With the exception of one of the larger turbines, all of the machines are now installed. The turbines are all of the enclosed type, ventilation being effected by drawing air through ducts from the outside of the building through the generator casings and discharging it into the boiler room.

TRANSFORMERS IN CONCRETE CELLS

Five switchboards are installed on a gallery extending almost the entire length of the room. These consist of a 25-cycle generator board, a 25-cycle rotary converter board, an exciter switchboard, a 60-cycle rotary board and a board for the 60-cycle generators. All of the high-tension apparatus is located at one end of the generating room. Underneath the high-tension gallery are six concrete cells for the six 375-volt to 33,000-volt oil-cooled step-up transformers. The transformers are supported on low trucks made of channel iron so that they may be readily pulled out in front of the cells, from which position they may be reached by the overhead crane. Behind the transformer cells are the static interrupters and above are the high-tension switches and lightning arresters. All of the wiring in the station is carried in bitumenized fiber conduit, of which about 6 miles are installed.



INTERIOR OF THE FORT WAYNE POWER STATION

The coal-handling apparatus is shown in an accompanying illustration. A gantry crane spans a concrete coal storage pit 60 ft. wide, 180 ft. long, and having a capacity of 7500 tons of coal. The crane carries a motor-driven McCaslin coal crusher. A clam-shell bucket elevates the coal from cars or from the coal pit and dumps it into a hopper above the crusher. After passing through the crusher it falls into a concrete coal bunker extending the length of the building. The coal-handling plant has a capacity for 40 tons of coal per hour, which should be ample for some time to come.

AN OHIO TALK ON RAILWAY TAXATION

Attorney-General Wade H. Ellis, in an address at Massillon, Ohio, recently, said that in making up the tax valuations on public service corporations, where franchises have been given, the market value of stocks and bonds should be taken into consideration. The tax valuation on tangible property is sometimes too low because the market value of the stocks of a company are high and are therefore of greater value. He said he did not think that corporations should be taxed on both the securities and the tangible property they own.

THE DENISON & SHERMAN RAILWAY, TEXAS

While the interurban systems of the Eastern States have been gradually working away from city electric railway practice towards that of steam roads, it is interesting to note that the first electric interurban line operated in Texas was built at the outset as nearly according to steam railroad practice as conditions would permit. This road now operates between Denison and Sherman, a distance of 10.5 miles,

THE HEAVIEST CUT ON THE LINE

in connection with small city systems in the two terminal cities. The two cities have a population of about 15,000 and 10,000, respectively. There are many similarly located cities of about the same size in the United States not having interurban connections, and interest in a description of this road is enhanced by the fact that its receipts are very good evidence that roads connecting such towns would give satisfactory returns to the investor. In 1905 the receipts were $104,591 and the operating expenses $60,683, giving a gross income less operating expenses of $43,908. At the present time the system is isolated, but in the course of about two years it will be connected in Sherman with the lines of

OFFICE AND STATION AT WOODLAKE

the Texas Traction Company being built between Dallas and Sherman, a distance of 65 miles.

The offices of the Denison & Sherman Railway Company, the power house and shops are located at Woodlake, about midway between the two cities, and there is also at this point a lake and park which is the chief amusement resort for the terminal cities.

TRACK AND OVERHEAD CONSTRUCTION

The interurban line is built on a private right of way varying in width from 50 ft. to 100 ft. The roadbed was constructed with a maximum grade of 1½ per cent. This necessitated one 20-ft. cut and several fills and trestles. The trestles are rather heavy, being constructed with six stringers. Both sand and cinders are used as ballast. The rails, which are 70 lbs., are in 60-ft. lengths. All of the switches are of the through type and are equipped with spring switches and Elliot frogs. Switch stands of the low target type are used. The rails are bonded with both pin and compressed bonds.

Span wire overhead construction is used throughout the system. In addition to the trolley the poles carry telephone wires and two 0000 feed wires. These feeders are for the purpose of feeding the city systems as well as the interurban line.

POWER HOUSE AND SHOPS

The power house at Woodlake is built in conjunction with a car storage barn and contains two simple Corliss engines

PAVILION USED AS A PARK STATION BY THE DENISON & SHERMAN RAILWAY COMPANY

belted to two 200-kw, 500-volt generators. The shops are located in a frame building near the power house and are well equipped with machinery for taking care of the system.

THE CASINO AND THEATER

A room separate from the remainder of the shop serves as a paint shop.

CAR EQUIPMENT

The car equipment consists of five interurban motor cars, seven open trail cars for use on the interurban line, and six cars with 16 ft. to 20 ft. bodies which are used in local service in the terminal cities. The interurban cars are from 37 ft. 8 ins. to 44 ft. long, and from 8 ft. to 8 ft. 9 ins. wide over all. They have a seating capacity for forty-

four people, and the cane seats are provided with arm rests. Two of the cars contain three and the remainder two compartments. The rear platform is open and is provided with a grill railing. A transverse pipe railing divides the floor


A THREE-CAR SPECIAL TRAIN ON THE LINE OF THE DENISON & SHERMAN RAILWAY COMPANY

space into a passageway into the car and a space for smokers behind it.

As the park at Woodlake is regarded as the chief amusement resort for the two cities, it is the source of a considerable income, and is as a consequence well kept up.

THE PARKS

There are, in fact, two parks at this point, containing 45 acres—one for white people and a smaller one of about 5 acres for colored people. The two races are kept entirely separate. Both parks are well wooded and are located on rather hilly ground. The main attraction of the larger park is a lake which contains 11 acres. This lake, which is about 20 ft. deep near the dam, runs back several


CASINO, DANCING PAVILION AND SHOOT-THE-CHUTES IN THE PARK OF THE DENISON & SHERMAN RAILWAY COMPANY


POWER HOUSE AND SHOPS, WITH LAKE AND DAM IN THE FOREGROUND

hundred feet, where the waters diverge and follow up two heavily wooded ravines. A band stand is located in the middle of the lake near the dam. The largest building in the park is the Casino, or theater, which has a seating capacity for 840 people. The stage is well equipped with scenery and dressing rooms are located on either side of it. The auditorium is provided with electric fans. A separate dancing pavilion was constructed last season. Near this pavilion is constructed a "shoot the chute" from which boats slide into the lake. A large pavilion built just below the dam serves as a station. As dancing is indulged in freely by colored people, a pavilion for this amusement has been built in that portion of the park set aside for them. All of the park buildings are painted a bright yellow with tuscan red trimmings, which color has been adopted as a standard by the company for both buildings and cars.

The parks are operated in a manner to attract only the better class of citizens. No intoxicating liquors are sold in them, and care is exercised in selecting the theater attractions. The park season lasts a little over three months, but as the climate is comparatively mild, the parks are kept open throughout the year. During the season a five-cent fare between the terminal cities and the park is made after 7 p. m., and trail cars are employed in handling the crowds.

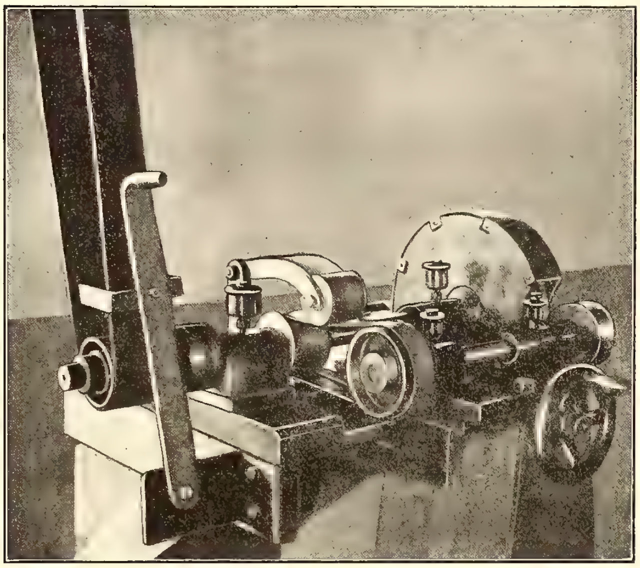
OPERATING FEATURES

Two local cars are operated in Denison and three in Sherman. On the interurban line a forty-minute schedule is maintained in winter with three cars up to 7 o'clock, when cars are run hourly. In summer a half-hour service is given after 12 p. m. The cars are dispatched by telephones, the instruments being located in cast-iron city fire alarm boxes on the trolley poles. The one-way fare between Denison and Sherman is 25 cents, but commutation tickets are sold at 17½ cents. No passes except occasional complimentary trip passes are given. Newspaper advertising is paid for in cash. Regular express cars are not run and only express matter that can be handled in the combination passenger cars is received.

The West Penn Railways Company, of McKeesport, Pa., will erect a grand stand, bleachers and fence at Olympia Park for free use by the McKeesport Baseball Association.

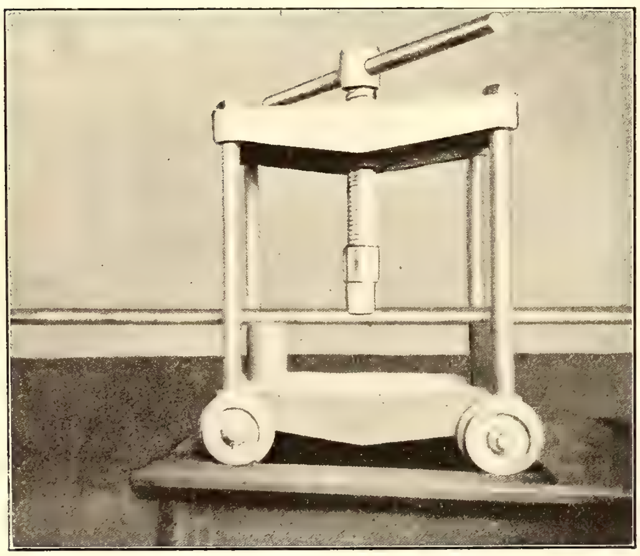
SHOP PRACTICE AT LITTLE ROCK

The shops of the Little Rock Railway & Electric Company contain several original devices for facilitating work, and there are several features of the practice in the shops which are of special interest. The courtesy of D. A. Hegarty, general manager of the Little Rock Railway & Electric Company, and the aid of W. T. Tunnah, master mechanic, makes it possible for this publication to give an account of the most interesting shop features.



TROLLEY-WHEEL GRINDER

A trolley wheel grinder built by William Kranz, shop machinist, is of interest. The company formerly had a brass furnace and manufactured its own trolley wheels, and this machine was used in grinding the grooves to the proper shape. It is built with two shafts, one of which carries an emery wheel with a specially shaped face, while on the other is bolted the trolley wheel to be ground. This second shaft is mounted on a carriage and by means of a hand wheel its distance from the emery wheel shaft may be varied. It is driven by a belt from a pulley on the grinder shaft. An idler maintains the proper belt tension. Since the practice of casting wheels in the shop has been abandoned this device is used to regrind wheels to shape. By so doing an increase of about 10 per cent is obtained in the life of wheels. A 4-in. wheel makes about 5000 miles. About two minutes is required to grind or regrind a wheel.



DEVICE FOR STRAIGHTENING POLES AND AXLES

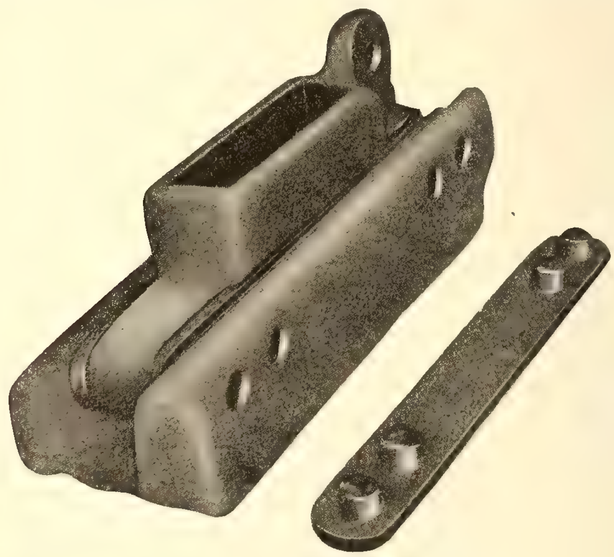
Another interesting device is used in straightening trolley poles, armature shafts and axles. This is essentially a "jim crow" mounted on wheels gaged to run on the bed of a large lathe. When axles are to be straightened, the device is placed between the head and tail stock of the latter, and while the part to be worked upon rests in the lathe, pressure is applied upon it with the "jim crow."

Instead of hammering dashes back into shape after they have been bent up in accidents or collisions, the dents and irregularities are rolled out in a press built especially for this purpose. This press, which was the suggestion of C. J. Griffith, superintendent of the railway department, is built with heavy rolls somewhat after the design of mangles in steam laundries.

CAR NUMBERS ON SIDE TRANSOM WINDOWS

PAINTING AND OVERHAULING CARS

In repainting cars all lettering is omitted and the omission of this, together with that of the scrolls and other ornaments formerly used, results in a saving of about $14 per car. Pullman green has been adopted as a standard car color, as this is the only color that has been found to hold. Other colors are bleached by the alkali soil. Contrary to usual practice, the seats and posts of summer cars are painted and grained when the cars are put through the paint shop. This practice it is considered gives a better appearance than when varnish only is applied to the stained woodwork. The seats and posts of such cars are given two coats of lead and a graining coat and are then finished with

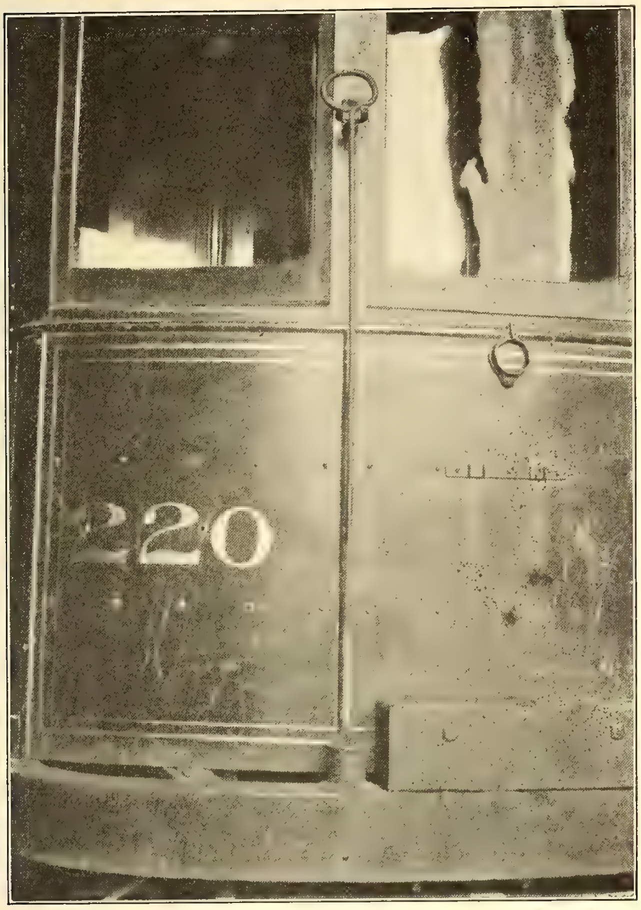


SHOES FITTED IN THE BRAKE BEAM RUNWAY OF BALTIMORE TRUCK TO TAKE UP WEAR

two coats of varnish. Cars are brought in the shop for a thorough overhauling once each year. As double equipment is used this is equivalent to an overhauling after six months of service.

SIGNS ON CARS

Instead of tacking miscellaneous card-board signs such as those making special announcements, prohibiting smoking, and talking to the motorman promiscuously about the car, all of these of a permanent nature are painted on the woodwork, while those which are subjected to change are printed on cardboard and are inserted in card racks at the ends of the car. "Remain Seated Until Car Stops" signs are placed in a rather effective manner on the backs of the seats of the open cars. On closed cars similar signs are placed in the interiors and over the vestibule doors. With these signs constantly before them, passengers if injured through disobeying them have only themselves to blame. Another sign which might to advantage be adopted by other systems is that on the controller on open cars reading, "Danger, Feet Off." This sign is printed in white letters and is intended to prevent passengers bracing their feet against the controller and defacing it. Car numbers are painted on the deck windows as shown in an accompanying view. It frequently happens that after an inspector has observed a motorman or conductor disobeying rules at night he is unable to report the violation because of his inability to catch the number of the car. By painting the numbers on the deck windows where they can be readily seen at night some of the difficulties of the inspectors are removed. Contrary to the usual practice, all of the cars are provided with fire extinguishers. These are of the dry powder type and take up very little space.



METHOD OF HANGING SWITCH-ROD AT LITTLE ROCK

One of the reproductions shows the manner of hanging switch rods to prevent them swinging and marring the dash. The lower end of the rod rests in a small cup screwed to the bumper iron.

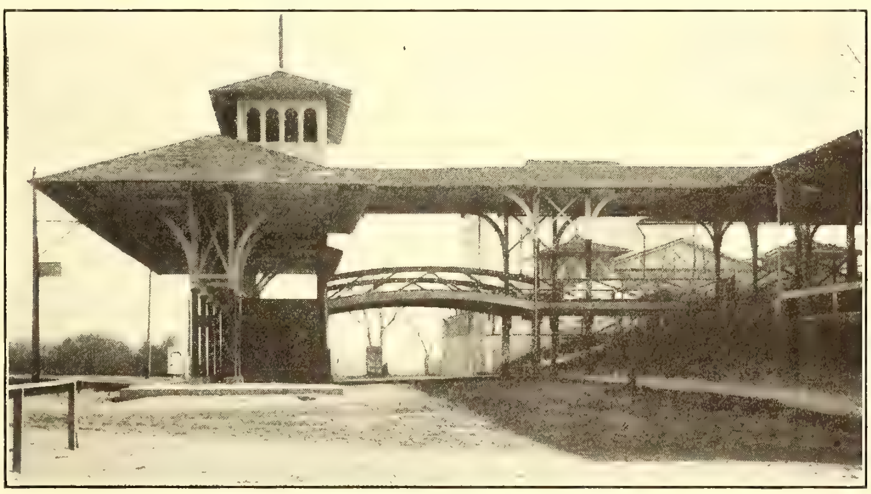
A kink of advantage to users of Baltimore trucks is shown in a view on page 688. Instead of replacing the worn runways of these trucks in which the brake beam slides, the wear is taken up by fitting in the shoes ordinarily used on the brake beams. They are placed in such a position that that shoe on the runway and that on the slide wear against each other.

ELECTRIFICATION AT ST. PETERSBURG

It is reported that work on the ten contracts which the Westinghouse Electric Company secured last year from the municipal authorities of St. Petersburg, covering the electrification of the first section of the tramway system of that city, is being rapidly pushed, and it is now estimated that the contracts will be completed very nearly on schedule time—by the last of September next. The contracts covering all the work necessary for the complete electrification of this first section amount in the aggregate to $5,500,000. In connection with this contract the Westinghouse Electric Company formed a Russian company which has acquired a complete electric manufacturing establishment at Moscow to manufacture the greater part of the apparatus required.

PARK ENTRANCE AT OKLAHOMA CITY

At Delmar Park, one of the parks reached by the Oklahoma City Railway, quite an artistic railway station has been erected. A pavilion supported by two lines of posts near the center extends over the track and a concrete platform. From each end of the platform steps ascend to a covered passageway, which is over an adjacent carriageway leading into the park proper. The park, which is owned and operated independent of the railway, embraces several acres and contains the usual attractions, including a theater, which is used as a roller skating rink in winter. A scenic railway extends through the central portion of the grounds.



PARK ENTRANCE AT OKLAHOMA CITY

HINTS FROM A CONDUCTOR

GUIDING WOMEN TO AND FROM THEIR SEATS

A great deal has been written about the subject of women and their getting off cars the right way. Men instinctively face forward in getting off a car, but women, for some unknown reason, seem almost always to face toward the rear. The two explanations generally offered for the women are that it seems to be quite natural for them, especially in cities where cars stop on the far side, to turn before alighting in the direction of the corner past which they have been carried, and also that women always make a practice of gathering their skirts about them with their left hand this, of course, leaving the right hand free and forcing them in alighting to turn backward. It would not add greatly to the burdens of the conductor to lend his aid in instructing the women in the proper way of alighting, and if this were done in a gentlemanly way no serious offense could be taken at the conductor's action. In fact, it seems that this is the only hope of ever training the women to alight properly. Placards and advertising done by street railways in their own cars seem not to have had any effect on the ladies. It would also seem advisable to require the conductor, where operating conditions will permit, to direct women to seats. They, more than men, seem bound to get aboard the open cars at the seat which is nearest to them when the car is brought to a stop. One might say, offhand, that it would require time for the conductor to do this work, but this would be compensated for by the fact that egress at the time of getting out would be materially lessened.

NOTIFYING MOTORMEN AND INSPECTORS

Various schemes are in use for notifying motormen and conductors that they are to see the superintendent. On some systems the practice is followed of posting a bulletin, and the men look over the list some time during the day and report to the superintendent at their convenience. Another method followed is for the superintendent to notify a man when he is wanted, through the starter, upon whom this task often works an unnecessary hardship. It would seem that the idea might be followed of employing an alarm clock in this work. The superintendent could have before him at all times a list of the names of the men and the times they start on their runs, and set the clock to the time of the man he wished to see. Thus, motorman Burns is to be seen. The superintendent looks at his list and sees that Burns is scheduled to be in the station at 4:10 p. m. He sets the clock for 4 o'clock, and when it rings tells the starter to tell Burns to see him before taking his car out. Conversely, it would be a good thing if each trolley car carried a flag of a certain color to be placed in a conspicuous place if an inspector was wanted.

DETACHING TRANSFERS

A question that bothers conductors not a little is that of detaching transfer slips easily. Frequently the conductor moistens his finger at his mouth in order to assist him in detaching the slips, a plan which is unhygienic, to say the least. A much better way for the conductor to do is to look after his transfers as soon as he receives his pad. If at the beginning of his run he can take the pad between the thumb and forefinger of each hand and run the transfers from left to right. They will separate readily. He can then tear the right-hand side about ¾ in., and with ease after that hand out the transfers one at a time. Another good scheme is for conductors to attach their pads by a string to a button of their coat, and pull the transfers off by running their hand down the pad.

HANDLING THE BELL-CORD

A simple expedient which would tend greatly to reduce the number of accidents would be for the conductors always to have the bell cord under proper control no matter where they are on the car. Although the rules specify that conductors shall be in view of the platform when passengers are boarding, it is nevertheless absolutely impossible at times for a man to be in a position where he can see the rear platform. It frequently occurs that a stop is made for a passenger when the conductor is in the middle of the car busily engaged in collecting fares. Frequently he relies either on the word of a passenger on the platform or on his own judgment as to the time allowance for a passenger properly to board a car, and then gives the bell a sharp jerk, releasing his hand immediately. If he would pull the bell and retain the control of the strap for a second or two, it would not seriously interfere with his work, and if the occasion should arise for his then stopping the car he could do so immediately.

TIME OFF

The question of time off for motormen and conductors is one that causes no end of trouble both for the superintendent and the starter, especially the latter. All sorts of excuses are made by men who desire to get away, and when the pressure on the line is great for men, a man who has asked to get away and been refused frequently feels that the starter might have discriminated in his favor. Would it not be better, where operating conditions will permit, to arrange the tables for 11 hours and 40 minutes a day, say for six days, than to make them up for ten hours daily for the seven days? This would give each man one day off every week and in no way decrease his income. It would of course lessen the troubles of both the starter and the superintendent.

REPORTING DEFECTS IN APPARATUS

Just why it is that motormen and conductors are so frequently berated for reporting damages to their cars it is impossible to understand. Brakes, wheels, ratchets and other parts will at times go wrong, and where the trouble is not positively serious, and a man feels that possibly he may be told that he has not handled his car with sufficient care, he does not report a slight defect. It would seem to be much better if a barn foreman would induce the trainmen to report at once any injury to the apparatus. In this way things could be corrected which, if allowed to run, go from bad to worse and eventually result in the car being laid up in the car houses. Another thing, the cost of operation is materially increased where cars are run that are not in proper condition for service. The car-house foreman should not only be constantly on the lookout for trouble, but should compliment his men on reporting faults as soon as they are found.

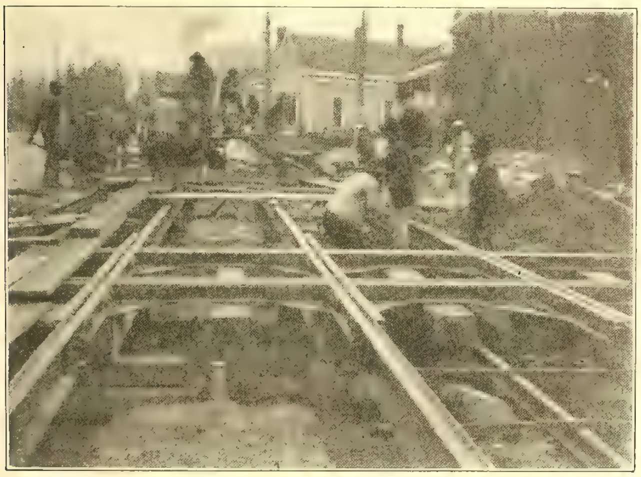
IDENTIFYING OLD MEN

When applicants for employment come before the superintendent of employment, that official sometimes suspects that a man is an old street railroader who for some reason or other has lost his previous job. Where a suspicion of this kind does exist it seems to me that the matter could be easily settled by the superintendent appointing one of his assistants to watch the man when he is breaking in. A man who has worked on a car and is thoroughly conversant with its duties will surely disclose his familiarity with things. He may impulsively go through the entire routine without

ever a thought of what he is doing. Or he may, on the other hand, attempt to cover up his knowledge of the work. In this case he bungles so noticeably that it will be detected at once. I have in mind an experience of my own in changing from one car house to another. The motorman asked me upon taking out the car if I had had any previous experience in railroading. I said that I had not, and when we had finished the day he said to me: "When you told me that you never had had any experience I said to myself: 'We shall be in the soup all day; but when I heard the bells I knew that you had worked as a conductor before." I observed, not so very long ago, without his knowing it, a man breaking in who was unconscious that the instructor was on the car. He boarded the car, wound up the brake, looked at the air, tapped the bell, worked the sand lever and threw the switch a couple of times, as well if not better than the instructor had done some time before.

TRACK CONSTRUCTION IN DALLAS, TEXAS

The track construction of the Dallas Consolidated Electric Street Railway, of Dallas, Tex., on its Ervay Street line, while of the concrete stringer type, differs somewhat from that used in other cities. No heavy cross-ties at all are employed. In addition to the customary tie-rod midway between the base and the top of the rail, a second tie-rod or bar is clamped to the base of the rail at points equi-distant from the round rods. The ties of each set are placed 10 ft. apart. The upper ones are ¾ ins. in diameter and are bolted to the rails in the usual manner. The lower ties, which are ½-in. x 1½-in. bar iron, extend under the rails and are fastened in a vertical position by a special clamp on each side of each rail. The concrete stringer proper under each rail is 18 ins. wide and 13 ins. high, but it is an integral part of the 7-in. bed of concrete placed between the rails and tracks and extending to the curb line.



STEAM-ROAD CROSSING BEFORE CONCRETING, SHOWING THE RAIL UNDERNEATH TRACK, WHICH SERVES AS A BOND OVER THE CROSSING

In laying new tracks on streets that are being improved, if single track is being replaced with single track, traffic is suspended on the line and the concrete allowed to set seven days before cars are run over it. The same method is used in replacing single track with double track, but in double track when the old rails are being replaced with new construction one track is taken at a time, using a temporary cross-over so that the service is not hindered.

The concreting and paving is done under contract by the company having a contract for paving the streets. The railway company pays for that between the rails and tracks and for 2 ft. on each side of the outside rails. The concrete is a mixture of 1 part cement, 3 parts sand and 6 parts limestone. A portable steam-operated continuous mixer is employed. In putting in the concrete, space is left around the blocks supporting the rails. After the concrete has set the blocks are removed and the holes left by them are filled in. The concrete is always allowed to set seven days before cars are run on the tracks. The streets are finished with a 2-in. layer of bitulithic paving which is carried up to the rails without use of paving block next to these.

Grooved 9-in., 95-lb. rails in 60-ft. lengths are used. These are bolted together with eight-bolt continuous rail joints and are electrically connected with two 210,000-circ.-mil plug bonds. On double-track work the slope of the street necessitates the outside rail of each track being placed ½ in. lower than the inside rails. No superelevation is given to the outside rails on curves, but at curves the gage of the track is made ¼ in. wider than on tangents.

The track construction at a steam road crossing is especially interesting. Under each rail intersection is riveted a steel plate measuring 30 ins. x 36 ins. and ½ in. thick. The spikes are driven into 16-in. x 16-in. timbers which are placed under each rail of the electric system and extend between the rails of the steam road tracks. In addition to the heavy timber, ties of standard size are spiked to the steam road rails. The whole crossing is then blocked up 3 ins. above the normal grade and a bed of concrete 18 ins. deep is placed under it. This bed extends on either side of the steam road track 6 ins. beyond the ties and back under it to the property line on each side of the street. After the concrete has set eight days the crossing is dropped to the normal grade. At railroad crossings bonding of the track is continued through old T-rails which are embedded in the concrete and are connected to the railway tracks at either end by copper bonds.

THE TRACK BEFORE CONCRETING, SHOWING THE METHOD OF SUPPORTING RAILS ON BLOCKS AND THE TWO SETS OF TIES

The track construction described has been used on about 8 miles of track in Dallas. Some of this track has been in service for three or four years, and with exception of a few places where the foundation was not firm it has been very satisfactory.

ORGANIZATION OF THE CENTRAL ELECTRIC ACCOUNTING CONFERENCE

A short account was published in a recent issue of this paper of the meeting of accounting officers of the electric interurban railways of the Central Western States, at the Algonquin Hotel, Dayton, Ohio, March 2. At this meeting it was decided to form an association, to be known as the Central Electric Accounting Conference, for the purpose of enabling representatives of the accounting departments of electric lines to become acquainted with each other and to afford an opportunity for the discussion of any matters of interest in reference to accounts which might be deemed of sufficient importance and of mutual interest. The following were present:

L. T. Hixson, auditor Indianapolis & Eastern Ry. Co., Indianapolis & Northwestern Tr. Co., Richmond St. & Interurban Ry. Co., of Indianapolis.

Walter Shroyer, auditor Indiana Union Tr. Co., Anderson, Ind.

A. F. Elkins, auditor Columbus, Delaware & Marion Ry. Co., Delaware, Ohio.

F. K. Young, auditor Scioto Valley Tr. Co., Columbus, Ohio.

H. E. Vordermark, auditor Ft. Wayne & Wabash Val. Tr. Co., Ft. Wayne, Ind.

A. C. Henry, auditor Lake Shore El. Ry. Co., Norwalk, Ohio.

J. J. White, auditor Dayton, Covington & Piqua Tr. Co., West Milton, Ohio.

R. A. Crume, auditor Dayton & Troy El. Ry. Co., Dayton, Ohio.

W. B. Wright, auditor Indianapolis & Cincinnati Tr. Co., Rushville, Ind.

W. I. McLure, auditor Toledo, Urban & Interurban Ry. Co., Findlay, Ohio.

H. A. Baymiller, freight auditor Toledo, Urban & Interurban Ry. Co., Findlay, Ohio.

R. H. Carpenter, auditor Western Ohio Railway Co., Lima, Ohio.

C. B. Baker, freight auditor Western Ohio Railway Co., Lima, Ohio.

H. H. Stephenson, ticket auditor Western Ohio Railway Co., Lima, Ohio.

C. C. Collins, general freight agent Western Ohio Railway Co., Lima, Ohio.

R. J. Wells, auditor Dayton & Xenia Transit Co., Dayton, Ohio.

M. W. Glover, auditor Indiana, Columbus & Eastern Tr. Co., Lima & Toledo Traction Co., of Cincinnati.

On motion of A. F. Elkins, duly seconded and passed, M. W. Glover was elected chairman of the conference and C. B. Baker was elected secretary.

An executive committee was elected, composed of the following: Walter Shroyer, acting auditor Indiana Union Tr. Co.; A. F. Elkins, auditor C. D. & M. Ry. Co.; A. C. Henry, auditor Lake Shore El. Ry. Co.; C. B. Baker, freight auditor Western Ohio Ry. Co.; M. W. Glover, auditor I. C. & E. and L. & T. Tr. Cos. It was decided that the executive committee would handle such matters as might come up in connection with the conference and which might not be of sufficient importance to call a special meeting of the conference to consider. It was decided that the next meeting of the conference be held at Indianapolis on Saturday, June 1, 1907, the hour and place to be determined later and all members to be notified.

The following plan for the settlement of interline freight and ticket accounts was adopted and it is expected that this plan will be followed by all lines whenever practicable.

INTERLINE FREIGHT ACCOUNTS

Interline billing shall cover the movement of freight and express shipments between such points and over such lines as may be agreed upon between the accounting departments of the respective lines. It is understood that when shipments covered by interline billing move over more than two lines, the forwarding line shall furnish to the intermediate line or lines, daily, copies of all way-bills moving over such lines or line. Settlement for all interline way-bills shall be made by the receiving line.

A report of all interline way-bills received shall be rendered by the receiving line on or before the fifteenth day of the succeeding month and shall include all way-bills received during the month for which the report is rendered. The original report, accompanied by a division statement, showing the apportionment of earnings between all lines interested, shall be mailed to the forwarding line and legible copies of such reports and division statements shall be mailed to all intermediate lines interested. The report and division statement as rendered by the receiving line shall be accepted as a basis for settlement, and all errors or omissions shall be taken up by correspondence with the receiving line and adjustment shall be made in the succeeding month's report.

The receiving line is responsible for the collection of proper revenue on all way-bills received and shall correct the freight earnings on all way-bills to basis of current rates and divisions and should issue correction sheets to all lines at interest, reporting the way-bill on monthly abstract at corrected figures, but no changes may be made in the advanced charges or total prepay of any way-bill received, until authority for the change is obtained from the forwarding line. If errors occur in the advanced charges or total prepay shown on way-bills, the receiving line should make a request to the forwarding line for authority to correct, and as soon as authority is received, issue correction sheets to all lines at interest accordingly.

As soon as interline abstracts have been exchanged between lines for each month, and not later than the twenty-fifth day of the succeeding month, the debtor line shall forward a voucher in favor of the creditor line for the balance due on interline billing for the previous month. It is understood that the debtor line shall not wait for any bill or notice from the creditor line before making the voucher.

It is desirable to settle interline billing each month, and the voucher should show month for which settlement is made. If more than one month's interline billing is settled by one voucher, the balance for each month should be shown separately on voucher, so that the creditor line may properly handle the amount in its accounts.

It is expected that all lines will promptly reply to all communications relating to differences in interline abstracts, so that adjustment of all errors may be made whenever possible in the following month's account.

INTERLINE TICKET ACCOUNTS

Ticket reports shall be rendered monthly, covering all ticket sales over foreign lines, and the line selling tickets shall apportion earnings to all lines at interest. Ticket reports shall be rendered as soon after the close of each month as possible, not later than the fifteenth day of the succeeding month, and the reports as rendered shall be accepted and all differences handled by correspondence and included in subsequent report.

As soon as ticket reports for any month have been exchanged, and not later than the twenty-fifth day of the succeeding month, the debtor line shall forward a voucher in favor of the creditor line for the balance due on interline tickets for the month for which rendered, without waiting for bill or notice from the creditor line. It is desirable to settle interline ticket accounts monthly, but if more than one month is included in the voucher, the amount for each month should be specified to enable the

creditor line to properly handle the payment. It is understood that interline excess baggage will be included in ticket reports and settlements.

Other matters of interest were discussed, but no definite action taken, and it was decided that members should be requested to submit to the secretary, in time for him to transmit them to all members, a list of subjects to be discussed at the next meeting of the conference, so that all members may know what matters will be brought forward for discussion.

Another subject discussed was the authority of the conference. It was decided that the conference did not, and did not desire to, assume any authority over, or to bind its members or any lines represented, to follow its rulings. Its object was simply to afford a means of having the auditors and other accounting officers of electric lines in the Central States, meet from time to time and discuss matters of interest in the hope that such discussion would be beneficial to all concerned, and would result in a uniform method of handling accounts. It was decided that the name "conference" would be better than the name "association," as the latter would possibly be misunderstood and the purpose of the gatherings be misconstrued.

The secretary was instructed to forward to the auditors or other accounting officers of all electric lines in the territory covered and not represented at the meeting, a request to become members of the accounting conference and to attend the next meeting in Indianapolis, if possible.

It is not expected that the meetings will last longer than one day, and as they are to be held in centrally located points, the time spent in attending such meetings will not be great.

DEDICATORY EXERCISES OF THE ENGINEERING SOCIETIES BUILDING

The dedicatory exercises of the new building of the United Engineering Societies, at 27 West Thirty-Ninth Street, New York, were held on April 16 and 17. This building, it will be remembered, was erected by money given by Mr. Carnegie on land purchased by the American Institute of Electrical Engineers, American Society of Mechanical Engineers and American Institute of Mining Engineers. It contains auditoriums of various sizes, a large union library and the headquarters of the different associations. A number of other associations, like the American Street and Interurban Railway Association and National Electric Light Association, also have offices in the building. Before the meeting on Tuesday Mr. Carnegie made a tour of the building and spent considerable time in the headquarters of the American Street and Interurban Railway Association.

During the exercises on April 16 Charles W. Hunt, past president of the American Society of Mechanical Engineers, presided. Rev. Edward Everett Hale opened the exercises with prayer. Communications and felicitations were presented from the President of the United States, the President of Mexico and the Governor General of Canada. That from President Diaz was offered in person by the Mexican ambassador. The others were read by T. Commerford Martin, president of the Engineers' Club.

Charles F. Scott, chairman of the building committee, then presented a historical address. He referred to the initial offer from Mr. Carnegie which was made at the time when the three societies were wellnigh strangers to one another. To utilize the gift they had to plan and work together. Mr. Scott continued:

"Three members were appointed from each of the three engineering societies and three from the Engineers' Club, which also participated in Mr. Carnegie's gift. The building had to be planned not only for the present, but the future. So rapid has been the growth that the aggregate membership of the three societies has increased 53 per cent since the gift was made. In his offer of the gift Mr. Carnegie had said that co-operation is "the keynote of success," and that "there is a harmonizing effect which counts for everything in the progress of any great movement, political, social or scientific." For this reason he associated the club with the societies in his gift, and the same idea has been found in the reception rooms in the societies' building. In a sense the crowning feature of the project, as it is of the building itself, is the library, which is a storehouse of power of great value and far-reaching influence. Years ago an engineer was apt to work by himself; technical knowledge and experience were kept secret. Stagnation resulted. Through increase of knowledge and interchange of experience progress came. In those branches where discussion has been most active progress has been most rapid. The new building will enable the societies to become more useful in the dissemination of knowledge."

Chairman Hunt then presented to Mr. Olcott, president of the United Engineering Societies, the key of the building. He then introduced Mr. Carnegie, who made a most felicitous address. Among other things, Mr. Carnegie said:

"It is the spirit of the men that does the work; the safety of human society lies just here. Whenever we coalesce to do some good, a unification and a consolidation take place. Whenever men meet to conspire against the public good—to do some evil—they find themselves unable to trust each other. That's why you needn't worry about the future and about what problems society is going to meet. Quite apart from whatever evil exists, the principle of improvement is inherent in us. To-day is better than yesterday and to-morrow will be better than to-day. So I look forward to the future of this building, and I know that the organizations to whom it is devoted will advance and continue to meet the developing needs of our age."

Mr. Carnegie also spoke of the inspiring value of co-operation and acquaintanceship as represented by a union building for the various associations. He continued: "We only hate those we don't know. The younger I get, and the more experience I have with men and women, the more I come to realize the truth of this. To know the virtues of your brother is to know the spirit of brotherhood. That is why I am an advocate of the peace of the world. We only have to know our brothers the world over to realize that all men of all nations are indeed brothers."

President Arthur T. Hadley, of Yale University, delivered the principal address, which was on the "Professional Ideals of the Twentieth Century." A digest of President Hadley's address follows:

PRESIDENT HADLEY'S ADDRESS

The men who did more than anything else to make the nineteenth century different from the other centuries that went before it were its engineers. Down to the close of the eighteenth century the thinking of the country was dominated by its theologians, its jurists and its physicians. These were by tradition the learned professions; the callings in which profound thought was needed; the occupations where successful men were venerated for their brains. It was reserved for the nineteenth century to recognize the dominance of abstract thought in a new field—the field of constructive effort—and to revere the trained scientific expert for what he had done in these lines. Engineer-

ing, which a hundred years ago was but a subordinate branch of the military art, has become in the years which have since elapsed a dominant factor in the intelligent practice of every art where power is to be applied with economy and intelligence. A building like this is therefore the symbol of all that is most distinctive in the thought of the century that has gone by. A hundred years ago we might have had a building in honor of theologians or of lawyers or of physicians; but one that symbolized the achievements of the engineer was beyond men's dreams, because the world at large had neither felt the need of his work nor dreamed how soon it should be seeking his leadership.

The public has recognized that scientific conduct of a business means the substitution of universal experience, learned with difficulty and applied with toil, for the narrower range of individual experience which was at the disposal of the so-called practical men of fifty or a hundred years ago. Of this change the engineer is the representative and the leader. He it is that makes physical science in its various lines applicable to the complex problems of construction and development. He it is who has paved the way for the recognition of the technologist and the expert in every line of human industry. He it is who has shown how mathematics, instead of being an abstract discipline, remote from everyday human affairs, may become the means of applying truths for a long time remote and undiscovered to the everyday affairs of the world in which we live. Not the buildings that you have built, not the railroads that you have planned, not the machines that you have invented, represent your greatest achievement. Yours is the proud boast of having in one brief century established science as the arbiter of the material affairs of mankind, and of having enforced her worship upon a world once reluctant but now gloriously admiring.

What then, you will ask. Is there anything which remains to be done comparable in importance to this? Yes, there is. An equally large part—perhaps in one sense a much larger part—of your professional duty yet remains to be accomplished. It is not enough to have technical training. It is not enough to know the special sciences on which the practice of a profession is based. A man ought to have clear conceptions of the public service which his profession can render and the public duty which its members owe. Thus, and thus only, can the engineer, the lawyer, the physician, or a member of any other learned profession, rise to the full dignity of his calling.

For there are two quite distinct qualities which must be combined in order to secure the best professional service; two quite distinct tests which work must meet in order to be pronounced first-class. One of these is the technical standard; the other, for want of a better word, may be called the ethical standard. The man who wishes to build a good railroad must not only lay it out according to the rules of the surveyor's art, with proper curves and grades and bridges which will not fall, but he must also have some intelligent regard to the needs of the population, the safety of travel, and the many other factors which determine whether a railroad shall be a work of public use or a source of industrial bickering and financial disaster. This combination of public and private demands is not peculiar to engineering. It can be illustrated in every other profession of importance. It is not enough for the lawyer to give advice which shall be technically sound and which shall enable his clients to keep out of jail. He must learn to take a large view of the law as a means of public service instead of private gain. It is not enough for the physician to know how to cure specific diseases. He must know how to care for the larger problems of public health, and to use the resources of the community in a way to meet as fully as possible its sanitary needs.

This larger view of professional obligations is not so fully recognized as it should be. We have in the nineteenth century made so much progress in the technical training of doctors and lawyers and engineers that we sometimes forget that there is need of anything more than technical training. We have let the old idea of public leadership, which was prominent in the minds of the great professional men of past centuries, give place to another and narrower ideal which is fully satisfied when a man has made himself a technical expert. Many a man of real eminence in his calling deliberately rejects the wider conception of professional duty which I have here indicated. Perhaps he recognizes the claims of public service, perhaps he does not; but in any event he believes that these claims rest upon him as a man rather than as an engineer or a lawyer. In his professional capacity he says he is hired not to tell what the law ought to be, but what it is; not to advise how a railroad can do the most public service, but how certain men with certain ideas of their own can best use the differential calculus to get those ideas carried out. This is perhaps the prevalent view of professional ethics to-day. I believe that it is a wrong view, which must menace not only the influence and standing of the professions themselves, but the general interests of the republic. It has been said that engineering is the handmaiden of commerce, but I do not believe that the men who have planned and dedicated this building will be satisfied with any handmaidenly conceptions of what their successors ought to do. If for a moment, in our zeal for new technical developments, we have let our responsibilities as public servants fall out of our hands, I feel sure that we shall be ready to take them up again as soon as our eyes are opened to the real situation.

There arises now and then among our engineers a man with this quality of looking into the future—call it genius, call it insight, call it imagination. One of your own members said in a memorable speech that the thing that distinguishes a man of the first rank in his profession from a man of the second rank is the possession of this quality of imagination. Unfortunately it is rare. We cannot all of us have it. But we can have more of it than we now have, if we will modify our training and widen our standards of professional success. Excellent as is the course in our technical schools, it does tend to have a narrowing effect instead of a broadening one. The ideals of our engineering societies are high, but they are not always as broad as they might be. The widening of the course in the schools and greater readiness in our associations to recognize services which we now call non-professional will, I am convinced, do more for the engineers and more for the community than would be represented by ten years' progress in mining or machinery and the various developments of applied science.

We celebrate to-day, and we are justified in celebrating, the recognition of science as a necessary guide in the conduct of the material affairs of each man's business. Half a century hence, when our descendants shall meet in this building, or some greater building, I am confident that they will celebrate a yet greater thing—the recognition of the right of men of science to take the lead in enlightening the thought of the people on public affairs and the responsibility of filling the highest positions in the service of the commonwealth.

In the evening of April 16 a general reception was held in the main auditorium, at which the presidents of the three engineering societies, President Olcott, of the United Engineering Society, and John W. Lieb, Jr., chairman of the dedication committee, received the guests.

On the afternoon of Wednesday, April 17, the exercises were continued under the chairmanship of Mr. Lieb, and addresses were made by the presidents of the four founder societies, Dr. Sheldon, of the Electrical Engineers; Prof. Hutton, of the Mechanical Engineers; Dr. Hammond, of the Mining Engineers, and T. C. Martin, of the Engineers' Club. Addresses were also made by representatives of the affiliated associations, and greetings and felicitations were received and read from foreign and national scientific societies and institutions of learning.

An address was then made by James Douglas, past president of the American Institute of Mining Engineers. At the conclusion of Mr. Douglas's address, Alexander Graham Bell was made the recipient of the John Fritz gold medal by Charles F. Scott, chairman of the board of award. Commemorative medals for distinguished services were also presented to Messrs. Pope and Raymond, secretaries of the Electrical and Mining Engineers, and Prof. Hutton, past secretary of the Mechanical Engineers. The presentations were made by A. R. Ledoux, past president of the Mining Engineers.

Professional sessions of the Mining and Mechanical Engineers were held on Thursday, that of the Electrical Engineers having been held on the evening of Monday. The exercises concluded Friday evening with an informal smoker and vaudeville at the Madison Square Garden Concert Hall, in which all of the associations joined.

MODERN TRAIN DISPATCHING ON INTERURBAN RAILWAYS *

BY H. H. POLK
President and General Manager, Interurban Railway Company

The managers of electric railways until recently have given but very little attention to that most important part of train operation, the dispatching of trains. However, they have at last come to the realization that safety in this respect is just as important to electric trains as it is to steam trains, and that it should be done in much the same manner. Even to-day the dispatching systems in vogue on most electric railways are very crude.

There are three important factors in train operation to be taken into consideration, viz.:

(1) First, and above all others, is safety both to passengers and property; this must be had regardless of cost.

(2) The speedy operation of trains over the road, giving them all possible dispatch commensurate with safety.

(3) The economical operation of trains, keeping them on the "go" all of the time, and not letting them lie "dead" on some side track waiting to meet something.

To obtain these very important results it is absolutely necessary that trains should be operated on train orders issued from a central office and directing train movements in addition to the ways provided for in the rules and time tables. The printed time tables which show the meeting places and time of all regular trains and the rules which direct how these trains are to proceed with relation to each other, if understood by all trainmen alike and faithfully carried out, will prevent collisions. If, however, it becomes necessary to issue special orders for trains not on the time card, then the train order is absolutely necessary. These orders must be clearly expressed, and the form and even the paper on which they are written must be such that they may be easily and quickly understood by all whose duty it is to read them. Conductors and motormen must know that they are given by competent authority and that all concerned have corresponding orders. There must be only one dispatcher issuing orders on a division at a time. This is one of the few cases where one head is better than two, for two dispatchers issuing train orders on the same division would not only involve a very serious risk, but would contribute largely to the lack of confidence on the part of all trainmen. Never let two men dispatch a train.

When a time card is issued a receipt for it should be taken from all persons concerned; this makes sure that it has been received. It is much more difficult to be assured that train orders have been received and understood by all concerned. After the order has been prepared by the dispatcher it is transmitted to the desired persons either by telegraph or telephone. The telephone is almost universally used by interurban railways for dispatching trains, while the telegraph is employed by steam railways. In my opinion, the telephone is far superior for transmitting train orders in interurban service. All stations and sidings can be equipped with telephones, by which a train crew may communicate with the train dispatcher at any time, thus avoiding serious delays.

The system now in use on the line I represent follows the standard dispatching systems of steam railroading, with some modifications necessary to adapt it to our use. All trains leaving the central waiting station of the Des Moines City Railway Company are under the jurisdiction of that company while running on its tracks, and receive their first order from the interurban dispatcher at Beaver Valley Junction, on the Beaver Valley Division, and at Grand View Park, on the Colfax Division. At these points are located telephone booths, which are equipped with telephones, a pad of standard thirty-one train order blanks, and a locked box in which to deposit the third copy. Of the latter I shall say more later on. One of these booths is also located at each siding on the line.

The conductors of an out-bound train, on arrival at these points, steps into the booth and calls up the dispatcher, saying, "Jones train, No. 96, at Beaver Valley Junction." The dispatcher reads to him the order which he wishes to issue, the conductor writing it himself verbatim as given. In so doing he makes three copies by use of carbon sheets, one copy to be given to his motorman, one to be retained by himself and the third to be deposited in the box, to be used in case of any misunderstanding of orders and as a means of placing the blame upon the proper person. After the order is written by the conductor, he reads it back to the dispatcher, who checks it with his copy. If correct, the dispatcher says "complete." The conductor then writes "complete," together with the time the order is made, and signs his name. He then goes to the motorman's cab and gives him a copy of the order, which the motorman, in turn, repeats to him. The conductor is now permitted to board his train. He gives two bells and the train starts.

We are very particular to have the conductor deliver the order to his motorman before boarding his train to avoid absolutely any start without a thorough understanding on the part of the motorman. With us it is a very serious offense to violate this rule. A few years ago we had a very serious accident, caused by the crew disobeying this regulation. The conductor, after receiving his order, stepped on the rear platform, signaled the motorman ahead, and was walking through the car to give the motorman his copy when the collision occurred. The order in this case was a "hold order."

Conductors are required to report at all stations where agents are located, and should a train become delayed between stations the conductor must call the dispatcher from the nearest telephone booth, thus giving him the opportunity to change the order if desirable. Our sidings are about 2 miles apart, but trains must report only at such sidings as are designated on the time card, and must never leave these designated sidings without a clearance or train order. In-bound trains must report their arrival at Beaver Valley Junction and at Grand View Park and also at the central waiting station in Des Moines.

Our dispatcher issues daily an average of 120 train orders. On the Beaver Valley Division we operate thirty-six passenger trains, two package express cars and two freight trains between 5 a. m. and 12:40 p. m., making a total of 1303 miles per day. While on the Colfax Division we run thirty-four passenger trains, four package express cars, and freight trains when necessary, making 1065 miles per day.

The telephone line as installed consists of two No. 9 B. B. galvanized iron wires carried on cross-arms in the usual manner on the same poles and underneath the high-tension transmission lines, and transposed every ten poles to prevent interference from parallel power and feeder line. The dispatcher's switchboard was made by the Stromberg-Carlson Telephone Manufacturing Company. The telephone instruments are of standard make and of the bridging type.

* Paper read at the Clinton meeting of the Iowa Street and Interurban Railway Association, April 19-20, 1907.

By reason of the almost constant use of the telephone line by the dispatchers, it became impossible to transact any company business without seriously interfering with the safe dispatching of trains. It, therefore, became necessary to build a second telephone line, or install what is known as a composite system. We chose the latter, as it was much the cheaper and meant only the cost of installing telegraph instruments. By so doing we have doubled the capacity.

In the installation of the telegraph we had the choice of two general methods, one being what is known as the European or open circuit method, the other being the American or closed circuit method. The former of these two systems was adopted upon the advice of Mr. Cunningham, our electrical superintendent, as it has many advantages over the latter, especially for the composite system. The European or open circuit system is essentially a multiple system, while the American or closed circuit is a series system. With the European open circuit no power is used except when the instruments are actually in use. Another advantage is that in case the line should break, instruments could be used on each side of the break. As no switches are used on the keys, it is impossible for the operator to go away and leave the line open by leaving his key open.

Both sides of the telephone line are used as one side of the telegraph line. For the other side the telegraph instrument is connected to ground by means of an impedance coil, wound so as to offer impedance to the a. c. telephone and signaling current passing from one side of the line to the other, but offering little resistance to the d. c. telegraph current passing from both sides of the telephone line through the telephone instruments to the ground.

The success of the composite system, of course, depends upon both sides of the telephone line having the same resistance, impedance, capacity and inductance. In other words, the telephone line must be perfectly balanced, so as to prevent the d. c. intermittent telegraph current impulses from passing from one side of the telephone line to the other through the receivers. In a perfectly balanced line there is no disturbance or interference between the telegraph and telephone instruments.

The use of the telegraph on the telephone line does not necessitate any more care than would be necessary for a satisfactorily operating telephone circuit paralleling high-tension lines. The energy used to operate the telegraph instruments is obtained at each station direct from the 600-volt d. c. feeder by shunting one 16-cp lamp in a series of five.

A composite system not only doubles the amount of business that can be handled over a single line, but is much more reliable and convenient than either a telephone or telegraph line alone. The telephone and telegraph are not affected by the same cause, and what would disable one will often not affect the other.

AMUSEMENTS—HOW SHOULD THIS FEATURE BE HANDLED BY THE OPERATING COMPANIES?*

BY H. W. GARNER,
General Manager of the Oskaloosa Traction & Light Company

It is not within the bounds of this paper to review the opinions and observations of any great number of persons engaged in devising, constructing and operating amusement resorts and catering to the pleasure whims of the public, for the railway manager has only to read the excellent articles on amusement parks and their operation regularly appearing in electrical periodicals to keep in touch with the extent, development and constant progress along this line.

It has been reliably stated that this country presents the greatest and most prosperous development of outdoor amusements in the world. In this connection it is safe to assert that, without electricity, the summer park, as we know it, would never have been evolved and brought to its present high stage of development.

This paper will endeavor to state, first, what the electric railway companies of Iowa have accomplished and are doing in furnishing or promoting amusements as a feature of their operation and for the purpose of inducing traffic; second, to determine as nearly as possible to what extent the companies can make conservative and profitable investments in maintaining or assisting amusement resorts, and third, to point out in a general way the best methods to pursue as shown by experience and observation.

The management and features of pleasure resorts certainly present as varied sides as the transportation business itself, and to-day millions of dollars are invested in this generally profitable industry. It is safe to say that every railway in this, as well as other States, has been in some way the originator or sponsor for the resorts now in operation or contemplated. In only a very few of the larger cities of Iowa has the amusement park taken a separate place in the business world and passed from the hands of the street railway into private control. In every instance, however, the street railway is absolutely essential to the development of these parks; the interest of the park operators and the railways are mutual.

The electric railways of Iowa are now represented by some twenty-three separate companies operating over 500 miles of electric street and interurban track and serving an approximate population of 500,000. For convenience, the companies are divided as follows:

Companies serving population of 40,000 to 100,000 = 6.
Companies serving population of 20,000 to 40,000 = 6.
Companies serving population of 10,000 to 20,000 = 7.
Companies serving less than 10,000 = 4.

In preparing this paper the writer assumed that the majority of members at this meeting would not be interested in conditions existing in cities of over 100,000 people.

To a certain extent, every one of these companies has engaged in the amusement business, and every manager apparently retains some distinct if not comforting memories. The writer remembers when it was one of his duties several years ago to preside over the ticket office of a summer vaudeville theater, and after each performance of a colored minstrel troupe locked up their band instruments for safe keeping, that these instruments were referred to in a certain chattel mortgage given to secure their railroad fare advanced. At the end of a rainy week the minstrels had faded away, but their instruments adorned the company's office for some time after.

To-day, however, reports from the different cities show that the railway companies are well advanced in having provided amusement parks for the patrons of their lines, and in several towns the companies have established and are now maintaining creditable and valuable amusement facilities in connection with their lines.

While it is not the purpose of this article to disclose to what extent the various cities have invested in this de-

* Paper read at the Clinton meeting of the Iowa Street and Interurban Railway Association, April 19-20, 1907.

parture, it may be stated that three companies own their parks outright and operate them directly. Eight companies derive benefit from amusement parks operated privately, by the city or leased by the company. The eleven remaining railways have no pleasure resorts on their lines.

The three companies first mentioned guarantee the expenses of the parks, and none of them reports a profit out of the actual park operation. From this it might be inferred that as a separate financial undertaking, apart from the profit derived from increased railway traffic, the summer park in Iowa has not proved a paying investment on the whole. With very few exceptions, the entrance to all parks is free, and it is a question whether the possible benefit secured in making an admission charge and enabling the management to provide better attractions might not be offset by a decrease in patronage due to the admission charge.

Every manager reports that the band concert is the most attractive feature, when furnished in congenial surroundings, as among shady trees, gardens and greenswards.

And here is the secret now well known: That every manager who sets out to furnish summer amusements must hold ever before him the fact that mankind never ceases to love and take pleasure in the open air, the beauties of nature and the restfulness of good music.

He was a clever man who named a park "Sans Souci," for it means, in French, "Without care," and the railway manager whose duty and interest it has become to provide for this side of man's nature knows very well, from observation, that his park or his amusements are successful and lasting only when they cater to the desire to be merry and care free.

Other attractive features which have been provided by the companies include vaudeville, theatrical and operatic performances, moving pictures, merry-go-rounds, balloon ascensions and other aerial acts, boating and bathing, figure eights, roller coasters and various other features. The writer will not attempt to go into the relative merits of the different amusement devices, since they are discussed frequently among railway men and are well described in the pages of the excellent railway publications that find their way into every office.

Sunday is universally the best day for the parks, and, as nearly as the writer can ascertain, the amusements furnished or intended at every park operated in Iowa, directly or indirectly, by street railway companies are absolutely clean and moral in nature and free from objectionable features. It may be added that the only parks or amusement resorts that have stood the test of time and are recognized as legitimate and permanent investments to-day are the respectable ones.

Certain members of this association will remember very distinctly a recent bill introduced in the last Legislature governing Sunday amusements. It was a significant fact that in the debate on this bill before the committee the attractions and music furnished at parks operated by street railway companies were not specifically designated by the supporters of this measure as the sources of amusement considered a desecration and obnoxious. Nevertheless, every man who was present at this hearing knows, and as developments proved later, that if this measure had become a law practically every park now operated by street railways would have closed its gates, for this measure, aimed at a supposed existing evil, would have embraced in its jurisdiction every park and pleasure resort, and the great public—the people who ride—would have been deprived of the great blessings that are due to the restfulness of beautiful shady parks, the diversion of pleasing, innocent amusements, and the refreshing stimulus of music.

What railway could operate its park without the Sunday traffic? It is the one day in the week the park is made for. This bill did not become a law because the street railway men of Iowa convinced their representatives that the parks were created for the people, and that no man had yet openly presented any convincing arguments why the parks should be closed. The laws for the next two years are made, but it behooves every street railway company operating or interested in any amusement resort patronized by the public on Sunday so to operate that park that no man can support a measure to close it because it is a nuisance or otherwise objectionable to any great class of men.

Most of the railway companies of Iowa financially encourage baseball games; in fact, if the truth were told, the National game could hardly flourish without the boosting hand of the street railway. Circuses are welcomed, and in many instances are furnished the grounds free when adjacent to car facilities. Chautauqua meetings have generally proved good traffic producers. Street fairs and carnivals are somewhat out of date, and railway companies have apparently not suffered any great loss. County fairs, race meets, conventions and football are all worthy of encouragement.

Harvest days for the street railways are not without their burdensome conditions. Chief among these in handling summer traffic are: The restriction of single-track roads; regular schedules delayed on account of extra traffic; increased liability to accident on account of increased traffic; inability to secure competent and trained men for short periods of summer traffic; and last, but not least, sufficient reserve capacity in cars and peak-load problems.

These so-called "necessary evils" must be faced, carefully considered and then provided for by every manager. To attempt to standardize the remedies for these conditions would be as impracticable as to attempt to reduce to an exact science the design and operation of amusement parks. Local conditions must be recognized in each particular case, but to this can be added the known experience of the past.

To many of the street railway managers of Iowa the extent to which their company is warranted in establishing or investing in the amusement field is a perplexing question. On one hand you are told by the experienced, successful park manager, "If you go in—get in strong." The writer knows of several instances when we "got in strong." On the other hand, a too conservative policy may be depriving your company on every bright summer day of traffic waiting to be invited. With at least one-half of the companies operating in Iowa, the writer does not believe, from his observation, that it is financially possible to maintain an attractive park theatre regularly during the summer season. In the other cities it may be possible, although reports received from those companies do not indicate flattering returns on the venture itself.

In nearly every city, however, where a street railway is operated it appears to be practical and eminently desirable, according to the size of that city and the resources of the company, to secure, either directly or indirectly, by lease or purchase, park grounds distant from the center of the city, but provided with good car facilities. In the smaller cities the assistance of the City Council and the people are almost necessary for the establishment of a public park. Only three companies of Iowa appear to own their parks and amusement resorts. Every other city derives its bene-

fits by financially co-operating with either private or public parks.

In preparing this paper the writer is indebted for several excellent letters received in response to requests for suggestions, and among these is a letter from Paul D. Howse, general manager of the "White City," Chicago, modestly designated as the "Finest Amusement Park in the World." It may be of interest to learn from Mr. Howse that the "Fire Show" was the greatest single attraction ever placed in the "White City." The scenic railway has had the longest life and drawing power. Free attractions are maintained at all times that "White City" is open. In Mr. Howse's opinion, street railway parks have been unsuccessful most frequently because no money was spent for free attractions.

In closing, I believe no better advice can be given to the members of this association on the question of how amusement features should be handled and considered than that which has come to me through the courtesy of E. C. Boyce, vice-president of what really is one of America's most beautiful scenic resorts, "Dreamland," Coney Island. Although Mr. Boyce has been interested in building many of the largest amusement resorts of this country, his suggestions are equally valuable for the guidance of managers interested in smaller enterprises. He says:

In cities of from 5000 to 65,000 population, I would advise street railways to keep clearly in mind the fact that an amusement resort should be considered solely as an indirect means of creating traffic for the railway. In this connection, I append the following list of things that may be profitably undertaken:

1. The erection of a band stand and maintenance of free music during the summer season, the cost of said music to be governed entirely by the income from traffic.

2. Free fireworks, weekly or bi-weekly. An excellent exhibition can be had for an expense of $50.

3. The building of a roller coaster or so-called figure eight, which is one of the two amusement devices that can be profitably operated for an indefinite period and whose first cost is comparatively low. The other is the merry-go-round.

4. Free out-door attractions, aerial acts, animal shows, etc., particularly attractive where prizes are given to children.

Aside from the things above enumerated, I would not advise street railway companies to invest in any other form of amusements or entertainment. The most practicable method is for the company to lease or purchase a suitable tract of ground preferably between 20 and 60 minutes ride from the city, make the same reasonably attractive by means of bunting, electric lights, etc., and plan to sub-let concessions either on a percentage or for a flat rental, preferably to local people, for any and all wholesome forms of amusement. The rental thus obtained always returns a large percentage of profit to the owners of the land.

It is always possible to find sufficient concessionaires to make a resort as attractive as the business will warrant. In this way a railway company cannot possibly lose money on the venture and it is always able to control the conduct of the resort generally, this latter being a very desirable feature. Under no circumstances is it wise to charge an admission fee to such a resort. The policy of the railway should be liberal in the matter of supplying and charging for electric light, power concessions, space, etc.

Mr. Boyce's suggestions, in my mind, are conservative and are well worth following, either by the company already engaged in the amusement business or one about to venture in the field.

The officials of the Fort Wayne & Wabash Valley Traction Company have organized an association embracing in its membership the various department heads of the company. It is the plan to hold meetings twice each month to discuss matters relative to the company's affairs and to promote a still higher state of efficiency in all the departments.

THE STEAM MOTOR CAR: ITS VALUE IN INTERURBAN SERVICE*

BY W. G. WAGENHALS,
of the Kobusch-Wagenhals Steam Motor Car Company

While considerable advance has been made in the development of the steam motor car by English, Austrian and French inventors, the field has practically been neglected in this country. The only real effort to develop a steam motor car of any size was made in the year 1898 by the Baldwin Locomotive Works, which built a car on the order of the Cincinnati, Hamilton & Dayton Railway Company for use between the cities of Middletown and Hamilton, Ohio. This car was to be run in competition with the interurban electric line, of which I was at that time general manager. I paid very little attention to the details of this machine, but, after repeated trials, it was placed out of commission. Since that time I know of no effort to design a steam motor car for railroad service.

About three years ago, I built a steam railroad 24 miles in length, from Ripley, Ohio, to Sardinia, Ohio, and finding that the passenger receipts did not justify the operation of a train service, I endeavored to find some form of a self-propelled car which would reduce the expense of operation, as our franchise obligated us to run three trains each way per day. I took the matter up with Mr. Kobusch, president of the St. Louis Car Company, and he advised me that there was nothing in the market which would fill these conditions. At that time I had under contract 24 miles of steam road and 50 miles of electric road, and after talking the matter over with Mr. Kobusch, we formed a partnership for the construction of a motor car for this service, I agreeing to give up the construction business and devote my entire time to the perfection of a motor car along the lines which I presented to him at that time. After nine months of work in this direction, we have produced the largest self-propelled motor car which has been built in this or any other country.

This car[1] has a total length of 32½ ft., with seating capacity of sixty-four people. The weight on driving wheels is 115,600 lbs., and on rear truck 62,960 lbs., or a total weight of 178,560 lbs. This car has a greater tractive weight than the largest six-wheel locomotives. Under repeated tests, it has handled twenty-two loaded freight cars on level track at a speed of 5 m. p. h., which gives its maximum pulling capacity. It has developed a speed of 45 m. p. h. on ½ to 1 per cent grades, at which speed it would easily be able to handle one or two trailers. It has a water carrying capacity of 2000 gals., sufficient for a 45-mile run, and an oil tank capacity of 1000 gals., sufficient for a 500-mile run. This car has been run over the Burlington Railroad out of St. Louis in the presence of mechanical men and general superintendents of the largest steam railroads in the country, and no criticism has been offered by them as to its design or performance. No alterations have been made in the original design of the car, as every detail of the operating mechanism has worked out as originally designed.

The engine is built entirely of steel castings, with the exception of cylinders and valve chambers, which are of cast iron. The frames of the engine are so designed that they form, at the same time, an oil-tight case for the cranks and cross-head; the forward end of this case is extended

* Paper read at the Clinton meeting of the Iowa Street and Interurban Railway Association, April 19-20, 1907.

[1] This car was illustrated on pages 568 and 569 of the Street Railway Journal for Oct. 13, 1906.—[Eds. note.]

to form an axle bearing to hold the engines in line with the driven or truck axle. The arrangement is identical with the present method of mounting motors on an electrically propelled car. All bearings are provided with removable brass shells, which make the repairs of the wearing parts practically the same as an electric motor car. The success of the car can be attributed to a combination of both steam and electric railroad practice, so far as the general mechanical design is concerned, the duplex steam engine displacing the motor.

The engine on the forward truck is connected to the boiler on the body of the car through a flexible steam connection, consisting of one expansion and two ball joints, which have been demonstrated to be perfectly tight under 300 lbs. pressure. The boiler is of the marine water-tube type, tested to 500 lbs. per sq. in. cold water pressure, with an allowed running pressure of 250 lbs. per sq. in. This type of boiler is in service on quite a number of United States Government torpedo planting boats. After five years of continued service it has been shown that they require a minimum of repairs, while, owing to the rapidity of the circulation, very little scale is formed.

The boiler has a greater number of square feet of heating surface for its size than any boiler in the market to-day. In a space of 8 ft. square and 8 ft. high there are over 1215 sq. ft. of heating surface, with a total grate area of 43½ sq. ft. This compares favorably with the largest six-wheel locomotives of to-day. Steam is generated by crude oil, atomized through a steam jet burner of special design, which sprays or atomizes the oil in the fire-box, and although we have five of these burners, it has never been necessary to use more than two of the same, with the car exerting maximum effort in speed or pulling capacity.

In one of the tests over the Burlington Railroad, on a 1½ per cent grade 8 miles long at a speed of 35 m. p. h., the car started the grade with 180 lbs. pressure and mounted the top with 250 lbs., with the engine running at ¼ cut-off. This performance was made in the presence of a number of Burlington officials, and was declared by them superior to any performance made by their locomotives.

The engines used on this car are specially designed, with cylinder 11 in. x 12 in. stroke. The valves are of the piston type, and were furnished by the American Balance Valve Company, which has recently furnished to the Pennsylvania Railroad over 1200 pairs of valves of the same type. These valves have shown perfectly tight under pressure of 300 lbs. per sq. in. Owing to their design, there is very little friction, and they can be moved by hand under this pressure.

The valve gear is a standard type of Stephenson link, as used in the ordinary locomotive. All bearings are amply large to withstand the different strains and, as noted above, the engines are so designed that they are self-lubricating, the frames forming the crank cases. The cylinders, while small in comparison with locomotive practice under the pressure used, develop 275 hp at the rail.

The connection between the car body and truck for the control of the link is made through an arc of a circle with a similar arrangement as used with the brake system for an ordinary double-truck interurban car. This allows for curvature of the truck without affecting the position of the links or the throw of the valves.

The exhaust of the engine passes through the center plate, through a metallic packed joint, which also allows for curvature, the exhaust ending in the stack of the boiler. The car is heated by both exhaust and live steam.

The foregoing will give you some idea as to the design and type of car. Now as to its practicability and uses. The car was originally designed to displace train service on branch lines of steam railroads where the ordinary train service would not pay. With a locomotive and one or two cars, four or five men are necessary for the operation of the train. They consist of an engineer, fireman, brakeman, conductor and flagman, without taking into account hostlers and repair men at the terminals. This type of car is operated by two men, an engineer and conductor. The same service can be obtained, and it is possible for the engineer to do his own repair work and also supply the car with fuel oil when necessary, as the only labor involved is the connection of a hose from the storage tank to the tank under the car and the opening of a valve. Compare this with the unloading of coal from a car in the hoisting bucket, the operation of a crane, and the removal of cinders as is necessary where coal is used for fuel. We claim to make a saving in labor alone which will pay the interest on the investment.

As stated, the car was designed to take the place of train service on a steam road. I do not claim that the car can be operated in competition with electric power where the service is hourly or less intervals, in which case operation by electricity is superior to any other power. But for interurban service, where a service of one or two hours is all that is necessary, the steam car can be operated for less money than the electric system. Take as an example, short lines from 10 miles to 20 miles, such as county seats, and the small distant towns which have no railroad connection. This car opens up a field where it can have no competition.

The expense of construction lies only in the roadbed and equipment of one or more cars. All freight and express matters can be handled with the same equipment, as the car is able to pull several trailers at its maximum speed.

Repeated tests have shown a consumption of oil of about 2 gals. per mile run. Figuring oil at 3 cents per gal., gives a running expense per mile, which compares very favorably with the gasoline type of motor car or steam generated with coal.

FREIGHT HANDLING BY ELECTRIC LINES *

BY P. P. CRAFTS,
General Manager of the Iowa & Illinois Railway Company

It was not so many years ago that projectors of an interurban railway were shown the exit when they approached capitalists with a proposition in which the earnings from freight handling were to be considered as a part of the road's income. Now the situation has reversed and the investor gives very careful consideration to that part of the business which he formerly scorned.

What has brought about this change of front? Simply the faith locked in the breasts of interurban managers that freight haulage would sooner or later become profitable and a strong influence in the earning power of properties under their charge. These managers have continued to hammer away until in the western section of the Central West, particularly, the results have been generally satisfactory and, in some cases, astonishing.

You may ask why should not Eastern roads have developed their freight business in the same proportions. A number have met with considerable success, but owing principally to physical and franchise conditions, due to lack of experience and foresight of the earlier builders, the freight business has been greatly restricted. The more recently

* A paper read at the Clinton meeting of the Iowa Street and Interurban Railway Association, April 19-20, 1907.

constructed interurbans, however, have drawn a lesson from the earlier roads and now build with proper regard to that traffic.

It is now customary, wherever possible, to organize interurbans under the general railway laws, to build on ample right of way and when built through small towns under franchise rights, to obtain the right to transact a general railway business, including freight; and in such towns to locate the line at some other point than on the main street. When conditions warrant, steam rights are obtained. The character of roadway construction is also changing, not only for the maintenance of high-speed passenger service, but also for the operation of heavy freight trains, with steam locomotives, if necessary.

It is impossible to give here an estimate of the proportion of freight to total gross earnings which might be expected of a new road, for that is governed purely by local conditions, some of which I will enumerate:

First, the population served outside of the main terminal and its dependence upon that terminal as a trading center;

Second, the proximity of other trading centers to the population served outside of the main terminal and railway facilities tending to attract business away from the latter;

Third, steam trunk line connections leading to the main arteries of commerce and the ability of interurbans to establish joint rates with them.

The Interurban Railway of Des Moines and the Iowa & Illinois Railway of Clinton provide examples of the first and second conditions, respectively. Des Moines, being located at a great distance from a city of superior class, is the normal trading center for the towns reached by the Interurban Railway, consequently the current of freight traffic to the smaller towns is principally from Des Moines.

In the case of the Iowa & Illinois Railway, however, although the tri-cities, that is, Davenport, Rock Island and Moline, would seem to be the normal trading center for Clinton, owing to the difference in population, yet the latter is only 138 miles from Chicago, and as a consequence Clinton divides its business. Although its trading with the tri-cities is constantly increasing, it will continue to be divided to a greater or less degree, depending largely on the business getting methods of the tri-city merchants, jobbers, etc.

The examples just illustrated bear more particularly on the package or less than carload traffic.

A full exposition of the third condition cannot be given without consuming too much time. In general, however, an interurban having proper freight terminals and handling facilities and which offers quick and efficient service, together with joint rates with some trunk line in competition with other trunk lines operating between competitive points, may reasonably expect a fair division or a greater portion of the freight traffic.

Shippers desire the best service with lowest rates, but assuming rates to be even, shippers are generally favorable to the roads which provide good passenger accommodations, and consequently the interurbans reap the reward of frequent passenger service. The proportion of freight to total gross earnings varies in this State from 5 per cent to an amount in excess of passenger earnings, depending upon the conditions given above.

Interurban freight traffic may be properly divided into the following classes:

First, strictly light packages, transported only in baggage rooms of passenger coaches, at express rates or at a fixed charge per package or per hundred, regardless of class, and generally termed express business;

Second, less than carload freight transported on fast baggage cars at regular freight or special tariffs under regular or special classifications, generally the former;

Third, a combination of class two and the haulage of a few local carload shipments daily, at regular tariffs and classification;

Fourth, regular carload traffic hauled by steam or heavy electric freight locomotives at regular tariffs and classification; or any combination of the foregoing classes.

A freight business of the first class may be conducted at small expense and is of material assistance in the earnings of a road. The freight carried generally consists of packages easily transported in baggage compartments of passenger cars, which are usually empty except for a very few trips per day; as usually no extra office force is required, the only expense is stationery, books, and possibly a small storage space at the main terminal. In some cases when the charges are a certain rate per package, regardless of weight within reasonable limitations, a proper system of tickets dispenses with way-bills, expense bills, etc.

Inasmuch as the majority of freight-handling interurbans of the Middle West come under the head of the second class, and that part of the paper will probably be of interest to the greater number of electric railway managers, I will enter into greater detail in handling the subject.

Interurbans which conduct their freight business under the head of the second class more nearly approach operating conditions parallel to the time freight business of steam railways. The ability of the interurbans to make fast time and to deliver at highways, farm crossings, and warehouse or store doors, offers an inducement to either the shipper or the receiver, which assist in obtaining the business. Being usually restricted, however, to a narrow car, similar in appearance to a passenger car, due to operating over city streets, there are limitations to the freight earning capacity of an interurban so situated.

To make such a business profitable depends largely upon the opportunity of the management to secure combined freight and passenger depots at the terminals, and in the larger local towns to avoid extra labor in billing and handling at stations; upon the charges of terminal city railways for the right to haul freight over their tracks, and the hour of day when freight may be delivered to the receiver.

Generally speaking, the margin of profit in this class is close, and only careful management will produce a profit, particularly during the first few months after the business is started. Expenses must be carefully watched and attractive freight houses and convenient handling facilities at terminals sacrificed for something which costs less to maintain.

Damage claims must be very carefully handled, and to that end it is advisable to adopt some system of billing and accounting which permits the easy tracing of a shipment from origin to final destination. Some interurbans have adopted simple billing systems requiring only one writing to make the receipt, way-bill, expense bill and office copy. Such a system, however, does not permit proper checking, particularly if merchandise is transported over more than one road.

After an interurban enters the second class, a good local commercial agent is a necessity. The business consisting of a great number of small shipments requires constant attention to develop and care for, particularly if competition exists. A live commercial agent, who is a good street man and not a desk man, earns his salary many times over, particularly if he understands how to deal with shippers.

The business obtained depends considerably on the personality of the commercial agent.

A few interurbans make team deliveries, either adding to the tariff to cover for optional deliveries, or an express tariff covering team delivery is maintained. In all cases which I have personally investigated, I discovered that the cost of operating teams consumed a large portion of the profits derived from the car service. As an illustration, one 50-mile interurban whose rates were based on express tariffs and whose freight earnings amounted to nearly $13,000 per year, derived only $2,600 net earnings. I believe the inducements of frequent service compensate for any advantage gained by making team deliveries.

I fear that many managers, in charging expenses to the freight business, do not give proper consideration to such items as additional clerks, printing and stationery, insurance on goods in freight houses, a proper percentage of the receipts to cover loss and damage, power for freight cars, proportion of track and line maintenance, telephone service, interest on the freight handling investment, etc. Neglect of these items deceives the manager, as well as his stockholders, and unless receipts grow beyond the safe point the awakening will be painful and embarrassing.

An average interurban operating 30 to 50 miles in a total population from 130,000 to 200,000 should not enter the freight field unless its receipts from freight will exceed $10,000 per year, beginning with the second year. If the receipts are below that figure, the margin of profit will be too small for consideration or the expenses will exceed the receipts.

Perhaps a brief description of the freight business conducted by the Iowa & Illinois Railway Company may be of interest as illustrating the point brought out above.

We went into the freight business in a very tentative manner. In fact, it took considerable time for us to decide whether or not there was sufficient business in less than carload lots to warrant the purchase of a freight car and the expense of conducting a freight business.

The next grave question was that of rate, and after considering for some time a reduction of the rate below that permitted by the Iowa State laws for Class A roads, we finally concluded to adopt the maximum tariff and to consider the business as freight and not express.

At first our old passenger depot in Davenport served as a freight depot as well, but within a very few months we outgrew the capacity of the space allowed to freight and were forced to take our passenger business to a new location. In Clinton, we still have sufficient space to handle the business, but within a very few months will be compelled to seek additional storage room.

Immediately upon starting the business, we engaged a commercial agent, and the quick growth of the receipts to the point where we were paying expenses showed our wisdom in so doing. With one freight car engaged in the business, some freight being carried on passenger cars, within one year the business grew to a gross exceeding $10,000 per year. During the summer and fall of 1906 we were compelled to operate our freight car two round trips per day for nearly 75 per cent of the time, and after the contract with the American Express Company was put in effect we purchased and placed in service a trailer freight car having the same capacity as the motor car. The better facilities which we have been able to offer shippers since purchasing the second car have increased the business at a very rapid rate, and we are now considering the purchase of a third car.

We make a specialty of beating the time of the steam railroads by twenty-four hours between Davenport and points on the Chicago & North Western Railway in the western part of the State on less than carload business. For this reason we obtain considerable business which is transferred to that road.

The schedule of our freight cars is as follows: The trailer express car leaves Clinton at 5:15 a. m. attached to one of the passenger motors, arriving in Davenport about 6:30 a. m. This trip accommodates the south-bound American Express and such freight business as is offered for early delivery. The motor express car leaves Clinton at 8:45 a. m., doing all of the local work, arriving in Davenport about 11 a. m. Returning in the afternoon, the trailer car leaves Davenport at 3 p. m. attached to a regular passenger motor, and carries nothing but transfer to the Chicago & North Western, local goods to Clinton, and American Express, no intermediate local freight being accepted for this trip. The motor car leaves Davenport about 3:45 p. m., carrying local freight and such Clinton local as cannot be handled by the trailer car.

Besides this, rush shipments of milk, cream, butter, eggs, etc., in small quantities are handled from certain stations, in the baggage rooms of the passenger coaches. Our passenger schedule, however, is extremely close, and permits very little freight handling.

The north-bound American Express is handled on three successive passenger cars, leaving Davenport at 6, 7 and 8 p. m. We anticipate in a very short time having a third car to handle the north-bound American Express and such freight as is offered to us after 3:45 p. m., leaving Davenport at 7 p. m.

With reference to the trailer freight car, we find it very much cheaper to operate than a motor car; but, of course, it can only handle through business. It does not seriously delay the passenger motor car to which it is attached.

When the business was started, we adopted what we considered a very simple set of forms for billing and accounting; but we soon ascertained that the tracing of damaged and stray shipments was very difficult, and, after carefully looking over the field, we finally adopted the same forms as are used by the Chicago & North Western Railway. These forms appeared at first to be very complicated, but a short acquaintance with them indicated their simplicity and ease of tracing damaged and stray shipments.

We make a specialty of rush orders by telephone via our private line. Oftentimes a merchant in Clinton finds himself short of some particular article, telephones to the Clinton office, and we transmit it to the shipper in Davenport through our Davenport office over our private line. Shipments so ordered are frequently in Clinton within two hours from the time we were called up at the Clinton office.

Whenever possible, we deliver from the cars to the store doors, which saves drayage and naturally brings business our way. A number of small platforms at which we stop our local express car have been built between towns by the shippers. We constantly endeavor to please our shippers and to show a spirit of co-operation, which has a great influence on the growth of our business.

We endeavor to be conservative in the charging off of expenses against the freight business and work into it anything which rightfully belongs to it. We go so far as to charge off monthly 3 per cent of the gross freight receipts. This is piling up a tidy fund, but we propose to allow the account to grow, for at any time we may have to meet heavy freight damages, due to fire, water or wreckage. At the present time the gross earnings from this business amounts to practically 15 per cent of the total gross earn-

ings, and we hope to see it reach 20 per cent on the same basis, that is, while our freight business comes under the head of the second class.

Referring again to the main subject in hand, very little can be said about interurbans coming under the third and fourth classes. Their business is merely a further development from the first class. The earnings from freight then becomes a large percentage of the total, and in the fourth class may equal or exceed the passenger earnings.

Joint tariffs are desirable either with steam trunk lines or a system of interurbans, particularly the former, that the carload business may prove profitable. Owing to the antagonistic attitude of the steam railroads, however, joint tariffs are difficult to establish, except where competitive conditions are such as will induce one of the steam roads to join with the interurban.

Let us hope that before long, under rulings of the national and State railway commissions, interurbans will be given the same rights to establish joint rates with their larger steam brothers as are enjoyed amongst the latter, irrespective of the fact that electricity is used as motive power.

Interurbans coming under the third and fourth class generally must of necessity have steam railroad terminals and yards, and the experience of our steam friends should teach us how far we can go in the development of such facilities. It is a very easy matter to become seriously overloaded with yard and terminal maintenance and fixed charges which are not warranted by the traffic handled, therefore such matters should be very carefully watched.

Another point which has been discussed by interurbans for several years is the best and cheapest motive power, namely, steam versus electric locomotives for hauling heavy trains. It is my opinion that unless a road is equipped for very heavy traffic in its power house, sub-stations, overhead wiring, etc., operation of heavy trains by electricity involves too great an investment, and therefore it is much cheaper to operate by steam locomotives. Take the ordinary interurban of 30 to 50 miles in length as an example. Its power generating equipment, sub-stations and overhead lines, particularly the two latter, have not sufficient capacity to operate heavy locomotives successfully. Consideration of the investment necessary for the increased capacity against the higher operating expense of a steam locomotive compared with an electric locomotive will favor steam operation.

In conclusion, I wish to say that the development of the freight business upon electric railways within Iowa has been very healthful for the past few years and bids fair to continue its growth in reasonably high percentages from year to year. We have all gained considerable experience in this part of our business, and, looking into the future, can readily see the benefits which our properties will derive. The development of the freight business has also been particularly strong in the States of Ohio, Indiana, Michigan, Wisconsin, Illinois and Missouri, or in that section of the country generally termed the "Middle West."

As an example of the growth of freight business on interurbans in Iowa, I will enumerate the present and guaranteed prospective roads which make freight haulage a feature of their business. The Inter Urban Railway, operating from Des Moines to Colfax on one division, to Perry and Woodward on a recently constructed second division, is an excellent example of the development and growth of freight traffic on interurbans. It conducts both a fast less carload and a carload business upon Iowa distance tariff and classification. An operating and joint rate agreement with some of the steam trunk lines is of assistance to the road and the territory served by it. Both electric and steam locomotives are employed as motive power.

The Waterloo & Cedar Falls, one of the first roads in Iowa to enter the freight field, conducts practically the same class of business and under like conditions, relating to joint rates and motive power, as the Inter Urban Railway.

The Mason City & Clear Lake Railway conducts a considerable carload business between Mason City and the Chicago & Northwestern at Clear Lake, operating under an agreement with the latter road. All freight is hauled by electricity. Its carload business is of considerable magnitude on that account.

The roads mentioned may be included under the third and fourth classes. Beginning on a comparatively small scale, the growth of traffic has been steady and substantial, until now their receipts from freight haulage constitute a large proportion of the total gross.

The Cedar Rapids & Iowa City road commenced operating in 1904 and immediately entered the freight field, conducting both a less carload business in a baggage car and hauled carload business by an electric locomotive.

The Iowa & Illinois Railway commenced operating in 1904, at first carrying packages on passenger coaches, and started a baggage car in 1905. This business has developed as described earlier in this paper. A very small local carload business is conducted, an electric locomotive or the baggage car being used as motive power.

Neither of the last two roads mentioned have joint tariff agreements with any of the trunk lines, but the Iowa & Illinois Railway does a considerable transfer less than carload business on two locals, as described earlier.

The Cedar Rapids & Marion City, Tama & Toledo, and the Oskaloosa Traction & Light Company conduct a local business partly in baggage rooms of passenger coaches and partly in baggage cars. These roads are examples of the first and second classes.

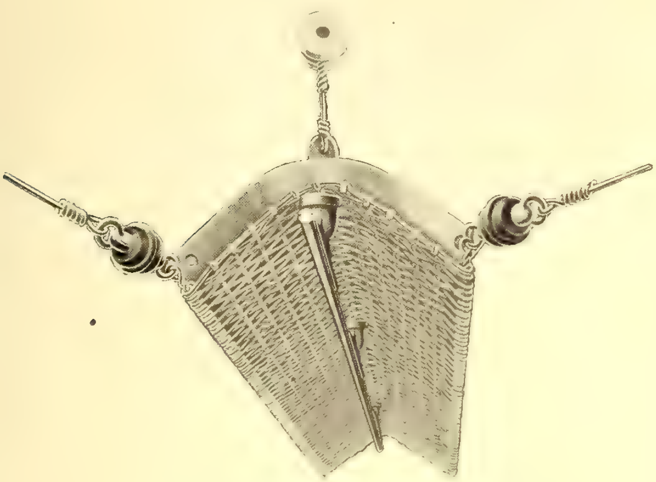
The Fort Dodge, Des Moines & Southern Railroad, now under construction, connecting Fort Dodge, Boone, Ames and several smaller towns with Des Moines, will be the greatest example within this State of combined electric and steam operation, and the development of this road will be undoubtedly watched with great interest by the electric railway men. This road is really a combination, physically at least, with the present Newton & Northwestern steam line, inasmuch as approximately 40 miles of the latter road will be electrified to complete the connections between the branches touching the towns above mentioned. It is proposed to operate electric passenger and fast freight service combined, with steam locomotives for heavy freight service. The combined length of the roads involved will be nearly 160 miles.

Backed by our experience in the past and at the present, I believe we can feel assured that any average interurban, the investment in which is warranted by the prospective passenger business, has practically assured a successful freight business, which will become an important factor in its earnings with a very few years.

On Thursday of last week a car bearing President Webb, of the Columbus, Delaware & Marion, and a number of guests from Louisville, made the trip over the line from Columbus to Marion in one hour and thirty minutes, ten minutes less than the fastest schedule time. The distance is 50 miles, and the officials wished to demonstrate to their satisfaction the possibility of operating a fast summer express between Marion and Columbus.

A TROLLEY GUARD FOR PROTECTING CARS AT STEAM RAILROAD CROSSINGS

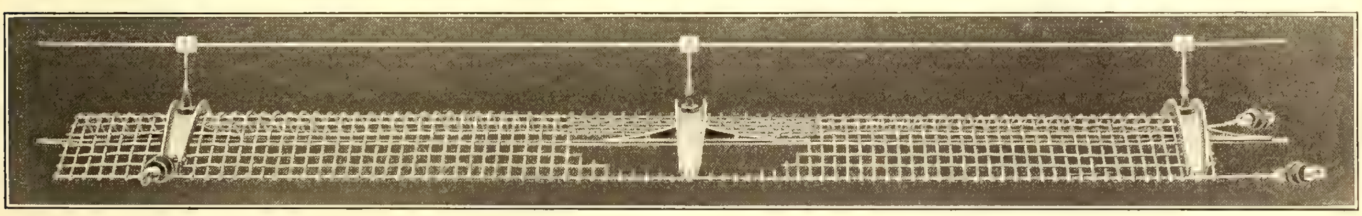
A trolley guard for installation at steam railroad crossings which has met well the requirements for which it was designed and is in service on such lines as the Cleveland Electric Railway, the Syracuse Rapid Transit Railway, the United Traction Company's lines in Albany, the Toledo Railway & Electric Company and a number of other roads,



VIEW FROM UNDERNEATH GUARD FOR PROTECTING SINGLE TROLLEY

is manufactured by the National Railroad Trolley Guard Company, of New York. The guard is made of woven galvanized iron, aluminum or copper wire, with extra heavy selvaged edge, and may be of any desired length all in one piece. When in position the guard assumes the form of a perfect inverted trough. This feature of the guard, which is always alive, makes it certain that if the pole jumps the wire the supply of current will not be cut off and the car can proceed without interruption.

Besides making for lightness, the open mesh form of construction provides against the accumulation of ice and snow and damage from winds. In addition, the guard offers practically no resistance to the passage of exhaust gases and steam from locomotives passing under it. Still another feature insured by this lightness is the doing away with the necessity of providing special suspension for the guard. The actual weight of the guard as installed is 13



THE GUARD AS IT APPEARS WHEN INSTALLED

ozs. per running foot of aluminum and 18 ozs. per running foot of galvanized iron wire and copper wire. The method of suspension, shown in the accompanying illustration, provides against the object of the guard being defeated by bolts or nuts working loose. The essential parts of the guard are the woven wire and the hangers, which are shipped together, with instructions for installing. The width of the single guard is 10 ins. and the depth 5 ins. The width of the double guard is 15 ins., with the double trolley 6 ins. between centers. The hangers are made of galvanized iron, drilled to take the standard ear, and they hold the mesh to its proper shape. To clamp the ear and mesh to the under body of the hanger, eye-bolts with set nuts are furnished. Due consideration has been given the question of strains. To provide against them substantial hangers are spaced 5 ft. apart. The wire mesh itself is Roebling No. 10 galvanized and copper wire and No. 9 aluminum with No. 6 Roebling selvage. In addition to its use at steam railroad crossings the guard also is available for service in car houses, at undergrade crossings, and, in fact, everywhere that the slipping of the pole from the wire is likely to entail special hazards.

BOOKING SHOWS FOR THE SUMMER THEATER

It is just at this time that attractions that have proved successful at the theaters are booking for the summer with the theatrical exchanges, these shows including all sorts of variety acts. Some of them have fascinated metropolitan audiences for months, and are even world-famous. A number of those which have been playing at such theaters as the New York Hippodrome and London Crystal Palace, like Ralph Johnstone, the aerial cyclist, and Con. Gaston Bordverry & Company, the champion sharpshooters, who play a piano with guns, have signed for the summer sea-

THE GUARD AS INSTALLED TO PROTECT DOUBLE TROLLEY

son with the Prudential Vaudeville Exchange, of New York, which offers these and about 200 other shows to park managers. The list of this Exchange affords any combination that may be desired, including such successful shows as E. E. Rice's "Girl from Paris," musical comedy with sixteen people; the Western comedy-drama, "The Belle of Silverton," which is twenty-two minutes in the acting, and includes in the cast only three people, and the comic opera, "The Witch of Salem," which is thirty minutes in the acting, and includes in the cast some seventeen people. The same company also offers Edouard Waldman's Dramatic Company in standard repertoire, and such musical attractions as Conterno's Band, with its "Battle of our Nation," and Restorff and his band.

NEW AUTOMATIC RADIAL COUPLER

To meet the requirements imposed by the operation of interurban, urban and elevated cars in trains, the Ohio Brass Company, of Mansfield, Ohio, has recently placed on the market the Tomlinson automatic radial coupler, in the operating of which no adjustment whatever is required, except the alignment of drawbars. Backing the

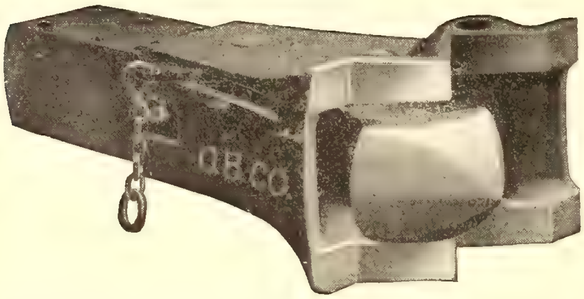


FIG. 1.—TYPE A, FORM 2, NOS. 2 AND 3 COUPLER FOR CHANNEL BAR DRAFT GEAR

cars together engages and firmly locks the couplers, and as there are no loose parts to be inserted in the coupler to put it in readiness for action, a car cannot, it is said, be left, through negligence or otherwise, with the coupler in an inoperative condition. After uncoupling, which is accomplished by simply pulling a chain, the parts return automatically to the normal position, ready for recoupling.

The coupler is made in two sizes, known as Nos. 2 and 3. Size No. 2 is designed to meet the requirements of all classes of city and light interurban service, and size No. 3 is adapted to elevated and subway service, also heavy interurban service, and for all service where it is desired to intercouple with steam road cars. Beside the variation in size, the couplers differ as to draft gear connection. They are made in four forms, for rectangular-bar draft gears, for channel-bar gears, for 80-lb. rail section gears and for drop gears, the principle of the coupler action being the same in all.

The coupler consists essentially of a strong malleable iron headpiece, which is hollow and contains an arrow-pointed, drop-forged coupler hook, with sufficient play in a horizontal direction to allow the coupler hooks of two engaging couplers to slide past each other and become

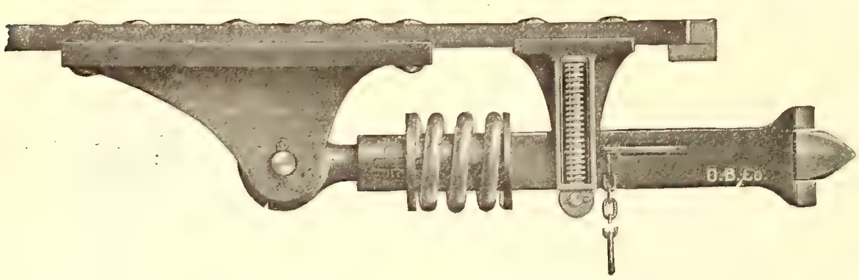


FIG. 2.—TYPE A, FORM 4, NOS. 2 AND 3 COUPLER WITH DROP DRAFT GEAR

locked. This hook is shown plainly in Fig. 1. The hook in each coupler is prevented from moving past the center of the coupler. It may, however, move toward the side of the coupler in opposition to the action of a spring. Thus, when the opposing coupler hooks meet, they are forced apart against the action of the springs sufficiently to allow the hooks to slide past each other, the shoulders interlocking. The arrangement is such, however, that should the spring in one of the couplers break and allow the hook to move to one side, there still would not be sufficient clearance to allow the couplers to unlock. The spring is under tension only at the instant of coupling or uncoupling, and gets no strain of the train load, either pushing or pulling. In uncoupling, the hooks are forced apart by a lever cam. To this lever cam is connected a chain, a slight pull on the chain of either coupler being sufficient to disengage the hooks.

An important feature of the coupler, and one which effectually prevents lateral movement of the coupler heads,

FIG. 3.—TYPE A, FORM 1, NO. 2 COUPLER FOR RECTANGULAR BAR DRAFT GEAR

is the form of the coupler face used. The faces of the couplers are serrated, as shown, and fit together accurately. They have large bearing surfaces and the serrations prevent any movement in a lateral direction. When once coupled the connection between the cars is practically rigid, and surging of the cars is prevented. This feature greatly facilitates the control of the train and does away with the necessity of buffing platforms. It is also impossible for the cars to become uncoupled when rounding curves.

The coupler will intercouple with all standard radial car

FIG. 4.— TYPE A, FORM 1, NO. 2 RECTANGULAR BAR DRAFT GEAR

couplers now in use without removing or even deranging any of its parts. By the addition of any emergency knuckle it will couple automatically with all M. C. B. couplers, as used on steam roads. A wedge-shaped extension of the knuckle is made of the right dimensions to fit into the space in the Tomlinson coupler, which ordinarily receives the coupler hook of the opposing coupler.

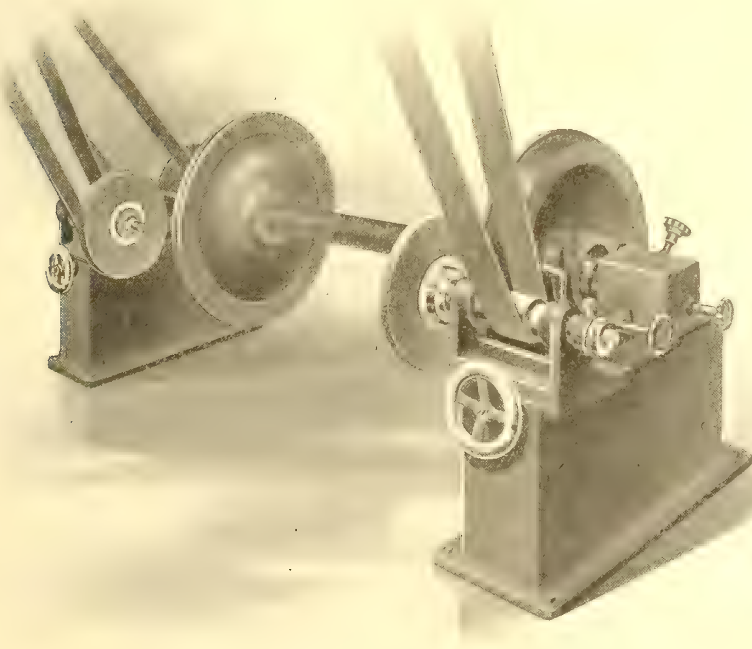
Fig. 2 illustrates the spring hanger attachment which is used where sharp variations in the grade line make necessary some allowance for vertical play of the coupler and draft gear. The hanger consists of a rectangular casting through which the draft gear passes, being supported by a yoke which rests on springs, allowing vertical movement, either up or down. These springs carry the weight of the coupler and draft gear and normally hold the former in a position parallel to the car sills. The spring, however, allows vertical movement through a considerable range, so that the coupled car can conform to any sudden change of grade. The carrier is supported by a radial slide bar under the car sills, the slide bar being formed in the arc of the circle, around which the hanger is free to slide when going around curves.

In Fig. 3 is illustrated the Type A, Form 1 coupler, made

in the No. 2 size. It is for rectangular bar draft gears and is adapted for city and light interurban service. Fig. 1 shows the Type A, Form 2 coupler made in the Nos. 2 and 3 sizes the No. 2 size for city and light interurban service, and the No. 3 size for heavy interurban, subway and elevated service, and all places where it is necessary to intercouple with steam road cars. This coupler is for channel-bar draft gears. Fig. 2, besides illustrating the spring hanger attachment, of which mention has been made, shows the Type A, Form 4 coupler with drop-draft gear. This coupler and draft gear are made in both sizes. Fig. 4 shows the Type A, Form 1, No. 2 rectangular bar draft gear.

CAR WHEEL GRINDER

The Hampden Corundum Wheel Company, of Springfield, Mass., has recently perfected and is now placing on the market a very effective and simply-constructed floor car wheel grinding machine intended for street railways desiring a low-priced, yet efficient, grinder. The device consists of two independent beds which are adjustable to any railway gage. The car wheels are run in adjustable bearings, into which they are rolled on an attached incline. These bearings enable the operator to grind a car wheel true, even if the axle is badly worn or sprung and out of alignment. The car wheels are revolved at ten r. p. m. by a belt and gearing, a large gear being put on the axle before the car wheels are put into the machine. This large gear has adjustable bushings, designed to take up any variation in the size of the axles. The emery wheels are each mounted on a shaft 1½ ins. in diameter, which runs

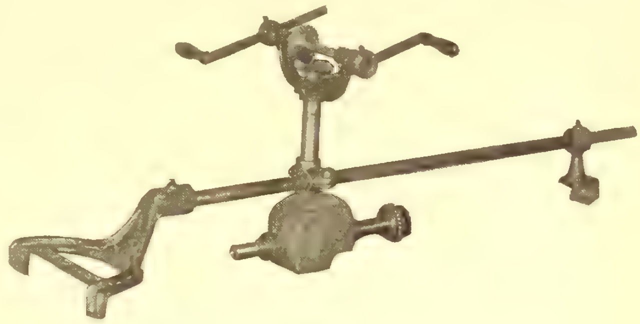


CAR WHEEL GRINDING MACHINE

in two sleeves, 3 ins. in diameter and 7 ins. long, the sleeves being prevented from turning by a keyway; this makes a very rigid construction. An eccentric on a large gear operates the automatic feed by which the emery wheel is carried across the face of the car wheel. This device is reversible through a racking pawl, so that the emery wheels can be fed across the car wheels in either direction. The entire weight of the machine itself is 1325 lbs.

NEW TRACK DRILL

A new track drill has recently been perfected and placed on the market by the Reed Francis Company, of Worcester, Mass. This machine has two extension cranks, near enough to each other for one man to use both arms for driving the drill. The crank in the position illustrated gives a direct motion from the body and doubles the power obtained, but when more power is required two men can



TRACK DRILL WITH EXTENSION CRANKS

work the drill, one at each crank. The drill is provided with an automatic friction feed to adjust the feed rate, this feed acting also as a quick return of spindle by reversing the cranks. The leverage of the crankshafts can be lengthened or shortened, according to the power and speed required, and other adjustments made for different demands. The socket is bored for 41-64 straight shank drills, and a sleeve is provided so that drills with a ½-in. straight shank can also be used. One revolution of the crank gives one revolution of the drill. When the top yoke is removed and one crank is put on the upright shaft, a speed of one revolution of the crank to two revolutions of the drill is obtained. A radical improvement has also been made over the ordinary track drill in that the lower gearing parts have been enclosed to remove the possibility of dust, gravel and other substances getting into the lower gears and interfering with the smooth and natural working of the machine.

CARS FOR CHICAGO INTERURBAN

The Chicago, Lake Shore & South Bend Railroad Company has just placed an order with the Niles Car & Manufacturing Company, of Niles, Ohio, through the J. A. Hanna Company, of Cleveland, for twenty-four 57-ft. heavy interurban coaches of full steam railway width, 10 ft., and fitted with seats 41 ins. long. Fifteen of the cars are of the exclusive passenger type, with passenger and smoking compartments, and nine cars are combination passenger, smoking and baggage type. All are fitted with Baldwin class 90-35 heavy trucks with 38-in. M. C. B. section steel-tired wheels and prepared for four Westinghouse No. 148 a. c. motors geared to 75 m. p. h. This, it is believed, is one of the first interurban electric lines to purchase cars of full steam railway width and of M. C. B. dimensions generally and fitted for operation over steam railroads.

RECENT ORDERS FOR PEACOCK BRAKES

Among a few of the orders received during the last month for Peacock brakes by the National Brake Company are the following: Virginia Passenger & Power Company, sixty-four brakes; Greensboro, N. C., Electric Company, thirty brakes; Georgia Railway & Electric Company, of Atlanta, eighty brakes; Augusta Railway & Electric Company, eighteen brakes; United Traction Company, Albany, fifty brakes; Chicago City Railway Company, six hundred brakes; Hudson Valley Railway Company, thirty brakes; Charleston Consolidated Railway & Gas Company, sixteen brakes; Maryland Railway & Electric Company, eighty brakes; Vallejo, Benicia & Napa Valley Railway Company, of California, sixteen brakes; San Jose & Santa Clara Railway Company, twenty-four brakes; Toronto Railway Company, one hundred brakes; Worcester Consolidated Railway Company, fifty-six brakes.

Other orders have been received from more than fifty companies, among them many roads that have placed their first orders for this brake.

ELECTRICITY AT JAMESTOWN

Electric power for the approaching exposition at Jamestown, like that at the Buffalo Pan-American fair, will come from a distance. Having no Niagara to rely upon, however, power in this case will be furnished by steam turbines in the power house of the Norfolk Railway & Light Company, about 7 miles from the exposition grounds. This fair will be the first where the electrical power will be generated by steam turbines. The machines will be of the Curtis type, these, as well as the complete electrical equipment, being supplied by the General Electric Company.

The exposition authorities have entered into a contract with the Norfolk Railway & Light Company to furnish all the current required for illumination and power. Power generated at the Jamestown power house will be transmitted to a model sub-station in Machinery Hall. Here will be located the transforming and distributing apparatus. This equipment consists of large air-cooled transformers, many smaller type H transformers for general illumination, as well as constant-current transformers for the series-arc lighting system, which will be used for police illumination. At the sub-station also are motor-generator sets, to provide direct current for the operation of searchlights and small motors where they may be installed by exhibitors.

The switchboard for controlling the various circuits throughout the exposition grounds is in a gallery, and is typical of modern switchboard engineering. All the electrical machinery follows standard lines similar to that installed at the St. Louis, the Pan-American and other American expositions.

Those who have seen the plans for the Jamestown exposition predict that the electrical features, particularly the illumination, will equal, if not exceed, the display at the famous Pan-American exposition. Thousands of Edison lamps will be supplemented by searchlights, both on land and on the fleets anchored in Hampton Roads, combining to make the nightly pageant magnificent and beautiful.

INCREASE IN WAGES IN MEXICO

On Monday, April 8, a new schedule of compensation for the motormen and conductors of the Mexico Electric Tramways, Ltd., went into effect on all the lines of the system. In the cases of the motormen the increase amounts to about 10 per cent, while in the case of the conductors it amounts to even more than this. The following is the new schedule of compensation for the motormen:

During the first year of service, 17 cents per hour; during the second year, 18 cents; during the third year, 20 cents; during the fourth year, 22 cents.

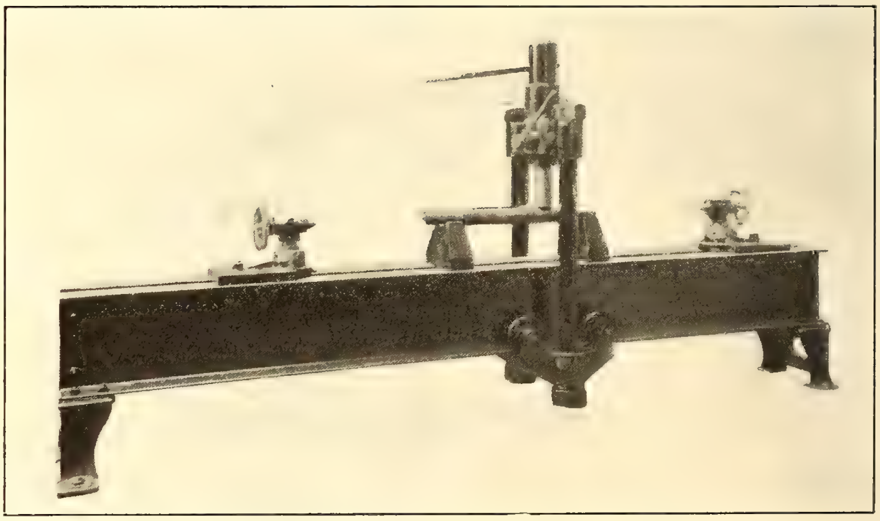
The conductors of the company, who have heretofore been paid at the rate of 10 cents per hour and 1 per cent of the receipts that they turn in, shall, from April 8, receive each 15 cents per hour, the percentage on money turned in being entirely abolished. The present compensation paid motormen of the tramways is as follows:

During the first two years, 15 cents per hour; during the third year, 18 cents per hour; during the fourth year, 20 cents per hour, and during the fifth year, 22 cents per hour.

The Mexican Light & Power Company, Ltd., is now furnishing about 300 hp to the Mexico Electric Tramways, Ltd., and by June 1 it will be furnishing about 500 hp. The stations to which the Necaxa people are supplying the energy are Churubusco, Indianilla and Veronica.

AXLE STRAIGHTENER FOR THE PUBLIC SERVICE CORPORATION

The accompanying cut illustrates an interesting axle and armature shaft straightener built for the Public Service Corporation by the Columbia Machine Works and Malleable Iron Company, of Brooklyn, N. Y. This device is operated by hydraulic pressure. The pump is worked by the long horizontal lever shown; the short lever is connected to a

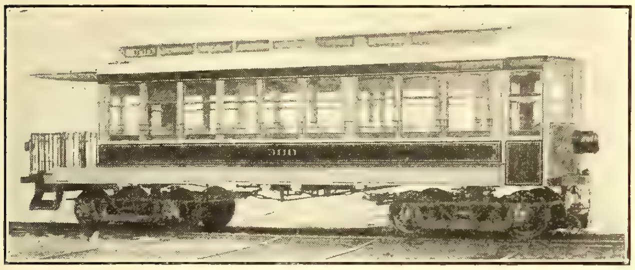


AXLE STRAIGHTENER FOR THE PUBLIC SERVICE CORPORATION

pinion shaft which works in a rack on the plunger to permit the rapid height adjustment of the plunger. The round nuts on the center heads are used to raise and lower the centers so that the height can be adjusted for any size shaft or gear up to 28 ins. diameter. The center heads also have an inside spring which avoids removing the center points from the axle centers when straightening shafts because the spring takes up the pressure at the ends. This last feature is a very important one, since it saves much time by permitting the center heads to remain in the same position during the entire straightening process.

INTERESTING CARS FOR A MAINE ROAD

The three types of cars ordered recently by the Lewiston, Brunswick & Bath Railway Company from the J. G. Brill Company have just been put in operation. The two types of combination passenger and smoking cars are intended for interurban service, while the standard closed type of single-truck car will be used for local service. The 7-ft. observation platform car, which is illustrated, is of the single-end type. The high-speed trucks used under these car bodies are unusually large for a car body of the dimensions of this one, and it was desirable to place them as near the ends of the car as possible, care being taken to have the location suitable for the proper negotiation of curves. It will be noticed that the sill plate is carried out beyond the corner post as far as the steps. These observation cars, which were eight in number, contain the grooveless post, semi-convertible window system, as do the two other combination cars ordered. These latter cars differ, aside from the dimensions, from those already described in the platforms only, access being from either end and from either side. The same type of high-speed trucks is used on both types of combination cars. The third type received by the company is of standard closed type mounted on 21 E single trucks. The windows contain no sashes, the glass being secured in rabbits by rubber washers. The dimensions of the observation cars follow:



CAR WITH OBSERVATION PLATFORM

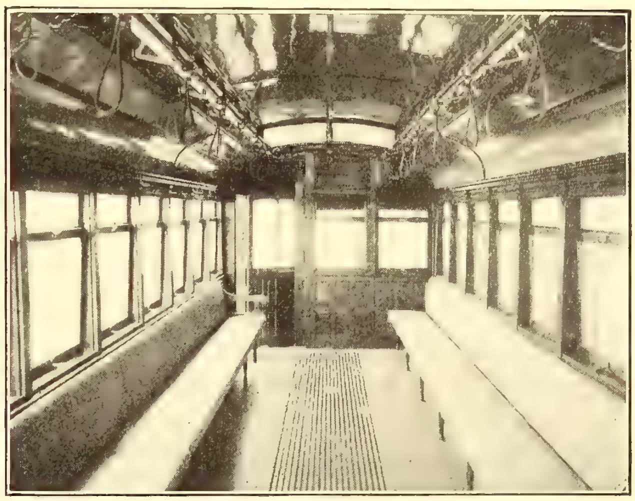
INTERIOR OF OBSERVATION CAR

Length over end panels, 25 ft. 10 ins.; over vestibules, 36 ft. 4 in.; motorman's compartment, 3 ft. 6 in.; width over sills, including sheathing, 8 ft. ½ in.; over posts at belt, 8 ft. 4 ins.; height from bottom of sills over trolley board, 9 ft. 7¼ ins.; size of side sills, 4 ins. x 7¾ ins.; end sills, 5¼ ins. x 6⅞ ins.; sill plates, ⅜ in. x 12 ins. The length over end panels of the other double-truck combination car is 25 ft. 4 ins.; over vestibules, 33 ft. 8 ins.; other dimensions, same as mentioned heretofore. The finish of all three types is of cherry, with ceilings of birch; another feature common to the new rolling stock is Brill seats with corner grab handles.

ADDITIONAL CLOSED CARS FOR EAST ST. LOUIS

The car illustrated is one of two lots lately purchased from the American Car Company by the East St. Louis & Suburban Traction Company, which operates all the lines in East St. Louis, Ill., and the suburban lines connecting that city with Belleville, Collinsville and other towns as far as Lebanon. Each vestibule has only one door, and these doors are at diagonally opposite corners of the car. The doors in the body ends are of the "semi-accelerator" type, the door being to one side, so that passengers on the platform do not obstruct the passageway from the door. The platform knees are reinforced with angle irons, with the angle irons of the center knees extending 4 ft. 9 ins. back of the body bolster. The lower sashes of the windows drop into the usual pockets, but the upper sashes are stationary. The seats are arranged longitudinally; interior finish is in golden oak; ceilings of birch veneer. The chief dimensions follow: Length over end panels, 28 ft.; over vestibules, 38 ft.; width over sills, including sheathing, 8 ft. 2 ins.; over posts at belt, 8 ft. 4 ins.; side sills, 4¼ ins. x 7¾ ins.; center sills, 3¾ ins. x 5 ins. The trucks are of the No. 27-G1 type with 4 ft. 6 ins. wheel base.

VESTIBULE CAR FOR EAST ST. LOUIS



INTERIOR OF EAST ST. LOUIS CAR

The cars in the other lot measure 30 ft. over the end panels and are fitted with transverse seats. The vestibule doors are of the regular type equipped with vestibule door controller. The truck employed is the 27-E1.

FINANCIAL INTELLIGENCE

WALL STREET, April 17, 1907.

The Money Market

There has been no material change in the monetary situation during the past week, rates for all classes of accommodation ruling practically unchanged from those heretofore quoted. The tone of the market, however, has been a shade firmer, especially for time loans. The extremely low rates prevailing for demand money here has ceased to attract any considerable amount of money from outside sources, but at the same time the inactivity in the security market has been reflected in a very material falling off in the demand for funds. Money on call has been in abundant supply throughout the week at rates ranging from 2½ to 1¾ per cent, and averaging a little over 2 per cent. On time, sixty-day money was freely offered at 4 per cent, with little desire on the part of borrowers to do business. Four months' money has been in fair request, and the quotation for that maturity has ruled slightly firmer at 4¾ per cent. For five and six months' accommodation offerings are rather free at 5 per cent, and while bankers and other lenders are not disposed to make concessions, they experience considerable difficulty in placing their funds at that figure. The demand for money from corporations has practically ceased, and it is believed that these requirements have been about satisfied, at least for the present. The foreign exchange market, although somewhat easier, is still at a point which makes gold imports from Europe impossible, and this fact has been reflected in much easier conditions at all of the principal European centers. The Bank of England reduced its discount rate from 5 to 4½ per cent, and in well-informed quarters the belief is entertained that a further reduction in the rate will be made in the near future. The Bank of the Netherlands, at Amsterdam, Holland, also reduced its rate ½ per cent to 5½ per cent. At the close of the week there was nothing in the situation calculated to cause any material change in the market in the near future. Reports from all of the interior points are to the effect that money is in good demand, and that finances at all of the larger cities are in excellent condition. The local banks continue to gain substantially on their operations at the Sub-Treasury, the gain from this source for the week, to date, amounting to about $4,000,000, due chiefly to pension payments and other Government disbursements.

The bank statement published on last Saturday was less favorable than had been generally expected, on account of the heavy expansion in loans, the increase in this item being $36,968,300. Deposits increased $44,948,800. Cash increased $7,648,900, or almost twice as much as the gain indicated by the preliminary estimates, but as the reserve required was $11,237,200 more than in the previous week, the surplus reserve was reduced $3,588,300. The surplus now stands at $15,852,925, as against $4,722,500 in the corresponding week of last year, $9,252,400 in 1905, $27,304,600 in 1904, $6,007,650 in 1903, $6,578,650 in 1902, $7,938,200 in 1901, and $10,950,275 in 1900.

The Stock Market

Although the stock market has been weak, and prices have sustained moderate recessions, the speculative situation is, if anything, better than it was a week ago. The failure of a Stock Exchange firm has cleared the atmosphere and the various disturbing rumors have now ceased to have any adverse influence. With the elimination of this one weak spot there has been something of a restoration of confidence, and while this is not practically reflected in any upward movement, it is shown in a cessation of selling in some of the active stocks. Some corrective influences are now at work which should bring about betterment in the stock market, and one of these is the more liberal policy of the Treasury Department in connection with the money market. Another is the recessionary movement in general trade, which is now beginning to attract some attention and which will count for much in that it will tend to relieve the urgent demand upon the banks for accommodations, and will make available a large amount of capital for speculative purposes. The present season is one in which crop news will count for much, and thus far there have been some disturbing reports regarding the winter wheat crop, but according to recognized experts these have been put out for speculative influence and are not based on any actual damage to the crop. The general situation is such that an irregular and narrow market is indicated for some little time, but in view of the heavy liquidation which took place during the past five months there is little probability of any material decline, and practically all the weak points in the situation have been eliminated. The steel situation continues very satisfactory and the outlook for the stocks of the United States Steel Corporation is regarded much more favorably. The monetary position is very much better, both here and abroad. In fact, the improvement on the other side is much more pronounced that at home, and the stronger position of the Bank of England will tend to give tentative support to our market. The reduction in the Bank of England discount rate is likely to be followed by further decline in the near future, and the fact that London is sending gold to Paris, reflects the stronger position of the former market, and its ability to repay loans made some time ago. The Bank of the Netherlands also reduced its discount rate, and it is expected that the Imperial Bank of Germany will take similar action at an early date.

There has been little of importance in the traction stocks during the week, and traders are holding off for a better line on the future of these shares. These companies are now entering upon the season of heavy business and large earnings, and with the additions to equipment they are in a position to handle the increased traffic in a more satisfactory manner.

Philadelphia

There was a material falling off in the dealings in the local traction issues during the week, and while at times prices developed irregularity, the general tone was rather firmer. Philadelphia Rapid Transit, which was under pressure at the close of last week, displayed strength, the price advancing from 16¾ to 18⅛, a gain of about 1½ points. Other strong features were Consolidated Traction of New Jersey, which sold at 73 and 72½, the latter figure representing an advance of a point, and Philadelphia Company common, which gained a fraction, to 50. Union Traction ruled strong, and near the close it reached 59¼. Philadelphia Traction lost nearly a point to 94⅛ on light transactions. Lehigh Valley Transportation preferred sold at 20, United Companies of New Jersey at 247½, and American Railways at 49⅞ to 50.

Chicago

Trading in the traction issues in the local market was considerably smaller than in the preceding week, there being a disposition to await further developments in connection with the proposed reorganization. Prices, however, were very irregular. Chicago City Railway, which advanced 55 points last week to 205, dropped back to 180, while West Chicago sustained a net loss of about 13 points. Union Traction was steady, with sales at 4⅞ and 5. Trading in the elevated issues was extremely dull, Metropolitan Elevated common selling at 26 for small amounts, while the preferred brought 66, an advance of a point.

Other Traction Securities

The market for tractions at Baltimore was active and very irregular. United Railway issues again furnished the leading features as regards activity, but the price movements were more or less irregular. In the early dealings practically all of these issues made fractional gains, on the publication of the company's annual report, which was considered favorable, but subsequently all of the improvements were lost on realizing sales. The income bonds were very active, upwards of $115,000 changing hands from 56 to 54⅜. The 4 per cent bonds sold at 88 and at 87¾, and the new funding 5s sold at 84½ to 84⅝. The free stock developed considerable activity, more than 3500

shares changing hands from 14¼ to 13. Other transactions included Washington City & Suburban 5s at 101½ to 101, Norfolk Railway & Light 5s at 96¼, Charleston Consolidated Electric 5s at 92¾ to 93, and Baltimore Traction 5s at 111. The Boston market was fairly active and weak. Boston Elevated, after an early advance to 145, broke to 143, a net loss of a point. Massachusetts Electric common declined a point to 17, and the preferred ran off from 61½ to 59½. Boston & Worcester was steady. Boston & Suburban preferred sold at 50, ex the dividend.

Not much trading has been done in electric railway stocks on the Cleveland exchange the past week. On Tuesday some one sold Forest City stock down a few points, but the price was soon restored, inside interests coming to the rescue. Its high water mark was 99. Some Aurora, Elgin & Chicago and Northern Ohio Traction & Light changed hands during the week, but the prices have remained about the same as in the past. Cleveland Electric has neither lost nor gained preceptibly, standing about where it did a week ago.

Security Quotations

The following table shows the present bid quotations for the leading traction stocks, and the active bonds, as compared with last week:

	April 10	April 17
American Railways	49½	50
Boston Elevated	143	141½
Brooklyn Rapid Transit	61½	60⅛
Chicago City	a200	180
Chicago Union Traction (common)	4½	4¾
Chicago Union Traction (preferred)	15¾	15¾
Cleveland Electric	58⅛	58¾
Consolidated Traction of New Jersey	72	72
Detroit United	75½	73⅛
Interborough-Metropolitan	26¼	25
Interborough-Metropolitan (preferred)	60	60
International Traction (common)	45	50
International Traction (preferred), 4s	72	72½
Manhattan Railway	137	138
Massachusetts Elec. Cos. (common)	18	16¾
Massachusetts Elec. Cos. (preferred)	60	a59½
Metropolitan Elevated, Chicago (common)	25	24
Metropolitan Elevated, Chicago (preferred)	65	65
Metropolitan Street	94	94
North American	75	73½
North Jersey Street Railway	40	40
Philadelphia Company (common)	45	44½
Philadelphia Rapid Transit	16¾	17¾
Philadelphia Traction	94	94
Public Service Corporation certificates	64	64
Public Service Corporation 5 per cent notes	93	93
South Side Elevated (Chicago)	80	80
Third Avenue	110	108
Twin City, Minneapolis (common)	96	95½
Union Traction (Philadelphia)	57½	57

a Asked.

Metals

According to the "Iron Age," steel in the Central West continues scarce, and efforts are being made by a leading interest to secure billets by going even so far afield as the South. The scarcity is most acute in the trade, which is under great pressure. The structural trade presents a favorable aspect. The New York subway work is looming up. The Lexington and Eighth Avenue lines will need 80,000 tons. The heavy purchases of steel making iron in Pittsburg last week seem to have given a good deal of encouragement to makers of merchant iron of different grades, West and South. A good deal of foreign iron continues to come in.

Copper metal continues firm and unchanged.

PROPOSED LONG ISLAND LINES CONSOLIDATE

It was reported from Patchogue, Long Island, on Monday, that the details had just been completed of a deal for consolidating the South Shore Traction Company and the Cross Island Railway Company, which plans to build to connect Patchogue, Brookhaven, Sayville and Port Jefferson. The South Shore Company has recently received extensions to certain of its franchises and has the consent of the Railroad Commissioners to build, but the Cross Island Company now has an application pending before the commissioners. Nothing of an official nature, however, has been given out regarding the companies. James T. Wood, of Sayville, who is president of the Cross Island Company, so report says, is to be president of the consolidated companies.

CONTROLLING INTEREST IN CHICAGO & SOUTHERN TRACTION COMPANY SOLD TO MICHIGAN SYNDICATE

The Chicago & Southern Traction Company on April 16 increased its capital stock from $2,000,000 to $5,000,000, and the bonded debt from $2,000,000 to $5,000,000. W. S. Reed has sold a controlling interest in the property to a Detroit syndicate, of which C. J. Reilly, C. A. Black, Matthew Slush and J. M. Mulkey, president of Detroit Salt Company, are members. With the increased stock and bonds, it is the intention to extend from the present main line to various points outside the Southern limits of Chicago, and also to extend the line to La Fayette, Ind., to connect there with the Indiana and Ohio lines. The road will be in complete operation as far as Kankakee, Ill., within the next six weeks.

OPERATION FOR THE YEAR IN NEW JERSEY

The State Board of Assessors of New Jersey has just made public the reports of the cable, electric and horse railway companies operating within the State for the year ending Dec. 31, 1906. The comparative statement of gross receipts, expenditures and dividends paid, shows that for 1906 the gross receipts were $12,209,738, as against $11,043,474 for 1905. The expenditures for 1906 were $7,239,409, as against $6,960,570 for 1905. The dividends paid were $885,890 for 1906, as against $803,370 for 1905. Below is given a comparative statement which shows the material increase in the difference between the reports for 1905 and 1906:

	Gross Receipts.	Expenditures.	Dividends Paid.
1906	$12,209,738	$7,239,409	$885,890
1905	11,043,474	6,960,570	803,370
Increase	$1,166,264	$278,839	$82,520

The report also contains a tabulated statement of the miles of track, capital stock issued, capital stock paid up, funded debt, other debts, cost of railroad, expenditure for repairs, superintendence, management, etc., the gross receipts and the dividends paid. Inasmuch as the only operating figures given are the gross receipts, the report is not especially significant. The figures for dividends, however, are interesting and show that among the companies paying returns on the capital stock were the Bridgeton & Millville Traction Company, the Camden Horse Railroad Company, the Camden & Suburban Railway Company, the Consolidated Traction Company, Five Mile Beach Electric Railway Company, the New Jersey & Hudson River Railway & Ferry Company, of Jersey City; the Rapid Transit Street Railway Company, of Newark; the Seashore Electric Railway Company, and the Trenton Street Railway Company. A number of these, however, are leased properties. The total of the several items which the companies report are rather interesting. The track mileage shows that there are 1060 miles of line in operation. The capital stock issued totals to $98,377,880, while the capital stock paid up amounts to $95,895,880. The funded debt totals to $97,158,087. Other debts amount to $28,132,749. The cost of railroads is given as $178,420,773, while the expenditure for repairs, etc., amounted to $7,239,409. The gross receipts as previously given amounts to $12,209,738, an increase is shown in the table at the beginning of $1,166,264. The dividends paid amounted to $885,890. Inasmuch as there are several operating companies in the Public Service Corporation which report separately to the State, the earnings of the Public Service Corporation, as a whole, are not given. The principal operating companies of the Public Service Corporation reporting to the State show earnings as follows: Public Service Corporation, $1,677,798; Jersey City, Hoboken & Paterson Company, $2,575,687; the North Jersey Street Railway Company, $5,614,974.

THE SITUATION IN CLEVELAND

Mayor Tom L. Johnson, of Cleveland, attempted to start his campaign for finances for his low fare companies immediately after the council meeting on Monday evening of last week. He first got a committee together among the friends of his hobby and placed in their hands the task of planning this campaign, with the idea that a still larger committee of both Democrats and Republicans should be made up later on to give the movement a non-partisan appearance. The mayor reasserted his belief that out of $200,000,000 of small savings accounts in the banks in his city, at least $10,000,000 could be secured through sale of stock for building the system.

The first public meeting at which the mayor made a move to secure funds was at the annual entertainment and ladies' night of the Sycamore Club. In a short address the mayor explained what he wanted and had blank applications scattered through the house. He asked that subscriptions in any amount from $10 up be made and impressed it upon the audience that the women should take stock in the experiment, and that parents should subscribe for their children. The assertion was made that the proposed system would be a success and would be owned by the people.

The truce that has existed between the Cleveland Electric Railway Company and the low-fare companies has not been broken. The cars of the Municipal Traction Company are still running from the Superior Avenue viaduct to the Public Square over the Cleveland Electric's tracks and the Central and Quincy Avenue lines are still being operated at a three-cent fare by the old company. The policy of the Cleveland Electric seems to be to oppose the wishes of the people as little as possible and let the administration make the first move in any warfare that may follow the failure to agree.

Some talk has been going the rounds to the effect that the traction matter would be taken into politics, but the better politicians seem to be fighting shy of the proposition. Chairman Price, of the Republican county committee, was called into conference with Mayor Johnson, President Du Pont, of the Municipal Traction Company, and E. W. Doty, secretary of the mayor's bank, a few days ago, but he said that no propositions of any kind were made to him, but that the traction matter was talked over to some extent. This was probably a move toward the non-partisan idea.

The Cleveland Electric Railway Company has begun its campaign for a franchise on the basis of a fare of three and a half cents again. Placards appear in all the cars reading as follows: "3½ cents fare is yours, if Mayor Johnson will let you have it. Speak to your councilman about it." So far this is all that has been done in the publicity campaign.

Several meetings have been held by H. J. Davies, secretary of the Cleveland Electric, and A. B. Du Pont, president of the Municipal Traction Company, to agree upon the amount the company owes the city for the use of Central and Quincy avenues since the franchise expired. Legally, it is said that the company does not owe the city anything, but it is possible that these gentlemen may decide upon an allowance to be paid, in order to carry out the policy of fairness that was adopted by the Cleveland Electric in the beginning.

The Forest City Railway Company has made no attempt to get possession of Central and Quincy avenues, although it is the contention of the officers of the low fare companies that the tracks of the Cleveland Electric have passed from the company's ownership, because they were not removed after the franchises expired. On the other hand, it has been said that neither the city nor the other companies may take possession of this property.

The Cleveland Electric Railway Company sent a communication to the City Council Monday evening, stating that on Tuesday, April 23, at midnight, service on the Central Avenue and Quincy Street lines would be abandoned, as they have been operated since the decision of the Supreme Court at a loss through giving a 3-cent fare. The letter stated that the company would sell the material to any one making application for it at a fair figure. Council adopted a resolution directing the Forest City Railway Company to take possession of the lines and operate them, when the Cleveland Electric ceases, but it is probable that this could not be done, since the company stated that the road would be taken up unless sold and paid for by the time mentioned above.

Council met in adjourned session Tuesday morning, having asked the Cleveland Electric to name a price for the lines on which the franchises have expired. A letter was presented from the company, in which it refused to name a price to that body, for the reason that it could not make the purchase, but saying that figures would be given any bona fide purchaser who had the money to pay for the property.

The Forest City Railway Company has announced that it is ready to enter into negotiations for the purchase of the Central Avenue and Quincy Street lines that are to be abandoned by the old company. A letter was sent to President Andrews to that effect by A. B. Du Pont.

Application was filed with the City Council by the Low Fare Railway Company for a franchise on the West Side, covering the same territory as one granted the Forest City some time ago. This was probably done to get around the financial interest that the Mayor is supposed to have in the Forest City Railroad Company. Substitutes were offered for several franchise ordinances introduced at former meetings and they were accepted.

LEGISLATION IN PENNSYLVANIA

Two bills directly affecting electric railways passed the House of Representatives last week. One was the Homsher bill, granting to trolley companies the right of eminent domain where the consent of 51 per cent. of the affected property owners has been obtained. The other was the Beidleman bill, permitting cities of the third class, such as Harrisburg, Lancaster, Reading, Altoona, York, Chester, Williamsport, Wilkes-Barre, Johnstown, Allentown, Easton and Erie, to tax the real estate of all public service corporations.

Under the Homsher eminent domain bill all trolley companies taking advantage of the new law must become common carriers of express matter and light freight. This is the point battled for by "Farmer" Creasy when the Homsher trolley freight bill was up for consideration, but which was voted down, it being left optional with the companies whether to carry freight or not.

Representative Decker wanted to strike out the provision giving the companies the right to condemn land for car houses and power houses, but the House voted down his amendments. The last amendment offered was to give viewers of land trolley companies wish to condemn $5 per day.

Like the trolley freight, 2-cent fare and railroad commission bills, which have been passed in the House, this eminent domain bill fulfills a pledge contained in the platform of the Republican party.

There was quite a protracted debate over the Fahey bill, providing that the consent of the local authorities of all cities, boroughs and townships of the first class and the Board of Road Supervisors of townships of the second class be obtained before the granting of any street railway charter. Opposition came from the country members, who charged that the measure was drawn entirely in the interest of Philadelphia people and that it allowed street railway companies too much leeway in the country. The bill lacked 13 votes of enough to pass finally. Subsequently the House reconsidered its action in defeating the measure and postponed further action on the bill for the present.

A large delegation of Philadelphia business men appeared before the Governor in opposition to the Fahey trolley bill recently passed, applying to the city of Philadelphia and the Philadelphia Rapid Transit Company. They requested the Governor to veto the bill.

In its report to the Legislature the committee to investigate the cost of living in Pennsylvania, which held sittings in Pittsburg, recommends that trolley companies be given the right to carry freight, which will encourage the production of a larger food supply for home markets and the creation of a railroad commission.

The Homsher trolley freight bill passed the Senate April 15 and now goes to the Governor, who will undoubtedly sign it. An unsuccessful attempt was made to amend the bill by prohibiting freight traffic on Sunday.

The Governor has signed the first and most important of the Fahey bills, permitting the city of Philadelphia to enter into an agreement with the Philadelphia Rapid Transit Company, whereby the franchise can be secured by the city at the end of fifty years. Whenever the stock of the company reaches a 6 per cent dividend basis the company and city are to share equally in the profits. It is believed that the companion measure will likewise become a law.

CHICAGO CITY DIRECTORS VOTE TO ACCEPT ORDINANCES—OTHER MATTERS

The acceptance on April 12 by the directors of the Chicago City Railway Company and of the new control company, the Chicago City Railroad Company, of the ordinances which were approved by the voters of Chicago on April 2 formally opened the way to the work of rehabilitating the Chicago properties. The acceptance of the ordinances, it was announced, would be filed with the city early in the week. In this connection it is of interest to note that the Chicago City Railroad Company, mention of which has just been made, was formed in January, 1907, in anticipation of the approval of the ordinances by the voters, and in accordance with the stipulation which provides that the obligations of the Chicago City Railway Company to rehabilitate its properties may be discharged either by the company itself or by the Chicago City Railroad Company, which assumes all the obligations of the railway company and is responsible for the operation of that company's property in the north and west divisions of the city.

In connection with the financing of the new work it is still persistently reported that the Chicago City Railway Company will authorize $50,000,000 worth of bonds, which will be sufficient to cover the needs of that corporation during the life of its franchise. These bonds it is said will bear interest at 5 per cent, and in effect will be guaranteed by the city. Of this amount it is estimated that about $18,000,000 will be required for the purpose of reconstruction, and that bonds of the par value of this amount will be sold at once. Here again it is pointed out that there is no need of a sinking fund, as the city agrees to pay the cost of improvements made on capital account, or, in other words, for which the bonds are issued. It is pointed out that in paying for the $18,000,000 improvements, therefore, the company will receive from the purchaser an amount equal to the par value of the bonds. The present assets of the Chicago City Railway Company, as agreed in the ordinance, are worth $21,000,000. This price, as has been before pointed out, must be paid by the city or any purchaser of the property. In addition the company has outstanding $3,000,000 in notes. These the ordinance agrees shall be considered in the same manner as assets, and out of the earnings, before any distribution of net profits, 5 per cent must be paid from the amount of the assets plus the $3,000,000 notes, or a total of $24,000,000. One authority says that this $24,000,000 will be immediately capitalized by the issuance to shareholders of $24,000,000 of the $50,000,000 issue. The issuing of bonds merely puts in concrete form the amount of the obligation which the city has agreed to pay.

One of the early moves made by the Chicago City Railway Company last week was the order placed by it for 10,000 tons of steel rails for use in constructing its lines. This order, which was placed with the Lorain Steel Company, of Lorain, Ohio, will provide for the rebuilding of fifty miles of single track.

It was proposed by the City Company and the Union Traction Company to establish through routes at once, but it was discovered that tracks on North Clark and North Halsted Streets are too close together to permit the new cars of the City Railway Company to pass each other. It is proposed to relay portions of this track, and until the work is completed the through routeing of the North Clark and Halsted Street lines will have to be deferred. In addition to the North Clark and Halsted Street lines it was proposed to through route some twenty-one other lines.

On Tuesday of last week Walter L. Fisher, who has been acting as traction adviser to the city, removed doubt as to his continuing that capacity by formally announcing that he would accept the appointment which had been offered to him by the new administration.

It was reported recently that Bion J. Arnold advocated building four-track subways that should extend to the limits on the north, south and west, and that he would submit plans for them along with the plans for the downtown system. In explaining his ideas on the subject he said that fast express trains could be run in such subways, "thus making it possible for the steam railway companies to locate their terminals outside the city and at the same time give the people in the outlying districts and those desiring to get from these railway terminals to the city rapid service to and through the business district."

Under the traction ordinances the city may require the street railway companies to join with each other and the city itself in defraying the cost of subways. The work immediately contemplated is the construction of downtown terminals. The contribution of the companies to this work is fixed at not to exceed $5,000,000. When the system shall have been completed, but not before the expiration of five years from the acceptance of the ordinances, extensions and additions may be required under a joint construction arrangement between the companies and the city.

At a mass meeting the employees of the Chicago City Railway refused to accept the wage increase offered by President Mitten, details of which were given in the Street Railway Journal April 13, 1907. The stand of the employees was that no agreement should be made that would prevent a sympathetic action in the event that the Union Traction or elevated railroad employees become involved in difficulty.

Incidentally, it may be mentioned that the transfer cases were decided in favor of the city in the United States Supreme Court. The decision was by agreement, Colonel Lewis, for the city, and John P. Wilson, for the traction companies, requesting the decree. This is a decision on the cases started some time ago by the city to compel the companies to issue universal transfers. The new traction settlement ordinances provide for transfers to cover the point in litigation.

NO TROUBLE WITH NEW HAVEN LOCOMOTIVES

Various notices have appeared during the past week or ten days in Boston, Connecticut and New York papers alleging that one of the New Haven electric locomotives was sent recently to the Grand Central Station in New York to pull out a Boston express, but that it had been found too light for the task. The story is absolutely without foundation. None of these locomotives has been nearer New York than New Rochelle, and no tests have been made except upon the makers' experimental tracks and on the school tracks of the New Haven Company, near Rye. The line will probably not be opened before June 1, and possibly at a later date.

THE IOWA MEETING

Through the efforts of the officers of the Iowa Street & Interurban Railway Association, the meeting to be held in Clinton, Iowa, on April 19 and 20 gives promise of bringing out some interesting facts on electric railway conditions in that State. The convention will begin on Friday morning, April 19, with an address of welcome by the Hon. H. U. Crockett, Mayor of Clinton, and a response by C. D. Cass, general manager of the Cedar Falls & Northern Railway Company. This will be followed by the address of President F. J. Harlon, the reading of the minutes and the report of Secretary and Treasurer L. D. Mathes. The morning session will be opened by a paper by W. G. Wagenhals, of St. Louis, Mo., on the "Steam Motor—Its Value for Interurban Service." This paper will be found on page 698 of this issue. The afternoon session will be taken up by two papers—one by H. W. Garner, general manager of the Oskaloosa Traction & Light Company, on "Amusements—How Should This Feature be Handled by Operating Companies?" and the other on "Freight Handling by Electric Lines," by P. P. Crafts, general manager of the Iowa & Illinois Railway Company. These papers are printed on pages 696 and 699 respectively, of this issue.

The Saturday morning session will open with a paper on the "Joint Operation of City and Interurban Cars over City Tracks," by Isaac B. Smith, traffic manager of the Cedar Rapids & Iowa City Railway & Light Company. Following Mr. Smith's paper, there will be a discussion on methods of handling peak or rush-hour traffic on city lines. Mr. Smith's paper will appear in the next issue of the Street Railway Journal. The session on Saturday afternoon will start with a paper on "Modern Train Dispatching Methods on Electric Railways," by H. H. Polk, president of the Inter-Urban Railway Company, of Des Moines. This paper is published on page 695 of this issue. After the discussion of this paper, the convention will end with the usual routine closing business of the convention, such as the nomination and election of officers for the ensuing year.

THE REPORT OF THE NEW YORK RAPID TRANSIT COMMISSION

The report of the New York Rapid Transit Commission for 1906 has been submitted to Mayor McClellan. As an introduction the commission indulges in praise of the work it has accomplished and details the trials that have hampered its work. After that it proceeds to consider the Elsberg law, which has curtailed its powers. Objection is made to that provision of the bill which practically gives the board of estimate the same power over rapid transit matters as the commission. The conclusion is as follows:

If the Rapid Transit Board is to continue to exist at all, its work can only be wisely performed by allowing it the initiative in planning both the scope of its undertakings and the manner in which they are to be carried through. The proper function of the Board of Estimate is to examine and criticise these plans when presented—just as it examines and criticises the plans of a Borough President for a section of the city map or his projects for a drainage area.

The Board of Estimate and Apportionment has no special acquaintance with the facts which may make one form of contract more or less expedient in a particular case. That special knowledge the Rapid Transit Board possesses, and in every other part of rapid transit act it is the Rapid Transit Board which is to plan and suggest, and the Board of Estimate and Apportionment which is to approve and authorize. The two sections just referred to are therefore anomalous, and may lead to serious confusion and delay.

Speaking of the delays which have occurred in completing the Brooklyn tunnel, the report has this to say:

By the terms of the contract for the construction of the Brooklyn-Manhattan Road it should have been "completely constructed and equipped ready for immediate, full and continuous operation" by Sept. 11, 1906. At that time the railroad, from the Battery to Brooklyn and through Brooklyn, was very far from completion, and the question arose as to whether, under those circumstances, the city was entitled to recover damages for the delay.

The contractor presented a variety of excuses, arising in part from litigation with property owners, in part from unexpected physical conditions under the East River at both ends, and in part from the change in plan in Fulton Street and Flatbush Avenue, as authorized by this Board and approved by the Board of Estimate and Apportionment.

The changes in plan have involved a great deal of additional work both in Fulton Street and Flatbush Avenue, and have necessitated a change in the orders for the steel used in construction, all of which has led to a very considerable delay. In consequence, the railway from the Borough Hall to the terminus at Atlantic and Flatbush Avenues is still far from completion at the present time, and will be delayed after the rest of the road is ready for operation. It may, however, be said with truth that the contractor's work on this section of the railway has been pushed with most unusual rapidity, and there is no reason to believe there will be any avoidable delay. The Interborough Company, under the contract, pays about four-fifths of the entire cost of the work, and can get no return until the road is in operation, so that it is very much to the contractor's interest to have the work completed at the earliest possible moment.

A very serious cause of delay has been due to the necessity of reconstructing a part of the work in Joralemon Street, and for a short distance under the East River. As early as the beginning of 1904 the engineer of the Board had occasion to criticise the method employed by the subcontractors in tunneling under Joralemon Street, and money was withheld from time to time from the contractor on account of this defective work. In the end it was found that the tunnel had settled in some places so that a uniform grade was not obtained, and if this had not been corrected it would have been difficult to run trains through at a high speed.

The work of reconstruction of the parts of the tunnel thus affected will not delay the operation of the road, because all this work can be done before the tunnels under the East River are ready for the passage of trains.

Of the approved route to Coney Island the board says that the population of the district traversed is growing enormously; that nine-tenths of the residents do business in Manhattan; that they have inadequate means of transit, and that in 1905 no less than 28,000,000 persons visited Coney Island, of whom 94 per cent started from Manhattan.

The proposed "tri-borough" route from Pelham Bay Park through 138th Street, and turning thence under the Harlem River into Third Avenue to the Battery is also commended in the report. This route provides for a track across Manhattan Bridge, under Flatbush and Fourth Avenues, Brooklyn, to Fourth Avenue, with another divergent branch in Brooklyn from Thirty-Eighth Street and Fourth Avenue to Eighty-Sixth Street, and thence as an elevated road to Coney Island. Its possibilities for connection with Staten Island by tunnel under the Narrows are emphasized.

The cost of the existing subway to the end of 1906 is set down as $38,782,276, which includes extra work authorized. This system earned in 1906: Gross, $7,080,507; net, $3,824,985. It has paid in rentals to the city, including interest on bonds and for sinking fund since the opening of the subway, $3,734,627. In 1906 this road was extended, first from 157th Street north to the Harlem Ship Canal, and then by a new bridge to 230th Street.

The commission hopes that the Brooklyn subway will be in operation by July 1.

A NEW TRANSFER SYSTEM FOR BROOKLYN

As the result of the study it has been making of operating conditions in Brooklyn as they affect the issuance of transfers the management of the Brooklyn Rapid Transit Company announced on Tuesday, April 16, a new system of transfers to go into effect May 1, which will limit each passenger to two transfers, and will permit the use of three separate lines to reach a destination. On tendering a cash fare, a passenger will be given a yellow transfer, and if he requires to use a third line the yellow transfer will entitle him to a green transfer, on which no other transfers will be issued.

The company states that its object in introducing the new system is not to abridge the legitimate transfer privileges hitherto accorded to passengers, as all passengers wishing to travel between any two points on the lines of any company can do so under the new arrangement, as easily and in the same manner as heretofore. The main purpose of the change is to eliminate, if possible, the principal abuses that have characterized the operation of the transfer system since the privilege was accorded, on March 30, 1906, of a transfer on a transfer. The new arrangement will not only affect unpleasantly the passengers who have availed themselves of these privileges and abused them to ride indefinitely on the lines of the system, but such passengers as have manipulated transfer tickets in order to make a round trip for a single fare.

Under the new system a passenger will be limited to three separate and distinct rides for a single fare, as before stated, except that at feeder lines an additional, or fourth, ride may be obtained upon a conductor's ticket, or a transfer agent's ticket, without the payment of an extra fare. The privilege of three rides for a single fare does not, however, apply to the two-fare routes, where the additional fare will be collected at the second fare points, as heretofore.

A passenger paying a cash fare, or presenting a white continuous trip ticket from the feeder lines, is entitled to a yellow transfer; a passenger tendering a yellow transfer is entitled to a green transfer; but a passenger presenting a green transfer shall not be entitled to an additional transfer. Under the new arrangement a transfer will only be issued when asked for at the time the fare is paid.

At the top of the yellow transfer are printed in alphabetical order the names and numbers of the lines to which the issuing line directly transfers. Should the destination of the passenger not be included in the list of direct transferring lines at the top of the ticket, it will be found in the second list (on both sides of the ticket in alphabetical arrangement) or under the heading "Important" at the bottom of the back of the ticket, where the feeder lines and optional transfer points are shown. Opposite the name of the line sought in this second list are printed the numbers of the direct transferring lines to some one of which passengers must first transfer by yellow ticket, and thence by green ticket to the line desired. In many cases, though, the issuing line may directly transfer to the line desired, and the conductor upon being informed of the passenger's destination, will be able to indicate a shorter route than by the use of two transfers.

The yellow transfer, which is issued for a cash fare or a white continuing trip ticket, will bear only one punch mark, indicating the time limit of transfer; but the green transfer issued upon the yellow transfer will bear an additional punch mark canceling the number of the line which issued the original yellow transfer. The green transfer will not be accepted by the conductor of the line whose number is punched thereon but will be honored within the time limit by any other line named on the ticket.

The form of transfer to be issued under the above outlined arrangement of transfers will present a novel feature never before used in connection with transfer tickets. The yellow transfer of each line obtained upon the payment of a cash fare contains full information how to reach any point on any other line of the system, and the shortest route there. It also shows clearly the number of rides necessary to reach that destination.

ANNUAL REPORT OF THE BALTIMORE COMPANY

The report of the United Railways & Electric Company of Baltimore for the year ended Dec. 31, 1906, just made public, is generally considered to be very satisfactory. The gross earnings increased $559,404, or 9.29 per cent. Operating expenses, after deducting extraordinary expenses of $929,762 for the year 1905, increased $385,412, or 13.59 per cent. The increase in other income was $2,000, while the increase in fixed charges was $135,520, or 6.8 per cent. The decrease in the amount of surplus for the year was $9,766. The increase in operating expenses is accounted for by the increased car service, to the advance in wages paid employees, and in part to increased cost of material and supplies. The comparative income accounts for 1906 and 1905 follow:

Gross earnings of lines (owned and leased)	$6,583,102	$6,023,698
Operating expenses (including insurance)	3,220,942	3,765,291
Net earnings from operation	$3,362,160	$2,258,406
Other income	4,725	2,725
Total net income applicable to fixed charges, taxes, etc.	$3,366,885	$2,261,131
Fixed charges, including park and other taxes, interest on car trust certificates, etc.	2,365,586	2,230,066
Surplus	$1,001,298	$31,064
Of which there has been credited to extraordinary expenditures	980,000	......
Balance, surplus carried to the credit of profit and loss	$21,298	$31,064

The president says in his annual report, in part, as follows:

While the earnings show a gratifying increase, as compared with 1905, the unusually frequent and heavy rains, which occurred during the summer of 1906, greatly interfered with excursion travel, the amount of precipitation during the three months—June 1 to Aug. 31—being 19.10 ins.

During the year, as a measure of future economy in operation, large sums were judiciously expended in bettering the condition of roadway, track and power plants.

Your directors have continued the policy which, in their judgment, would best promote the efficiency of the service and economy in operation, it being their purpose to meet the requirements of the public in the matter of increased facilities.

In view of the fact that the financial plan of the company made available a large surplus each year for the next four years, and in view of the increase of gross receipts and the economies to be effected from increased efficiency, it was deemed expedient to continue as rapidly as possible the plans for the improvement of the company's property. The work was greatly facilitated by the open weather prevailing in the spring of 1906.

As a result, the plans of improvement were very materially advanced during the year 1906, much of the work scheduled for 1907 having been completed in the past year.

The increased cost of both labor and material in 1906 was, of course, an important factor in adding to the amount of ordinary operating expenses, extraordinary expenditures, etc.

During the past year, under the advice of expert accountants, in order to preserve in condensed form an accurate record of the cost of rehabilitating the property, there was opened an account referred to herein as "Extraordinary Expenditures," which account includes expenditures for rehabilitating the property distinguishable from the cost of ordinary maintenance and repair under normal conditions of efficiency. The extraordinary expenditures for the year were $1,436,692.98.

Of the total cost of this work, $980,000 has already been charged against the net income of the year and credited to extraordinary expenditures, leaving a balance standing to the debit of extraordinary expenditures on Dec. 31, 1906, of $456,692.98, the final distribution of which will be made by your board of directors. It appears for the present on the balance sheet as a deferred asset, ad interim.

Taxes.—The total amount of taxes, including park tax and the cost of paving streets during the year, was $652,802.67, as against $560,368.96 in 1905, an increase of $92,433.71.

The park tax for the year was $410,308.67, as against $378,658.57 in 1905, that for the last quarter of 1906 having been $107,517.61, the largest quarterly amount ever paid the city.

Tracks.—The Track Department reconstructed during the year, with standard rails, bonding, fastenings and new ties, 31,625 miles of single track.

The company now operates 394,454 miles of main track, of which 171,867 are laid with T rails upon suburban lines, and 172,666 with 9-inch girder rails, while 49,921 miles are made up of various types of smaller sections, the joints upon 40.62 miles of which have been cast-welded."

Cars.—During the year the company has received and placed in service 100 additional double-track 4-motor air-brake cars, 90 of which were bought under Car Trust (Series "C") and 10 purchased outright by the company, from the proceeds of insurance.

A contract was closed by the Maryland Electric Railways Co. on Nov. 24, 1906, for 40 double-truck, semi-convertible, high-speed cars, and on Feb. 1, 1907, an order was placed for 40 additional cars of same type; all to be equipped with multiple-unit control and leased to your company; it being the intention to use these cars in the Bay Shore Park excursion service, to be operated either singly or in trains, as the traffic warrants, thus releasing 40 practically new cars from this service for use on other city and suburban lines.

Ten snow-plows and two sweepers, purchased by the Maryland Electric Railways Co. and leased to your company, were received in time to be of service in clearing the tracks of the heavy snows on Feb. 4 and 5, 1907.

As explained at some length in this report, large expenditures have been made during the year. In consequence, the value of your property has materially enhanced.

Since the great fire of February, 1904, there has been expended for the general betterment of your property by the reconstruction of tracks and power-houses, for the purchase of cars, and for extensions about $6,891,734.21.

The new board of directors of the United Railways & Electric Company organized by electing Wm. A. House president, to succeed the late Gen. J. M. Hood; Frank A. Furst, first vice-president; Thomas A. Cross, general manager; Wm. Early, secretary, succeeding H. C. McJilton, and J. H. Windsor, acting treasurer. Mr. Furst takes the place of George C. Jenkins, who declined a re-election. The second vice-presidency, made vacant by Mr. House's promotion, was not filled. No changes were made in the executive committee.

THE KALAMAZOO STRIKE IN THE LIGHT OF REASON

In the issue of the STREET RAILWAY JOURNAL for April 13 the settlement was noted of the strike of the employees of the Michigan United Railways Company's lines at Kalamazoo, which lasted exactly one week and resulted in a decisive victory for the company. The principal demand of the men was for recognition of the union, which was positively refused by the company. Since the strike the opportunity has been taken advantage of by the local press dispassionately to consider the situation and to comment on the outcome. Thus some pertinent remarks are made by the Kalamazoo "Telegraph," which in its issue of April 11 said in part:

The real responsibility for the lawless acts during the strike rests with those persons who, for political purposes, have for two years made the Traction Company a political football. The minds of many, especially the irresponsible, have been inflamed against the Traction Company until many, whose bias is against capital and against corporations, were ready to smash car windows, destroy cars and tear up tracks. For political purposes the "Gazette" and its associates have held up the Traction Company to abuse and ridicule and attack until many thought that it was a monster to be destroyed and annihilated. No opportunity was lost by that paper to tell the people that a strike was imminent when none was contemplated. The people were told that the company was fighting and robbing the city, and that it, the company, ought to be crushed. At the same time the company was spending hundreds of thousands of dollars in the city.

The result was, when a strike did come, these inflamed people were desperate and ready to do anything—even take life if necessary. The resulting lawlessness has given Kalamazoo a bad reputation from which she will not recover yor years.

This comment is not made by way of a defense for the Traction Company, but as a sort of "square deal," which many men preach, but do not practice.

Now, the events of the past week have, we hope, brought the responsibility of lawlessness where it belongs and taught all that it is a dangerous thing to stir up and inflame the masses just for politics. The bill of damages against the city will be heavy, and the cost in reputation and standing can never be adequately estimated.

The Traction Company, presumably, does not claim to be perfect or without fault, but it is deserving of decent treatment at the hands of the newspapers and the politicians who happen to have a little brief authority.

Public sentiment will no longer tolerate this wholesale and political slaughter of an institution that manifestly is trying to give the people good car service. Public sentiment will rise in rebellion against any more games of political shuttlecock with any local institution that serves the public and is spending money to help Kalamazoo. It is neither fair nor just, and a long ways from being a square deal.

Now that the trouble is over, let all be good citizens; let this unceasing political attack on the M. U. R. cease. If that company does wrong, there is always a peaceable remedy for the citizens.

The lesson has been costly, but much has been learned.

We know better who Kalamazoo's real friends are.

SIX TRACKS FOR THE LONG ISLAND FROM LONG ISLAND CITY TO JAMAICA

President Ralph Peters, of the Long Island Railroad, has just announced that the company will build a six-track system from Long Island City to Jamaica, a distance of about 15 miles. This statement is of considerable interest, as the branch for which the improvement is proposed is within the electric zone.

INTER-POLE MOTORS FOR BROOKLYN

The Brooklyn Rapid Transit Company has entered into a contract with the Westinghouse Electric & Manufacturing Company for equipments to be placed on 100 2-motor equipment surface cars and 100 2-motor equipment elevated motor cars. The former will employ 200 Westinghouse 93-A-2 60-hp motors, and 100 sets K-28-B series parallel controllers, and the latter 200 Westinghouse 200-hp commutating-pole or inter-pole motors, and 100 unit switch-group multiple unit control equipments.

DELAWARE & HUDSON SEEKING TO FINANCE CONSTRUCTION OF ELECTRIC PROPERTIES

It is reported in financial circles in New York that the Delaware & Hudson Railroad will raise $10,000,000 on two or three year notes, if favorable terms can be secured. This money, it is said, will be used to provide for the improvement of the Hudson Valley Electric Railway, recently taken over, and will include the payment for the big power plant at Mechanicville and double tracking the entire system, or the divisions carrying the heaviest traffic. These plans are in accordance with the announcement made regarding the continuation of the Rutland and Washington branch of the Delaware & Hudson system from Salem across Washington county to connect with the Hudson Valley lines at Schuylerville.

PREPARING THE PHILADEPHIA & WESTERN FOR SERVICE

The Philadelphia & Western Railroad, extending out of Philadelphia, will be placed in operation very shortly. The finishing touches are being added along the lines, and the cars are being equipped for service. Already twenty cars are on the ground, and the work of installing the motors is being carried out at the company's barn just west of the Philadelphia Rapid Transit Company's terminal at Sixty-Ninth Street, Philadelphia. The cars, which were built by the St. Louis Car Company, are upholstered in olive colored leather. The trimmings are of brass. Arc headlights are used. The work on the equipment, so it is said officially, is so far advanced that the company expect to have the eastern division running for the instruction of trainmen by April 20. By May 30 it is planned to have both the east and the west divisions carrying passengers. On the same day it is probable that Beechwood Park, 5 miles from the heart of Philadelphia, will be formally opened.

FINANCING THE NEW LONG ISLAND ROAD

George Stanley, purchasing agent of the Cleveland Electric, J. R. Nutt, of the Citizens' Savings & Trust Company, of Cleveland, and George Thrasher, manager of the New York & Nassau syndicate, made a record in financing the proposition for the road across Long Island, from Mineola to Port Washington, the organization of which was noted on page 564 of the STREET RAILWAY JOURNAL for March 30. Within a week from the time of beginning, these men had $1,000,000 ready to turn over to the Citizens' Savings & Trust Company, most of it having been subscribed by Cleveland men. However, some came from Akron and other places in the northern part of the State.

The work of securing franchises was begun only two months ago and it is understood that these grants have all been made and that there will be no further trouble in that respect. The time set for beginning work was last Monday. The company will have a capital stock of $1,250,000 and will issue bonds to the amount of $1,000,000. It is said that the syndicate managers will receive $250,000 of the stock as a bonus.

PRIZES FOR SAFETY DEVICES

At a meeting of the advisory committee of the American Museum of Security, held April 11, 1907, Charles Kirchoff, of the Iron Age, was elected chairman and T. C. Martin, of the Electrical World, vice-president of the committee. Dr. William H. Tolman, director of the American Institute of Social Service, announced that Francis H. Richards had offered a gold medal worth $75 to be awarded to the best invention to be exhibited at the American Museum of Safety Devices relating to automobiles and motor boats. Action was taken on the award of the annual gold medal offered by the Scientific American for the best safety device, mentioned in a recent issue of this paper. It was decided to have a committee of nine judges of experts prominent in the different industries, and to be appointed by the executive committee of the Institute. Dr. Tolman also announced that Dr. L. L. Seaman had offered an annual prize of $100 for the best essay on the subject of safeguarding life. The subject of quarters for the permanent museum was discussed, and Dr. Tolman announced that several manufacturers had made application for space.

YEAR'S RESULTS AT LIVERPOOL

The annual report on the Liverpool Corporation tramways for the year 1906, by the traffic manager (Mr. C. W. Mallins) has just appeared. The capital expenditure to date is £1,901,997; total revenue last year, £586,619, against £566,628 in 1905; operating cost, £391,282, against £381,378; gross profits, £192,337, against £185,250; interest and sinking fund, £109,508, against £109,291; balance, £82,756, against £75,959; transferred to reserve, renewal, and depreciation, £55,171, against £50,639; transferred to general rate account, £27,585, against £25,319. An analysis of the cost of working shows: Traffic expenses, £148,667, or 2.94d. cost per mile; general repairs and maintenance, £82,366, or 1.631d.; power expenses, £99,918, or 1.980d.; general expenses, £54,452, or 1.079d.; rent of leased lines, £5,876, or .116d.; and interest and sinking fund, £109,580, or 2.171d.; making a total of £500,862, or 9.922d., against car mile earnings of 11.17d.

EXTENDING THE CUMBERLAND VALLEY ROAD

Tracklaying for the extension of trolley service on the Dillsburg and Mechanicsburg branch of the Cumberland Valley Railroad Company from Dillsburg Junction to Mechanicsburg has been almost completed and passengers between Mechanicsburg and Dillsburg will soon be carried the entire distance without the usual long wait at Dillsburg Junction. The Cumberland Valley Railroad Company is so well satisfied with the working of the electric cars on the Dillsburg and Mechanicsburg branch that it purposes proceeding during the year with the electrification of the Waynesboro and South Pennsylvania branches. When the gage on the Chambersburg & Gettysburg Electric Railway (which is controlled by the Cumberland Valley) is changed to conform with the railroad company's gage cars will be run over the trolley track from Chambersburg to West Fayetteville and thence to Waynesboro over the Mont Alto branch. A parallel track will be built along the South Pennsylvania from Chambersburg to Marion. When these improvements are completed freight on these branches will be handled at night by steam locomotives and electric passenger cars operated during the day. The company will convert present combination cars on its main line into trolley cars.

EXTENDING THE TOLEDO, FOSTORIA & FINDLAY LINE TO TOLEDO

F. W. Adams, general manager of the Toledo, Fostoria & Findlay Railway Company, announces that he will start immediately to build an extension of the company's line to Toledo from Pemberville, its present terminus. The road, as already in operation, extends from Findlay, the northern terminus of the Western Ohio property, 34 miles to Pemberville, via Fostoria. An extension of slightly over 15 miles is necessary to reach Toledo. This will result in two lines from Findlay to Toledo, as the Toledo Urban & Interurban already is in operation between the two points. As the two routes are in no sense common, however, except from the termini, practically no competition will result from the new construction. Mr. Adams will have entire charge of the construction; in 1905 he built 18 miles of road and operated cars over it in less than four months, but he thinks that it will take considerably longer to do the present work, owing to the fact that no preliminary work has yet been done. This company is somewhat unique in that none of its securities are on the market, and none will be offered for the purpose of "financing" this work. The company expects to purchase sub-station machinery and six passenger coaches and two express cars complete.

STREET RAILWAY PATENTS

[This department is conducted by Rosenbaum & Stockbridge, patent attorneys, 41 Park Row, New York.]

UNITED STATES PATENTS ISSUED APRIL 2, 1907

848,663. Brake Shoe Mounting; Van Buren Lamb, New Haven, Conn. App. filed May 19, 1906. A brake-shoe provided with a protecting tenon, the lateral surfaces of which are undercut, a divided head one end of which fits about one portion of the tenon and the other end of which comprises laterally separable parts, and means adapted to hold said parts together.

848,730. System for Transmitting Electric Currents to Cars; John J. Eagan, San Francisco, Cal. App. filed Dec. 26, 1905. The trolley wires are strung transversely of the track, and a long collector shoe on the car presses the wires upwardly into contact with the current supply.

848,731. Door Opening Device; Oliver M. Edwards, Syracuse, N. Y. App. filed Apr. 9, 1904. Means operated by a foot lever for releasing the trap door, and at the same time giving it a percussion blow in case it sticks as is often the case in damp weather.

848,796. Illusion Car; William H. Winterborne, San Antonio, Tex. App. filed Sept. 6, 1906. A pleasure car in which means are provided for effecting a side-to-side or swaying movement of the car, an up-and-down movement similar to the jolting of a car on an uneven track, and a turning movement to represent the curved portion of a track.

848,958. Selective Signal System; Elmer F. Bliss, Schenectady, N. Y. App. filed July 12, 1906. Relates to a device of the mesenger call type in which semaphore signals are selectively set by a current having a predetermined number of pulsations. The release mechanism is actuated by a current of reversed polarity.

848,959. Block Signal System; Elmer F. Bliss, Schenectady, N. Y. App. filed Sept. 19, 1906. Relates to modifications of the above.

848,993. Slack Adjuster for Brakes; James M. Hines, Albany, N. Y. App. filed Aug. 2, 1906. Relates to slack adjusters for car brakes, and is intended to supply improved means for taking up the slack due to the wear of the brake-shoes and wheels, and the stretching and bending of the brake-operating levers and rods.

849,046. Railway Crossing Signal; Delano J. Brush, Columbus, O. App. filed Oct. 29, 1906. An arm carrying a danger flag is caused to be raised to upright position by the engagement of each car wheel of an approaching train with a lug adjacent to rail. As soon as the wheel passes out of contact with the lug, the flag falls to normal position and is again raised by the next wheel of the train, thus rapidly oscillating the flag.

849,093. Composite Railway Tie; Louis H. Wolff, Indianapolis, Ind. App. filed May 17, 1906. The process of making a composite railway tie which consists first in pressing the external portion into shape, and in subsequently forming and pressing the central portion into place in the external portion for uniting the two portions, and giving to the whole tie substantially the same density and character.

849,157. Engineer's Alarm; Edward McClintock, Merriam Park, Minn. App. filed Nov. 6, 1905. Trolleys laid between the track rails with circuits by which the steam of a locomotive is automatically cut off in case a following train approaches too close to a preceding one.

849,170. Electric Signaling; Jacob B. Struble, Wilkinsburg, Pa. App. filed Dec. 3, 1902. Relates to improvements in electric signaling, and is designed to utilize alternating pulsating or fluctuating currents. Has a translating device responsive to alternating current, but unresponsive to a modification of the alternating current, and means for modifying the alternating current under certain circumstances.

849,171. Electric Signaling; Jacob B. Struble, Wilkinsburg, Pa. App. filed Jan. 17, 1906. Modifications of the above.

849,172. Electric Signaling; Jacob B. Struble, Wilkinsburg, Pa. App. filed Jan. 17, 1906. Additional modifications.

849,173. Signaling System for Electric Railways; Jacob B. Struble, Wilkinsburg, Pa. App. filed Jan. 3, 1907. Further modifications.

849,183. Adjustable Locking Device; William S. Atwood, Montreal, Canada. App. filed Mar. 10, 1905. Means for adjustably locking a brake head in different angular positions upon a brake beam. The brake beam and brake head each embody a sleeve constructed to fit one within the other, one of said sleeves being provided exteriorly, and the other interiorly with a plurality of locking faces, an odd number on one end, and an even number on the other, and a key for forming a locking connection between a pair of said faces.

848,262. Trolley Wheel; George B. Nussbaum, New Philadelphia, O. App. filed Dec. 6, 1906. The trolley harp is pivotally mounted on the pole, and the trolley cord passes from the pole downward through a projection at the base of the harp whereby the wheel may be kept in normal alignment with the pole.

848,313. Car Replacer; Edward H. Best, St. Thomas, Ontario, Canada. App. filed June 28, 1906. Consists of a body having its top inclined downwardly from its center to its ends, ribs upon said body to engage the treads of car-wheels, a guide-rib upon said body, and a swinging deflector point mounted to engage either of said tread engaging ribs, and to form a continuation of said guide-ribs

PERSONAL MENTION

MR. BERTRAM E. WILSON, of the Rochester Railway Company, has been appointed general passenger agent of the Rochester & Eastern Railway, and Mr. C. F. Crane has been made assistant agent and John E. Joyce claims agent.

MR. O. D. COLLINS, superintendent of the Home Gas & Electric Company, of Redlands, Cal., has resigned that position to become superintendent of the Redlands & Yucaipe Railroad. Mr. Collins has been a director in the company since its organization, and was formerly superintendent of the San Bernardino Traction Company.

MR. WILLIAM H. DUNKERLEY, who for several years has been connected with the accounting department of the Utica & Mohawk Valley Railway Company, has resigned to accept the office of auditor for the Rockford & Interurban Railroad, of Rockford, Ill. Mr. Dunkerley formerly was auditor of the Belt Line Company, of Utica, now merged into the Utica & Mohawk Valley Company.

MR. URIAH FOSS has resigned as superintendent of the lines of the Consolidated Railway Company, at New Britain, Conn. Mr. Foss came to New Britain from Bridgeport under the management of the Connecticut Railway & Lighting Company, where he was foreman of the car house. He formerly was connected with the Syracuse Rapid Transit Company.

MR. THOMAS A. CROSS has been elected general manager of the United Railways & Electric Company, of Baltimore, Md., to succeed Mr. William A. House, who has been elected to the position of president to succeed the late Gen. J. M. Hood. Mr. Cross has been with the United Railways & Electric Company a number of years, and has recently been serving as superintendent of overhead construction of the company.

MR. H. A. HAGADORN, who for some time has been employed as superintendent of overhead construction by the Sche-

nectady Railway Company, has resigned from the company to become connected with the electric division of the New York Central Railroad Company in and about New York City. The place made vacant by Mr. Hagadorn's resignation will be filled by Mr. C. E. Clothier, at present in charge of the emergency work.

MR. A. M. HEWES, secretary and treasurer of the Electrical Installation Company, of Chicago, has been elected general manager of the Indianapolis, Crawfordsville & Western Traction Company, to take effect June 1, when the company's line between Indianapolis and Crawfordsville, Ind., will be ready for operation. In this connection it is announced that the Electrical Installation Company has been selected by the Indianapolis, Crawfordsville & Western Company to operate the line, which will be known as "The Ben-Hur Route."

MR. C. S. YOUNG, who had charge of the survey of the New Orleans & Baton Rouge Electric line, and who since the line was taken over by Stone & Webster has been its chief engineer, has been appointed general superintendent of the Stone & Webster electric properties in Texas with headquarters at Dallas, having charge of construction. Mr. Young, after the completion of the survey of the New Orleans & Baton Rouge line, was retained by Mr. W. Osgood Orton, the promoter of the road, as head of the engineering department. Later, when the line was taken over by Stone & Webster, Mr. Young was retained as chief engineer.

MR. THEODORE P. SHONTS has been made chairman of the executive committees of all the subordinate companies of the Interborough-Metropolitan Company. When Mr. Shonts came to New York from Washington it was understood he was to have control of construction and operation of all the lines, with Mr. August Belmont in charge of financial matters. As the company is only a holding company it was found that Mr. Shonts did not have necessary power to act until given the legal right to issue orders to the officers of the underlying companies. He is now in charge of the four systems, the Interborough Rapid Transit Company, Manhattan "L," Metropolitan Street Railway Company and Union Railway Company in The Bronx.

MR. ALEXANDER McIVER, who, as noted in the Street Railway Journal for April 13, has been appointed to an important position with the New York City Railway Company assumed his duties with the company Monday, April 15. Mr. McIver was graduated from Johns Hopkins University in 1895 as an E. E., and soon thereafter entered the employ of the Sprague Electric Company, with which he was connected in the railway department until 1902. In the latter year he entered the railway engineering department of the General Electric Company, at Schenectady, where he remained until July, 1906, when he became connected with the Chicago & Milwaukee Electric Railway Company as master mechanic.

MR. H. E. HUNTINGTON has returned to Los Angeles and resumed his duties at the office in the Pacific Electric building after an absence of more than four months. In speaking of the expansion of his system Mr. Huntington said that with the exception of the completion of the lines to Glendora, Azusa, Covina, Duarta and Pomona there are no plans. Ultimately there will be electric railway communication to Ontario, Redlands, San Bernardino and Riverside. Four tracking of the Pacific Electric to Watts will be rushed, and the rails extended to Long Beach later, and the same number of tracks pushed to Pasadena. So long as the twenty-one year franchise limit is part of the city's charter extensions inside of Los Angeles will not be hurried. Mr. Huntington expects to remain in Los Angeles all summer.

MR. I. R. NELSON, whose resignation as general foreman of the Public Service Corporation of New Jersey was announced in the issue of March 30, has established the firm of I. R. Nelson & Company, of 54-56 Clinton Street, Newark, N. J. This firm will act as specialists in street railway shop work and the economical maintenance of rolling stock, and is prepared to inspect railway systems with the view of recommending and carrying out, if desired, reforms in their equipment, especially so far as shop and rolling stock are concerned. For this work Mr. Nelson's experience eminently fits him, as he has occupied the position of general foreman of rolling stock of the Public Service Corporation for the last three years. His electrical experience commenced with the Brush Electric Company, of Cleveland, from which he resigned to take charge of the armature department of the Little Consolidated Railway of that city. He then went to Detroit as superintendent of the Rapid Railway with Mr. Du Pont. From there he was called to become manager of the Milwaukee, Racine & Kenosha Railway, with which he remained until the road passed into the hands of the Milwaukee Electric Railway & Light Company. He then went to Indianapolis in charge of the electric work of the Indianapolis Street Railway Company, but later was called to St. Louis by Mr. Du Pont to take charge of the rolling stock and electric repairs on that system. From there he went to the Public Service Corporation.

MR. H. N. LATEY, who has just resigned as electrical engineer of the Interborough Rapid Transit Company of New York, to enter the field of consulting and contracting engineering in partnership with Mr. F. R. Slater, was the guest of honor at a banquet held at the Hotel Manhattan in New York on Friday evening, April 12. About sixty were present, including many of Mr. Latey's former associates in the Interborough Rapid Transit Company, Mr. George S. Rice and Mr. D. L. Turner, of the Rapid Transit Commission. Mr. H. G. Stott, superintendent of motive power of the Interborough Rapid Transit Company, acted as toastmaster and referred to the high respect in which Mr. Latey is held by all who know him, and particularly pointed out his eminent services in the field of New York rapid transit. Messrs. E. P. Bryan, president of the Interborough Rapid Transit Company; Frank Hedley, general manager of the Interborough Rapid Transit Company, and L. B. Stillwell, electrical director of the Interborough Rapid Transit Company, who were unable to be present, sent letters which when read caused a veritable storm of applause. All agreed in their high regard of Mr. Latey's abilities, and in their best wishes for success in his new enterprise. Mr. Rice, chief engineer of the Rapid Transit Commission, stated that although Mr. Latey has resigned from the staff of the Interborough Rapid Transit Company, his connections are not entirely severed from the transportation companies of New York, as he, together with Mr. F. R. Slater, has been appointed consulting engineer of the Rapid Transit Commission. Other speakers were Mr. S. L. F. Deyo, chief engineer of the Metropolitan-Interborough Company; Mr. George Pegram, chief engineer of the Interborough Rapid Transit Company; Mr. D. L. Turner, of the Rapid Transit Commission. When Mr. Latey responded in his modest and sincere way to the many wishes for his success, the applause lasted for several minutes.

MR. WILLIAM A. HOUSE, who has been acting as president of the United Railways & Electric Company, of Baltimore, Md., since the death of Gen. J. M. Wood, and who in addition has also served as general manager of the company, has been formally elected president. Mr. House will now relinquish the duties of general manager, and they will devolve upon Mr. Thomas A. Cross, as noted elsewhere in this issue. Mr. House has been connected with the Baltimore company and its constituents for twenty-eight years, for it was in 1879 that he entered the employ of the old People's Passenger Railway Company as an assistant in the accounting department. He served in this and other departments until 1883, when the People's Company was reorganized with Mr. T. E. Hambleton as president, at which time Mr. House was made secretary and general superintendent of the new company. In 1889 the People's Railway Company was succeeded by the Baltimore Traction Company, and soon thereafter Mr. House was made general manager of the combined properties. In this capacity in the year 1892 the work was carried on by him of electrifying the lines in Baltimore. In recognition of his faithful service there came in 1895 his election to the vice-presidency of the company, in addition to his duties as general manager. The following year Mr. House was elected president of the combined properties to succeed ex-Governor Frank Brown. In 1897 another consolidation of Baltimore properties was effected, the City & Suburban and Baltimore Traction Companies being merged into the new Baltimore Consolidated Railway Company, with Mr. Nelson Perin as president. Mr. House was made vice-president and general manager of this company. Two years later there was effected the consolidation which brought into one company all the traction properties in Baltimore. The company that succeeded to the different independent lines was the United Railways & Electric Company, with which Mr. House became connected as second vice-president and general manager. As previously stated, Mr. House has since the death of Gen. Hood last fall been serving in the dual capacity of president and general manager.

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Changes of advertising copy should reach this office by 10 a. m. Monday preceding the date of publication, except the first issue of the month, for which changes of copy should be received two weeks prior to publication date. New advertisements for any issue will be accepted up to noon of Tuesday for the paper dated the following Saturday.

Of this issue of the Street Railway Journal 8000 *copies are printed. Total circulation for* 1907 *to date* 138,850 *copies, an average of* 8168 *copies per week.*

Railway Construction

The action of a large number of the manufacturers of railway supplies in Chicago, recently, in signing a petition protesting against further railway agitation and legislation is of more than passing significance. The petition sets forth that business has been, and is, prosperous, and that there is apparently no commercial reason for expecting a discontinuance of existing conditions, except the widespread crusade against railroad corporations in legislatures and the governing bodies of cities and towns which seems to have been inaugurated recently. Various instances are cited as to new work, which has been discontinued, and proposed work, which has been abandoned for these reasons. While many of the supply companies are busy on present orders, the number of new contracts is falling off, and everyone must recognize the seriousness of the condition when extensions to our railroad systems are prevented or limited. Unless adequate security and a fair return on their investment are assured, the investment of money by capitalists cannot be expected in the transportation business. The railroad interests are, next to farming, the largest in the country, and, as a whole, the railroads are by far the largest purchasers. When they begin to economize, every other business is seriously affected, and it is time to sound a note of warning.

Electric Railways and Publicity

President Bancroft, of the Boston Elevated Railway Company, puts his finger directly on the secret of securing friendly relations between electric railways and the communities which they serve at the close of an article in the current number of the "Inter-nation" on "Public Service Corporations and the Public." He states that the transportation manager is getting fairer treatment now than he used to get, and that the view of the vast body of citizens is broadening. Not a little of the trouble in the past was due to lack of acquaintance. The modern manager believes in publicity, in taking his patrons into his confidence, in having them come to know him through the public prints, through discussions and debates, lectures and whatever other means may offer itself. The result has been the real awakening of the public and the opening of its eyes to many of the manager's difficulties, which explain some of his apparent shortcomings. Good service is, of course, a factor of the utmost importance, as well as publicity.

General Bancroft points out that the friendship of its community is the most valuable asset a company can have. The company can win it only by deserving it—and letting the community know that it does deserve it. There was a time when it was almost impossible for the newspapers to get from corporations even the kind of news that it would be of incalculable value to the corporations themselves to have circulated. This was largely due to lack of comprehension on the part of busy men who could not see how their work was of interest to others. It was an extremely short-sighted policy.

The wise and progressive manager puts at the disposal of the newspapers, the great public instructors, large facilities for learning and telling everything in which their readers may on any account be properly interested. Thus the public

service corporation draws into closer intimacy with the people whose problems it must solve, and, who, in turn, create its problems.

How well these principles have been put in practice in Boston is best understood by those who have come in close touch with the operation of the company which General Bancroft heads. The work of the Boston Elevated publicity department is constantly broadening in scope. The location of this company's tracks in a large number of separate municipalities and the operation of its nine generating plants, movement of cars on the surface, underground, overhead, and beneath the waters of Boston Harbor, and the extensive organization of employees, large amount of maintenance and construction work, all contribute to furnish many items of wide interest to the public. Lectures, illustrated by lantern slides, are given almost weekly by one official or another in different sections of Greater Boston. The courtesy and forbearance of executive officers at hearings in the face of a none too considerate and often impertinent public is another factor which tends to reduce friction between the community and the company. And, finally, every official in the Boston organization is readily accessible to the public upon every legitimate demand.

Express Car Speed

To an electric railway taking up a light freight and parcel business for the first time, the proper schedule speed of express cars is a matter which must be settled at an early stage. If the local conditions are clear enough to point the way to an immediate decision the company is fortunate. The type of express car to be used, the total loaded weight to be expected, the alignment and grades of the track, feeder capacity, districts traversed and the hours during which trolley freight is to be handled, all bear upon the speed question.

In general the value of electric express service to the consumer lies in its greater speed of delivery than any other competing agency. The frequency of passenger service, even on trolley roads traversing remote country districts, is so short that almost the only argument in favor of slow daytime express schedules are those of power economy, reduced first cost of motive power and rolling stock, and decreased wear and tear on cars and track. If there is no competition of importance, the express traffic need not, as a rule, be keyed to the schedule of the fast passenger service unless the dispatching requirements and turnout locations so dictate. In most cases it is safe to consider that the express service will be in a measure competitive, and the requisite of a large and growing business under such conditions is a high degree of celerity in the car movements. For daylight express service, then, the four-motor equipment geared close to the maximum speed of the regular passenger cars and capable of negotiating the heaviest grades and "bucking" snow in cold climates, of accelerating to make up time lost at loading and delivery points, and of holding to a schedule equal to the following cars is a most desirable specification to follow. Interference with passenger traffic very quickly wipes out the profits of trolley express operations.

Express traffic handled at night or in the early morning when the passenger business is at its lowest ebb, is not restricted by speed requirements to anything like the degree found in day service. Except on very long runs, economy is better served by moderate speeds. The loading of milk, vegetables and other products between country and city does not demand the speeds of passenger service if the lines are free for slower movements. Parcel deliveries and perishable goods handled in the daytime call for faster transit. No electric railway can go far in the handling of light freight and express matter without being obliged to classify the merchandise offered for transportation. The tendency of many classes of freight to be run at speeds close to passenger service is a marked point in steam railroad practice, and certainly as far as electric express car movements in the precious hours of daylight are concerned, there is little doubt of the wisdom of providing power for high-speed operation on a par with the regular passenger travel.

Gasoline Motor Cars

Mr. McKeen's paper on this topic before the New York Railroad Club is disappointing in its lack of operation results, yet it gives several very interesting hints as to some of the methods which have been followed on the U. P. in construction and design. Mr. McKeen is no believer in the steam dummy in any degree of refinement whatever, but pins his faith to the gasoline car on account of its comparative simplicity. In car design he stands for new ideas, breaking away from the traditional types and adopting the specialized construction particularly fitted for fast, independent motor cars. The most striking feature of Mr. McKeen's design of car is its shape. To avoid serious trouble with air pressure single cars must be relatively smooth in surface, sharp in the front and rounded in stern and the U. P. design, from the sills up, represents practically the form determined by the St. Louis tests as offering the least resistance in this way. The only criticism which we can suggest is that it seems somewhat short for the best results, and that a reduction in air resistance would be secured by carrying the sides down, to enclose the trucks. Whether the saving made by the form adopted at the schedule speeds at which this car runs is sufficient to warrant the expense is another question which we would have been glad to have seen more fully discussed in the paper, but the author-builder is to be congratulated upon combining in concrete form the salient features of high-speed car design. Steel is certainly the best material for such a car, and Mr. McKeen believes that in using steel it should be so utilized as to give the maximum of strength instead of serving for a mere copy of the wooden cars which are to be replaced. The result is a strong and safe car that cannot be telescoped or burned and should have very low depreciation in service. It is distinctly a well-planned new car for a new use and not a mere adaptation.

The point of particular interest to most readers will be the design of the engine. The striking feature of the U. P. design is that complete speed variation is obtained simply by varying the speed of the engine. The big steel car can be started and accelerated to a speed of a mile a minute merely by varying the spark and the throttle, and this is done smoothly and efficiently. The engine is fitted with a

friction clutch, operated by compressed air, but is absolutely free from the complicated transmission gears that are the nightmare of the automobilist. The success of throttling in the U. P. cars, in the opinion of Mr. McKeen, is due to a combination of carefully balanced features. In the first place the 200-hp engine is a six-cylinder machine, of which the reciprocating parts are very thoroughly balanced. Next, the gasoline vapor pipes from the carburetor to the cylinders are adjusted so that there is equally free access to each cylinder over an exactly equal distance so that one cylinder never steals charge from another. Finally the valve motion and the timing devices have been worked out especially with reference to the production of uniform output at various speeds. Apparently the results have been successfully attained. It would be most interesting to know whether this method of control requires materially larger weights than control by variable gears. We should be inclined to think that the engine itself would have to be increased in weight to get the required output at low speeds, yet, since the weight of the transmission gears and their casing is saved, the net result may be favorable. The practice described by Mr. McKeen might be difficult to follow in automobile construction, yet one cannot help thinking that judicious design, especially in six-cylinder engines, might very greatly simplify the transmission mechanism, even if it could not absolutely abolish it. Certainly, at the present time, complication has been pushed to the limit, and it is about time to take back-tracks.

The discussion and paper indicate a serious attempt on the part of engineers and builders to solve this question of internal combustion motor cars and to apply the lessons acquired in automobile service to the more serious work of transportation on rails. There has certainly been great advance in this field during the last two or three years, and the future holds promise of important developments.

The Slip of Wheels

Considering the magnitude of street railway interests, it is somewhat astonishing that more data have not been secured on the exact relations between track and wheels. We noted recently some facts relating to rail corrugation which bore directly upon the question of incipient skidding during braking. It does not follow that all rail corrugation is due to this particular cause; indeed some of it probably is not. Yet it ought not to be a difficult matter to get a record of the variation of rotation during braking that would throw considerable light on the factors that tend to produce corrugation. Of course, once a low spot is started from any cause the wheels tend to keep it going from bad to worse. Corrugation sometimes takes place on straight track where there is no braking to give it a start. Does not a sudden change in acceleration, due to a shift of the controller, tend to produce incipient slipping that is equally mischievous with braking? If so, how great is it and what, if any, is the proper remedy? In many electric railway experiments there appear some indications that in heavy work there is a biting action of the drivers quite different from the rolling friction of the free wheels. To what extent does this actually exist in ordinary operation, and how far is it an element in the wear of track? In bad weather the track and wheels may be covered with a sort of gritty slime, and it is a common experience to see the wheels spinning in this at a rate that suggests starting a low spot in short order.

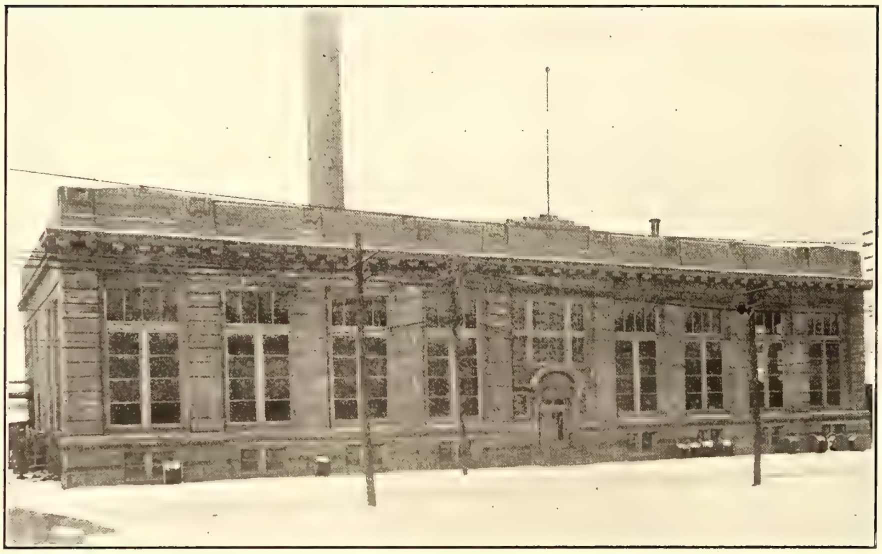
It is quite certain from ordinary railway practice that wear of track increases not so much with the tonnage as with the number of driving wheels employed on it, which suggests that, as on street railway track, there is a grinding action that is rather serious in its results. The exact nature of this action deserves more study than it has ever received, for, while it may be quite unavoidable, there is a chance that it may be in part due to preventable causes. It certainly has an immediate bearing on the character of the rail best adapted to resist its effects. The exact determination of the relation between the track covered and the distance swept out by a point on the wheels is not altogether an easy matter, for slipping during acceleration and skidding during braking would act against each other. It is a good thing for those equipped with testing cars to follow up to a conclusion, as it is under test conditions rather than in every-day service runs, that the facts would most readily come to the surface.

An analogous question is involved in the working of multiple-unit control. Elevated roads in general show very heavy wear of the rails, either from the way in which the power is applied or from some other cause. Will there be the minimum wear from slipping when there are few driving wheels or when the driving is divided among many wheels having relatively smaller tangential stresses but less certainty of dividing the total stresses uniformly? Does anybody know in fact how exactly the work of driving is in practice distributed among twelve to twenty motors? They can be made on the average to divide the total current pretty well, which fact does not exclude the possibility of rather large instantaneous variations. The practical bearing of all this on the matter of track renewals is of rather serious import.

Data on wear of rails on electric lines with respect to speed and tonnage are much scarcer than they should be, especially on lines which, from being on their own right of way, are comparable with ordinary railways. Yet some of the facts indicate, as is well known, an amount of wear that is exceptionally great and which forms a very grave item of expense. To what physical things is this wear proportional? Is it determined by tonnage, by tonnage and a function of the average speed, or by the total expenditure of energy on the trains? And if by the last named, what distribution of energy will give the required service with the minimum wear and tear? Just as the total energy spent on a train tends to degenerate ultimately into heat, so a certain part of it appears in one kind or another of physical disintegration, and it is of no small importance to determine how great this part is and why and where it appears. The chance of finding out is greater on a modern electric line than anywhere else, since the input can be ascertained and the effects are to a certain extent localized. It is as yet one of the unsolved dynamical problems of transportation which should no longer be neglected. Investigation stands a good chance of paying for itself many times over, and it should not be delayed.

NEW POWER PLANT OF THE CENTRAL PENNSYLVANIA TRACTION COMPANY AT HARRISBURG, PA.

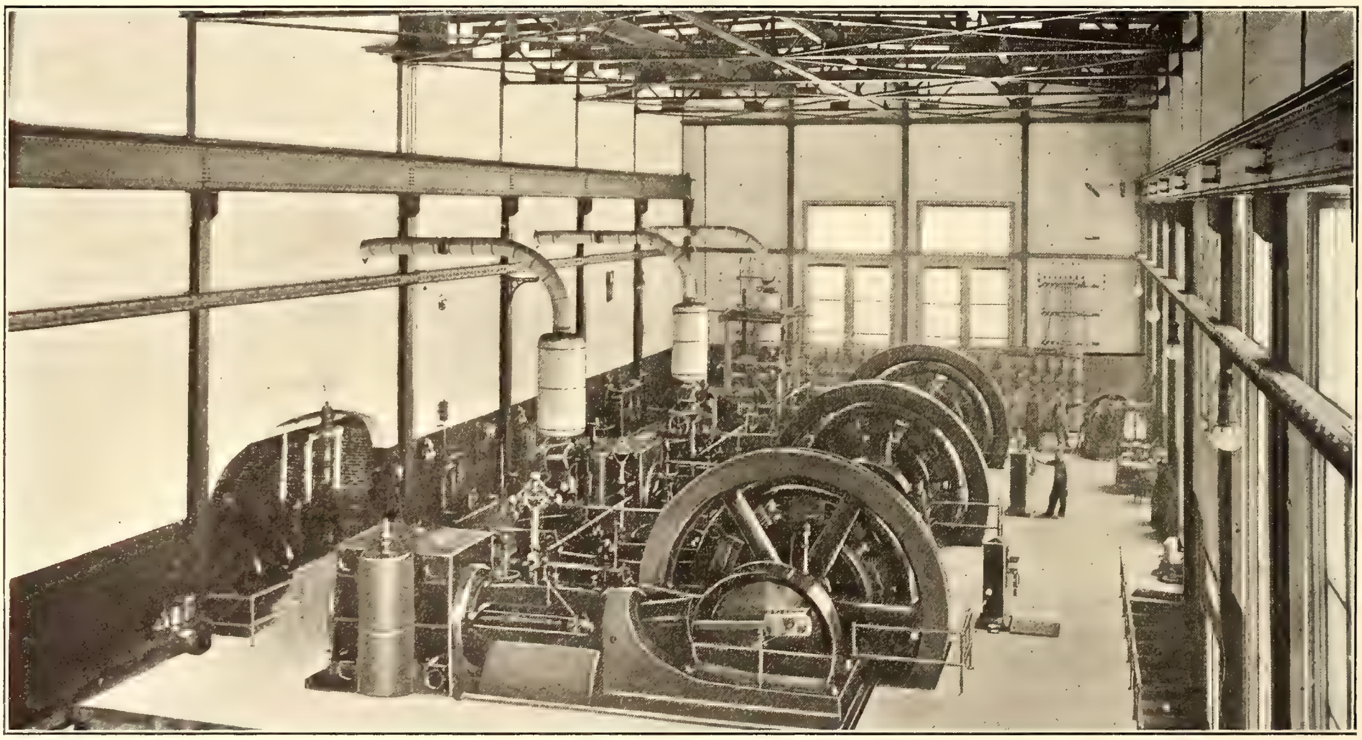
Short articles have appeared in this paper in the issues of Oct. 7, 1905; Jan. 6, 1906, and April 28, 1906, in regard to the construction of a new power station by the Central Pennsylvania Traction Company at Harrisburg, Pa. This station is now completed and possesses a number of novel features. The Central Pennsylvania Traction Company operates about 64 miles of electric railway in Harrisburg, Steelton, Highspire, Middletown, Pembrook, Progress, Linglestown, Oberlin, Paxtang and Hummelstown. Its new power house is located immediately adjacent to the old No. 1 station on South Cameron Street, Harrisburg, and about 1¼ miles from the electrical center of the system, figured on power consumption. Other sites were considered, two of which would have been more desirable on account of being nearer the load center of the system and also nearer the Susquehanna River. For various reasons neither of these could be obtained, and it was finally decided to locate the plant where it now stands, using the funds which would have been required to purchase a new site for building a water-supply line to the Susquehanna River, which is about 1100 ft. distant in a direct line.



EXTERIOR OF CENTRAL PENNSYLVANIA TRACTION COMPANY'S POWER STATION, HARRISBURG, PA.

The building is a composite structure having a steel skeleton with concrete walls, the columns being designed simply to carry the crane and roof loads and only sufficient lateral bracing in the shape of diagonal rods was used to maintain the framework in position while filling in the walls. The walls are of mass concrete, generally 12 ins. thick, and were carried up by filling in plain forms about 3 ft. deep, the forms being secured to and held in alignment by the columns. The building is divided longitudinally into two rooms of nearly equal size, the front portico being occupied by the main engines and switchboard and the rear by the boiler equipment. The foundations for the building consist of continuous concrete walls, 5 ft. to 8 ft. deep, with extended base, 6 ft. to 8 ft. wide at bottom.

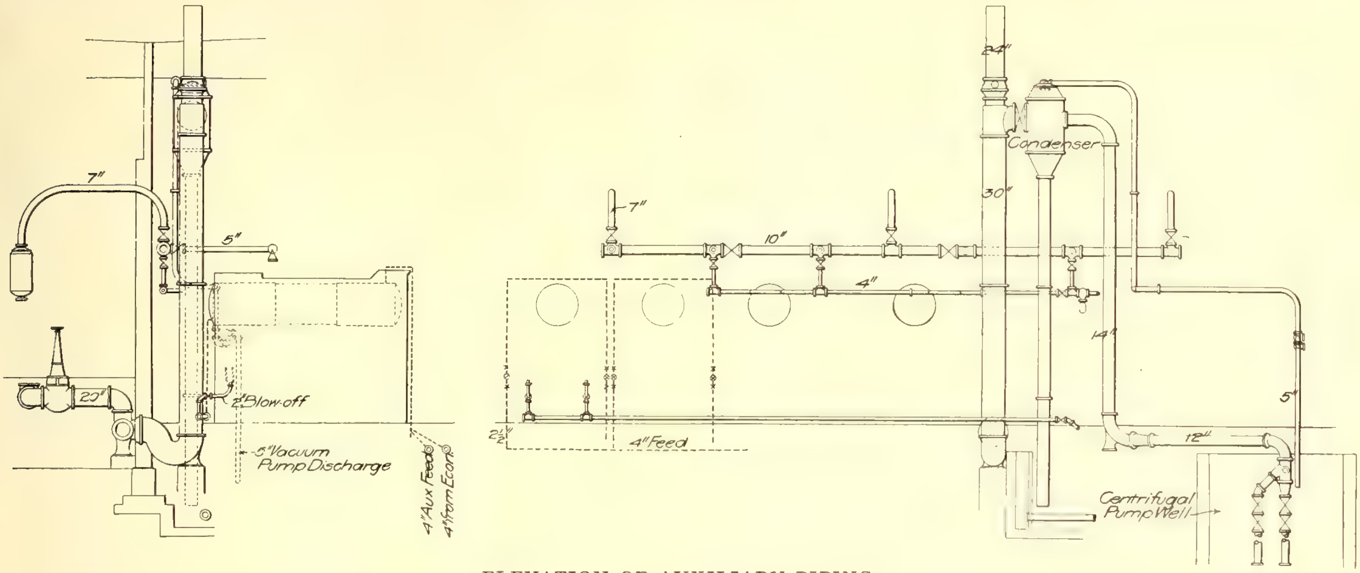
The roofing consists of 8-in. steel channels placed about 6 ins. between centers and resting on steel trusses, the whole being covered with 3-in. slab cinder concrete reinforced with ⅜-in. round rods, and this, in turn, covered with four-ply tar paper and slag roofing. The façade of the building was designed by C. H. Lloyd, a local architect, whose design was submitted in competition with two others. The front wall of the building is of mass con-



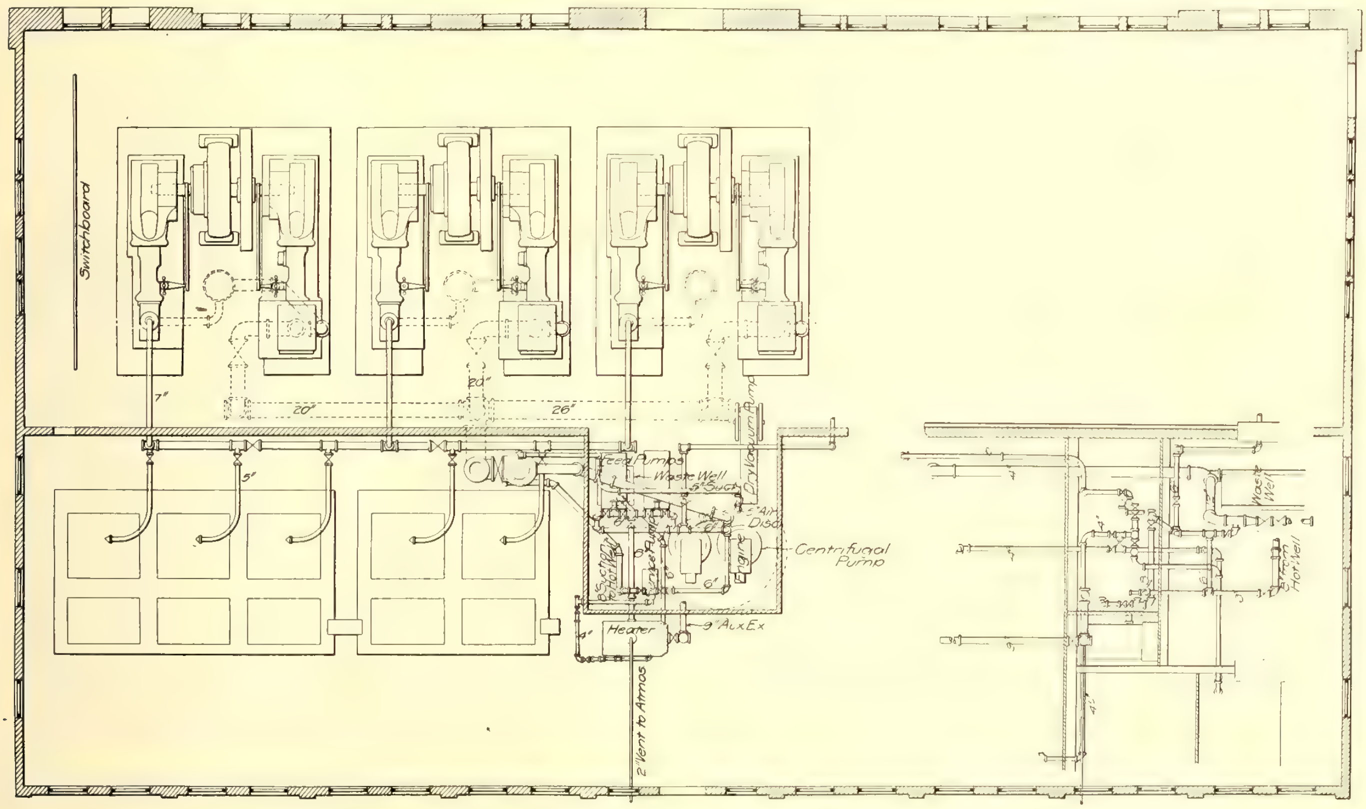
INTERIOR OF ENGINE ROOM, SHOWING STEAM PIPING CONNECTIONS TO BOILER ROOM

crete, as is the rest of the building, with the exception that the face of the wall was made of cement and sand mortar, mixed fairly dry, which was placed in forms and back-filled with rough concrete. This gives the building a smooth and even finish, as though made of dressed stone, although no effort was made to disguise the fact that the building is of concrete construction. The windows in the front of the building and opening into the engine room are very large, measuring 10 ft. wide by 23 ft. high. There are two swinging sashes on vertical pivots and one large transom, all being filled with plate glass. The windows extend neary to the floor line, thus giving abundant light and enabling people in passing cars to get a good view of the dynamo room.

The main floor of the engine room is about 8 ft. above the level of the street, while the floor of the boiler room is 5 ft. lower than that of the engine room. The building is approximately 175 ft. x 103 ft., and only a trifle more than half the floor area is occupied by the present equipment. The rapid increase in the power requirements of the traction company in the past few years indicated the advisability of providing ample space for future growth.



ELEVATION OF AUXILIARY PIPING

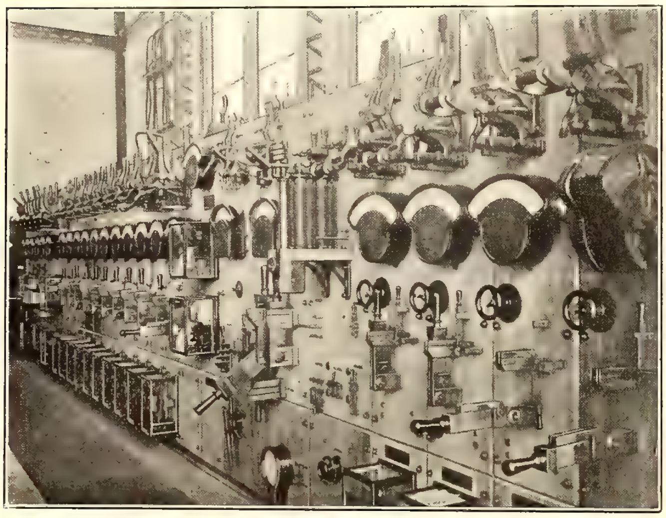


PLAN OF MAIN AND AUXILIARY PIPING

The central bay of the boiler room is used as a pump room. In this are placed boiler feed-water pumps, circulating water and air pumps, feed-water heaters, condenser, etc. The floor above, or roof, of the pump room is built on steel beams and carries the economizer and main smoke flue, the flue occupying the center of the floor space and the present economizer installation space being adjacent to the boilers. The main flue passes out on the

level of this elevated floor directly to the chimney located 23 ft. to the rear of the building. A rectangular coal bin, having a capacity of 600 tons, extends the full length of the space occupied by the boilers. This bin is constructed of plate girder sides and I-beam floor, lined throughout with concrete. A coal gate is placed directly in front of each boiler and the coal is delivered to the boiler room floor by a traveling weighing hopper.

Clearfield coal is delivered to the building over a siding



THE SWITCHBOARD

from the Pennsylvania Railroad running between the rear wall of the building and the chimney. Near the center of the building and under the track is a hopper which receives the coal as it is dumped from the cars. The coal passes to a crusher and thence to the boot of a vertical chain and bucket elevator. This latter delivers the coal to a screw conveyor in the roof of the building from which it is distributed to the coal bin previously mentioned.

Ashes drop from the hand-fired shaking grates to pits from which they are removed in a steel dump car and delivered to the elevator boot mentioned. The ashes are then elevated to a bin located in the roof of the building adjacent to the elevator, the bin having a capacity of about one carload. The proximity of the elevator and the bin obviates the necessity of handling the ashes by the screw conveyor, and the ashes are removed to the outside of the building by means of a gate and chute. By means of this arrangement, the car on the track outside may be emptied of its coal and filled with ashes without being moved from its position. The coal and ash handling machinery has a capacity of twenty tons per hour, and was furnished by the Jeffrey Manufacturing Company, of Columbus, Ohio.

The chimney was constructed by the Weber Steel Concrete Chimney Company, of Chicago. It has an internal diameter of 10 ft. and is 190 ft. high above the boiler room floor and 215 ft. above the foundation. The chimney stands on a circular base 25 ft. in diameter and about 3 ft. thick, and for 75 ft. of its height above the boiler room level has two shells, an inner shell of 4 ins., a 4-in. air space and an outer shell of 7 ins. The upper 115 ft. has a single ring 5 ins. thick, and the chimney is reinforced throughout with 1¼ in. x 1¼ in. tees, vertically, and ¾-in. round rods, horizontally. The main flue opening is 7½ ft. by 12½ ft., the bottom of the opening being 18 ft. above ground. The chimney is designed to withstand a wind pressure of 50 lbs. per square foot, which is equivalent to a 100-mile gale.

The present boiler equipment consists of five 327-hp water-tube boilers built by the E. Keeler Company, of Williamsport, Pa. Each boiler is equipped with 164 4-in. wrought-iron tubes of No. 9 gage and with a single drum 54 ins. in diameter. Foster superheaters, built by the Power Specialty Company, of New York City, superheat the steam to 100 deg. Regan shaking-grates are used, and the steam pressure carried is 175 lbs.

As previously stated, it is the intention to secure all water for boiler and condenser purposes from the Susquehanna River. This is to be accomplished by boring a tunnel about 5 ft. high and 6 ft. wide through the solid limestone rock, 40 ft. below the surface of the ground. The tunnel starts from a shaft 15 ft. in diameter directly under the pump room and passes out under the center of the chimney. Most of the tunnel is under the yard of the Central Iron & Steel Company, which is interested with the traction company in the execution of the work, as it intends to utilize the same source of water supply later on. From the river bank where the terminal shaft is placed there extends out into the river about 700 ft. a 36-in. wood stave pipe placed in a trench cut in the rock bottom of the river. The construction of this tunnel and intake is now well under way, and the capacity of it will be about 15,000,000 to 20,000,000 gallons daily.

The steam piping for the plant was installed by the Best Manufacturing Company, of Pittsburg, and is designed throughout for a pressure of 200 lbs. All flanges are of wrought steel, and Van Stone joints and Merwith gaskets are employed. A 10-in. main receives the steam from the five boilers, and from this lead 7-in. goose necks connecting with each main engine immediately above the high-pressure cylinder. Above the throttle of each engine is located a Cochrane receiver and separator, which also acts as a reservoir of steam. A 4-in. main runs a few feet below the main header, from which connections are taken

THE BOILER ROOM

for the auxiliary pumps. This main also acts as a drain for the main header. The exhaust steam from the three main engines is passed through an Alberger condenser, while that from the auxiliaries is passed through a Cochrane open heater. Feed-water is ordinarily taken from the hot-well to the open heater, from which the boiler feed-water pumps deliver it to the economizer, thence to the boilers, where it arrives normally at a temperature of approximately 300 degs. The economizer was built by the Green Fuel Economizer Company.

The condenser is a 30-in. jet type barometric, built by the Alberger Condenser Company. The water is delivered to the condenser by means of vertical shaft centrifugal pumps in duplicate, each of which has a capacity of 1000 gallons of water per minute. This type of pump was adopted for the plant on account of the fluctuation in the height of the water supply which is intended ultimately to come from the Susquehanna River. The pump floor is located 33 ft. above extreme low water. As the river has a maximum rise of 27 ft. and it was desired to have all of the moving machinery of the plant under the direct control of the plant engineer, besides making it easy of access, the layout was arranged accordingly. The centrifugal pumps and the horizontal rotating engines driving the same were furnished by the Morris Machine Works, Baldwinsville, N. Y. The boiler feed-water pumps are of Worthington make.

The main engines were furnished by the Allis-Chalmers Company, each of the three engines being identical in construction. The engines are of the horizontal, cross-compound, rolling mill type, with cylinders 22 ins. and 48 ins. by 42 ins. Each is provided with double eccentrics and butterfly automatic stop valves. The engines have a guaranteed rating on 165 lbs. steam pressure with 75 deg. superheat of 984 ihp, with a steam consumption of not over 12.4 lbs, the speed being 100 r. p. m. and the vacuum reading 26 ins. Without superheated steam, the steam consumption is guaranteed at 13¼ lbs. per horse-power per hour. Each engine weighs approximately 220,000 lbs. and has a clearance of 5 per cent on both the high and low-pressure sides. The mechanical efficiency is guaranteed to be 94 per cent. Garlock metallic packing is used on the piston rods and Richardson sight-feed mechanical oiling sets are fitted on the cylinders. The balance of the oiling is done on a gravity system. The main shaft of the engine carries a 50,000-lb. fly-wheel and the armature of the generator.

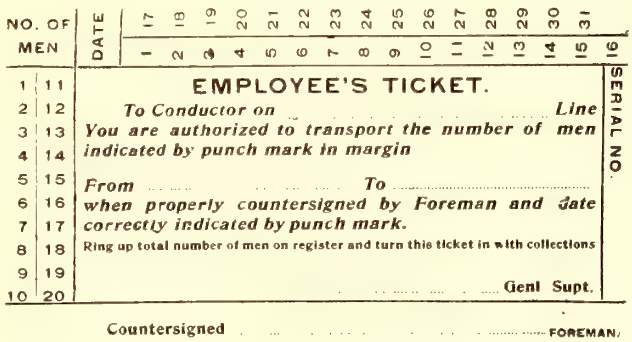
The generators are of the Bullock railway type having a rating of 600 volts and 1084 amps., and being guaranteed to run twenty-four hours under full load without sparking and without heating the windings more than 35 degs. and the armature more than 40 degs. above the temperature of the surrounding atmosphere. They are also guaranteed to carry an overload of 50 per cent following a 24-hour run for one hour, without heating the windings more than 55 degs. C., and to carry a momentary overload of 100 per cent. The guaranteed efficiency of the generators at three-quarter load is 93.8 per cent and at full load, 94.2 per cent. Each generator has ten poles and weighs 115,000 lbs. The armature weighs approximately 38,500 lbs., and the dimensions of the commutator are 80 ins. by 12¼ ins.

The switchboard was built by the Westinghouse Electric & Manufacturing Company. It is made up of twenty-six panels apportioned as follows: four generator panels, one being blank; three storage battery panels; one total load panel; eleven unboosted feeder panels; four boosted feeder panels; two booster panels, and one blank panel. No boosters have as yet been installed. Each generator panel is equipped with a circuit breaker, indicating ammeter, quick-break switch and Thomson watt-hour meter, together with voltmeter plugs and receptacles for the voltmeters on the swinging brackets at the end of the board, besides the usual field rheostat, the resistance for which is placed below the floor. The three storage battery panels were furnished by the Electric Storage Battery Company, of Philadelphia. The panels are provided with the usual controlling devices, including a carbon regulator. The storage battery is installed in a building immediately adjoining the power house and is made up of 288 cells. The total load panel is equipped with an indicating ammeter, a recording ammeter and a recording voltmeter. Each of the feeder panels is equipped with a single-pole, quick-break switch, a circuit breaker, an indicating ammeter and a watt-hour meter. This makes a very elaborate feeder panel, as it is not the usual practice for railway companies to place a watt-hour meter on each feeder.

The total cost of the station, exclusive of the intake tunnel, is about $230,000. Excavations for foundations were begun early in January last year, and power was furnished on the line late in May. The station took the entire load and three old stations were abandoned in October. Owing to the large increase in the number of cars operated and alterations in schedules, the station is furnishing an average of 60 per cent more power than was required to operate the system a year ago. The entire plant was designed and constructed under the direct supervision of Mason D. Pratt, of Harrisburg, to whom this paper is indebted for many courtesies extended in the preparation of this article. Associated with Mr. Pratt were C. O. Mailloux and W. C. Gotshall, of New York City, acting as advisory engineers.

EMPLOYEES' TICKETS AT OKLAHOMA CITY

To avoid the inconvenience of passing out individual pass tickets to each workman of construction and track crews, the Oklahoma City Railway issues to the foremen of the gangs tickets good for as many men as is indicated by


NO. OF MEN | DATE | 17 18 19 20 21 22 23 24 25 26 27 28 29 30 31 | 1 2 3 4 5 6 7 8 9 10 11 12 13 14 15 16

1 2 3 4 5 6 7 8 9 10 | 11 12 13 14 15 16 17 18 19 20

EMPLOYEE'S TICKET.

To Conductor on .... Line
You are authorized to transport the number of men indicated by punch mark in margin

From .... To ....
when properly countersigned by Foreman and date correctly indicated by punch mark.
Ring up total number of men on register and turn this ticket in with collections

.... Genl Supt.

SERIAL NO.

Countersigned .... FOREMAN.

OKLAHOMA CITY RAILWAY'S EMPLOYEE'S TICKET

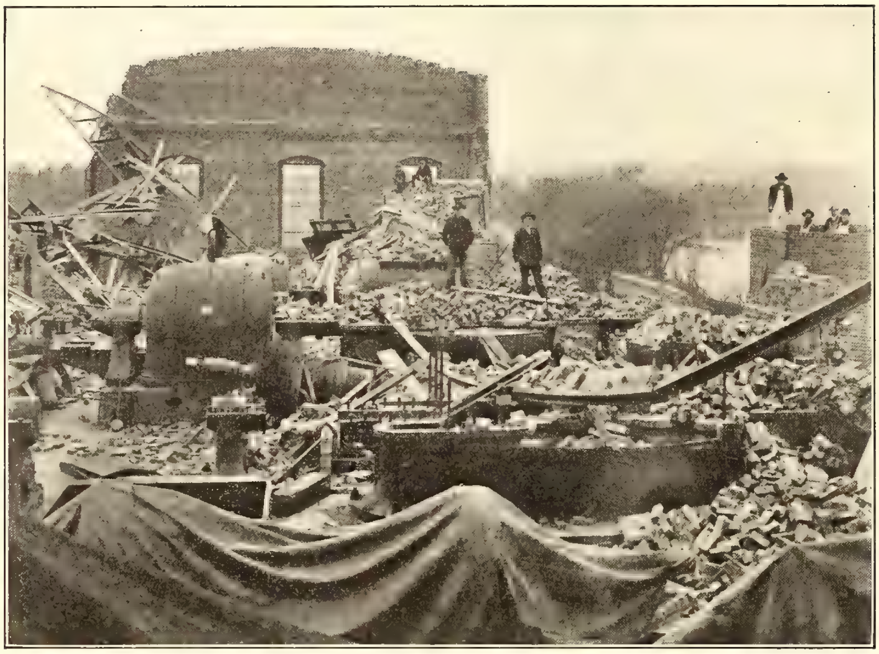
the number punched. The tickets are issued to the foreman by the general superintendent and are good for one passage only. They are taken up by the conductor, who rings up the total number of men for which they are punched and turns the tickets in with his collections.

POWER STATION EQUIPMENT FOR EAST LIVERPOOL

The Ohio Valley Finance Company, which is building an electric railroad from East Liverpool to Stubenville, Ohio, and whose system was described in the Street Railway Journal for Sept. 1, 1906, has concluded a contract with the Westinghouse Companies for the power house equipment that will operate the road. This will include three 1000-hp Westinghouse-Parsons steam turbines, three electric turbo-generators of a corresponding capacity, as well as rotary converters and requisite switchboard apparatus.

NEW OHIO POWER STATION DESTROYED BY WIND STORM

The new Lindenwald power station of the Cincinnati Northern Traction Company at Lindenwald, a suburb of Hamilton, Ohio, was partially destroyed on Sunday afternoon, April 7, by a terrific wind storm. The station was rapidly nearing completion, and was designed for an ultimate capacity of five 1500-kw Westinghouse turbo-alternators and one 750-kw turbo-alternator of the same make. These were placed on the second floor of the building, the first floor being occupied by the boilers.



THE TURBINES BURIED UNDER THE DEBRIS

The outer walls of the building are built of brick, and the floor of the turbine room is of reinforced concrete, resting on 24-in I-beams supported by iron columns. The concrete roof was in process of construction and a roof form of light pine was built over the entire station. A small portion of the roof at the north end had already been completed at the time of the accident, and, as will be noted in one of the engravings, withstood the storm. During the height of the storm the wind lifted the entire roof form from the building and carried it across the coal storage bins, a distance of about 100 ft. to the east. With the roof form went the roof trusses, and, in dropping to the ground, the former was reduced to kindling wood and the latter were twisted out of shape. Simultaneously with the carrying away of the roof the east and west walls of the building above the turbine floor, being left unbraced, fell, and the five turbines which were in process of erection, as well as much of the smaller machinery, were buried beneath a mass of brick.

Two of the turbines had their cases in place and were practically uninjured, but the other three, which were more or less exposed, were badly damaged, one being a complete wreck. The case of the latter was broken in two and the blades of the runner so bent and broken as to be of no use. The spindles of the other two turbines had much of the blading broken and bent, and many of the stationary vanes in the cases were destroyed. The Lafayette Engineering Company, of Lafayette, Ind., was the building contractor, and, with the Westinghouse Machine Company, is a heavy loser. The loss to the building and machinery is estimated at $40,000, and is not covered by insurance. The general view of the station from the northwest shows the coal-handling crane and the lifting crane, both of which were uninjured. It will also be noted that only the upper story suffered. A view of this floor is also given. The turbines that were left uninjured are shown, and in the foreground may be seen the damaged rotor of one of the other turbines. The position of the twisted roof trusses is also shown. The station is very compact, and in its arrangement is a departure from general practice.

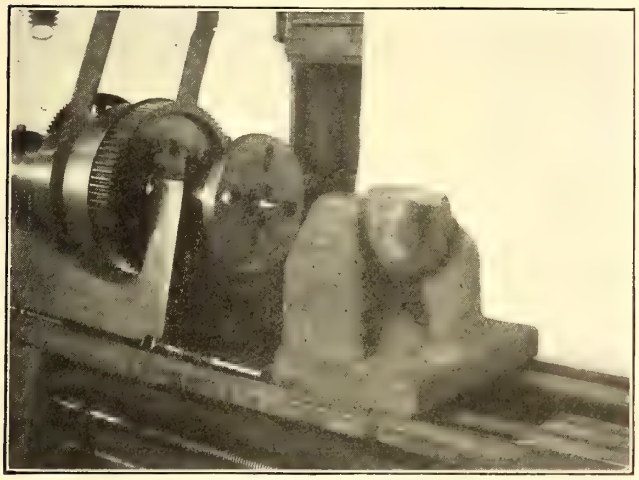
THE STATION, SHOWING THE DAMAGE TO THE ROOF AND THE ROOF TRUSSES, WHICH ARE ON THE GROUND

President W. Kesley Schoepf, of the Cincinnati Traction Company, has presented the citizens' committee that was appointed to discuss transfer matters with him a mass of information for guidance in making requests. This information shows that the company has made it possible now to transfer in about 5000 different ways. Mr. Schoepf explained to the committee that, owing to the topography of the country, lines starting from the center of the business section often cross each other on the outskirts or at other points, and that the issue of transfers is rather a delicate matter, if passengers are to be debarred from making round trips on one fare.

A NOVEL ARMATURE SHAFT STRAIGHTENER

BY R. P. LEAVITT,
General Mechanical and Electrical Superintendent of the Albany & Hudson Railroad Company

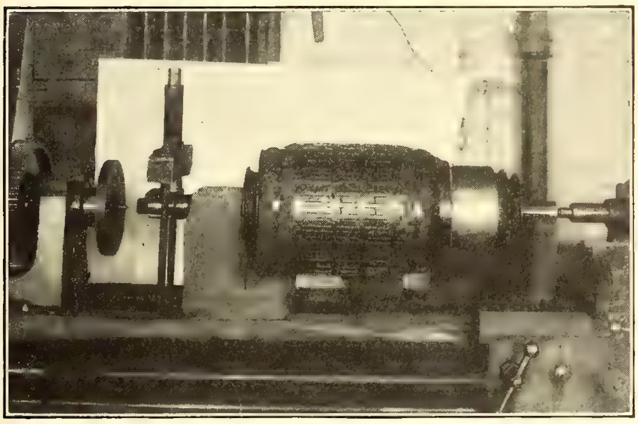
The writer has been very much interested in reading the various articles which have appeared in electrical periodicals regarding the different methods of straightening armature shafts of railway motors. He has been particularly on the lookout for ideas which could be applied to remedy this trouble in cases when the shaft is bent inside and close to the concave thrust collar. As he failed to find any reference to straightening an armature shaft at this



THE CAST-IRON FULCRUM

point, it may be of interest to present a brief description of a fulcrum which the writer devised for use on a G. E. No. 51 railway motor armature shaft of 3¼ ins. diameter.

Since a large percentage of our bent shafts are sprung close up to the thrust, it requires a fulcrum which will project into the concave collar and be of sufficient strength to take the serious strain necessarily exerted in straightening a shaft of this size. The casting shown in the illus-

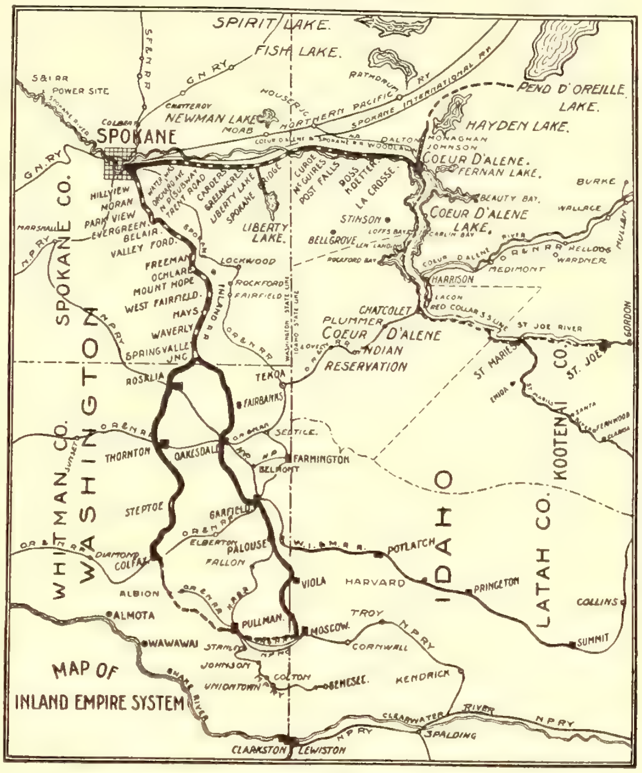


THE ARMATURE IN PLACE

tration, which follows the inside outline of the thrust collar but supports the shaft only at the extreme end of the projecting nose, reduced the expense of performing this work to a minimum. The armature is supported on the lathe bed at the commutator end by a wooden bearing and clamp, while the screw for giving the desired pressure at the pinion end is worked against rods fastened in a suitable timber across the under side of the lathe bed. As the lathe centers are not employed at all, the usual damage to these and the possible damage to a light lathe bed are eliminated.

NOTES ON THE INLAND EMPIRE SYSTEM OPERATING FROM SPOKANE, WASHINGTON

The Spokane & Inland Empire Railroad Company, or the Inland Empire System, as it is called locally, is the outgrowth of the combination of the Spokane Traction Company, which began operations in November, 1903, and the Cœur d'Alene & Spokane Railway, which began operating



THE INLAND EMPIRE RAILWAY SYSTEM AND CONNECTIONS

SPOKANE ELECTRIC TERMINAL USED BY THE LINES OF THE INLAND EMPIRE SYSTEM

in December of the same year. The former now has 26 miles of city lines and the latter has 44 miles, including its extensions to Hayden and Liberty Lakes. The main line, which is 34 miles, extends from Spokane, Wash., to Cœur d'Alene, Idaho. Hourly trains are run in either direction, and during the month of March the average patronage ranged from 1200 to 1500 daily. During the summer months, when traffic to the lakes is much heavier, the daily average is about 2000.

The Spokane & Inland Railway, also a subsidiary com-

pany of the Spokane & Inland Empire Railroad Company, was incorporated Dec. 14, 1904, and began operating to Waverly, a distance of 34 miles, September last. At present it is operating 46 miles of road to Rosalia, Whitman County.

A PORTION OF THE FREIGHT YARDS OF THE INLAND EMPIRE SYSTEM AT SPOKANE. THESE YARDS ARE 300 FT. WIDE AND 2000 FT. LONG

The eastern division of the line is now practically completed to Oakesdale, a point 13 miles south of Spring Valley Junction, and train service will be installed very soon. The track is also laid into Palouse on the eastern division, a distance of 76 miles from Spokane, and track laying is now being completed on the western division of Colfax, which is an equal distance from Spokane. An 800-ft tunnel has been bored north of Colfax, and in order to enter Palouse at the desired grade a solid rock cut of 650 ft. x 50 ft. was made at a cost of $65,000, and an 800 ft. x 30-ft. concrete retaining wall built for about $35,000. When both divisions of the Spokane & Inland are completed to Colfax and Palouse the road will have 112 miles in operation and the Inland Empire System 180 miles. An extension of 16 miles from Palouse to Moscow, Idaho, is now being graded.

Pending the completion of the power plant, described on page 419 of the Street Railway Journal of March 9, the Inland Empire System has a contract with the Washington Water Power Company for power at $20 per horse-power per annum. The Spokane Traction Company lines and the Cœur d'Alene & Spokane division are operated on a direct current of 550 volts. An installation of four storage batteries and three booster stations serves to keep down the peak loads. At the Spokane & Inland division's frequency-changing station four 1000-kw motor-generator sets are used, the current being received at 4000 volts, 60 cycles, and converted to 2200 volts, 25 cycles. The machines operate or float on a 275-cell, 33 type-R storage battery which reduces the peak load and serves to hold the in-put from the Washington Water Power Company at a constant load. Two 375-kw oil-insulated transformers raise the voltage to 45,000, at

SPOKANE FREIGHT TERMINAL, 40 FT. WIDE BY 300 FT. LONG

SPOKANE & INLAND PASSENGER TRAIN OF TWO MOTOR CARS AND ONE TRAIL CAR. THE PANTAGRAPH CURRENT COLLECTORS ARE USED ON THE INTERURBAN DIVISIONS

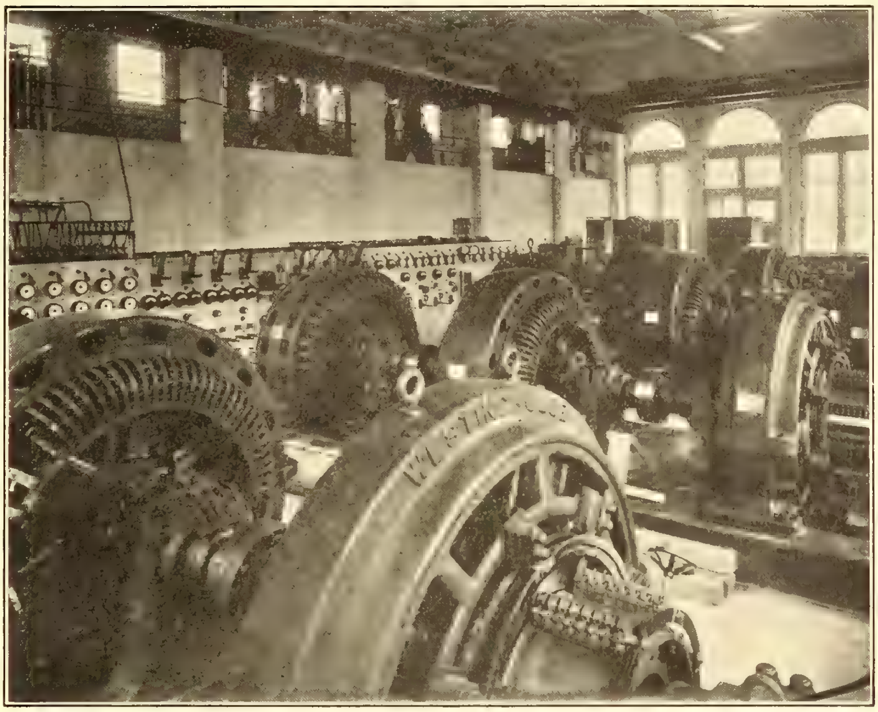
which potential it is transmitted to the sub-stations, located about every 10 miles along the line and again reduced to 6600 volts and turned on to the single-phase trolley.

The overhead construction of the Spokane & Inland is a single catenary with 7-16-in. steel messenger wire and an adjustable clipped trolley. The cars are of Brill make, 58 ft. in length and finished in mahogany, rattan and plush. Cars Nos. 1 and 2 each have four 100-hp motors, while No. 3 is a trailer with an observation platform. Some of the motor cars are furnished with baggage compartments.

The motor cars collect current through pantagraph collectors on the interurban divisions, but the usual trolley wheel is employed on the city division. The appearance of cars thus equipped will be noted in one of the acompanying illustrations. Both suburban divisions of the Inland Empire System are equipped for handling freight by electricity. Beside the 400-hp freight cars there is a 50-ton, 600-hp locomotive. An order for eight more locomotives has been placed. These are to weigh 72 tons, and will be of 700-hp capacity.

Car houses and machine shops of the Spokane & Inland are located at Spokane. They are of brick and are 100 ft. broad by 200 ft. wide.

The freight terminal, used by both the Spokane & Inland and the Cœur d'Alene & Spokane, is 40 ft. by 300 ft. The freight yards adjoining the terminal are located directly between those of the Great Northern and the Northern Pacific and are connected by a transfer track. The present yards are 300 ft. by 2000 ft., and will shortly be doubled, besides extensive storage tracks to be located at the Y or junction of the two suburban lines south of the river.



INTERIOR OF FREQUENCY CHANGING STATION ON THE SPOKANE & INLAND DIVISION

CAR HOUSE OF THE SPOKANE & INLAND DIVISION AT SPOKANE

The Spokane electric passenger terminal is located at Main and Lincoln Streets in the block adjoining the site for the new Federal Building. It is 50 ft. x 160 ft, of buff brick and terra cotta and oval in shape. The tracks are so laid that the trains circle the building. The lower floor is finished in golden oak and Washington marble. Waiting rooms, ticket office, baggage and express departments are located on this floor. The second floor contains the executive offices and the third the accounting and drafting departments. The arrangement of the offices is such that all have outside windows and an abundance of light. Steel vaults are located on each floor. The building cost $110,000.

FREIGHT SCHEDULES

With the opening of the train service to Oakesdale and Rosalia, the Spokane & Inland Railroad sent out post cards to all shippers in its territory, announcing that all passenger trains would carry express. It was announced that such shipments would be received up to within 10 minutes of train time at the Spokane terminal on cars leaving at 7 and 9:30 a. m., and 1 and 5:30 p. m. This frequent service will afford prompt delivery of shipments for all points on the Palouse line; the Coeur d' Alene and Hayden Lake divisions, and Lake Coeur d' Alene, St. Joe and St. Maries Rivers via Red Collar steamers. The freight schedule issued shows four trains a day from Spokane to Waverly via Rosalia and Oakesdale. Freight at the Spokane terminal will be received up to 5 p. m.; carload business is accepted to all points on the eastern division to Palouse and the western division to Rosalia.

TRANSPORTATION FACILITIES IN SOUTH AMERICA

Theodore Stebbins, who last fall went to South America in the interest of J. G. White & Company, of New York, to report on some railroad and other projects which that firm has in contemplation there, has just returned to the United States. While Mr. Stebbins was not prepared to make any announcement as to the result of his investigation in as far as it concerned his clients, he did make some interesting statements regarding those countries which it was his fortune to visit. Mr. Stebbins went down the west coast and up the east and then crossed to Europe, where he spent several months traveling through Italy, France, Belgium and England. In South America he traveled in the interior some 3000 miles, and crossed the Andes seven times at elevations of more than 13,000 feet. His highest ascent was 15,500 feet, but he was not seriously inconvenienced by this altitude.

Mr. Stebbins states that there is a marked awakening of activity in South America, that the people are getting tired of revolutions, that the governments are being established on more suitable bases, and better security is being offered for capital investments. The commercial and social relations and sympathies of the peoples are still largely with European countries, but the advantages of American methods are appreciated and desired by the more advanced business men. As an indication of the closeness of the relations with Europe the leading papers will have several columns of cabled matter from all the European centers and no news, or scarcely any, from the United States and that little of a very trifling character. American manufacturers will never get their proper share of South American business until more consistent efforts are made to study and meet the needs of the people and more care is taken in packing and shipping goods for the existing methods of transportation there. South Americans feel that during the last century the center of development in the Western Hemisphere has been in North America, but that during the present century South America will occupy the center of the stage. Undoubtedly enormous developments are possible there.

Better transportation constitutes the great need of the west coast. The steamers run as locals, making stops of from a few hours to a few days at each port, and trips are interminably long. Freight has to be lightered at many ports from steamer to land, and is roughly handled. In the interior few railroads have been built on the west coast, and a great deal of the transport is still conducted on muleback. The cost from some interior points to European ports is as much as $100 per ton. Contracts have been let for the construction of a railway system of considerable size in Bolivia. This road will afford means of delivering the rich mineral products of the country to the coast and will greatly increase the output of the rich mines and increase mining values.

Transportation is so difficult over the mountains that the coal imported into Bolivia for the railway's own use costs $30 per ton. At La Paz abundant timber grows within fifty miles from the mountains, but transportation is so difficult that trolley poles and lumber for building operations are brought from the State of Oregon, a distance of thousands of miles.

Spanish is the prevailing language in all of the Central and South American countries except Brazil, where Portuguese is spoken. In the principal cities one can find English-speaking people in the larger hotels and other places in contact with the traveling public, but none of the common people on the street, the hack-drivers, policemen or street-car conductors speak English. Each country has its own currency, and that of one country differs from that of every other. The English gold sovereign is the coin most universally accepted. In passing from one country to another it is economical to dispose of all the currency of the country one is leaving, as otherwise it must be sold at a discount at the next country reached. The metric system is in general but not exclusive use, and many old Spanish measures of varying standards are still frequently employed. The passenger rates of fare are quite reasonable, but little weight of baggage is allowed with a ticket, and the rates are high on excess baggage.

In the course of the trip Mr. Stebbins made some interesting observations of electric railways in operation and proposed. Kingston, in the island of Jamaica, has a modern railway giving an excellent service and operated by English interests. Panama is a compactly built city with narrow streets without railway facilities, but a system is projected to be extended a few miles outside of the city to the canal terminus.

Guayaquil, Ecuador, population 76,000, has a mule line operating forty-five cars on ten routes. The fare is ten centavos. Transfers, tickets and registers are not used. The franchise was given for thirty years as a monopoly, and at the end of thirteen years was renewed for twenty years. The company paves with cobble-stones between rails at its own expense and outside of the rails at the city's expense. It pays as dividends 1 per cent monthly plus 8 per cent annually, besides accumulating some sinking fund. The stock sells at 160 per cent. The line is to be electrified.

Lima, Peru, population 100,000, has a network of urban and suburban lines which are being electrified. The electric lines are doing a greatly increased business, and the report of the Lima Tramway for the half-year ending Dec. 31, 1905, before any electric operation has been commenced, shows seven and a half million of passengers carried. During the same period the average receipts were 2 cents (American) per passenger and $1.50 per capita per six months. All the railway and lighting interests have been consolidated, are operating by water power, and are doing so well that the stock has greatly advanced in price.

Arequipa, in the southern part of Peru, has a horse-car line operating light cars over light track, and apparently doing a light business also. Statistics of operation are not obtainable.

La Paz, Bolivia, population 60,000, has a railway line 100 miles long to Lake Titicaca, of which 94 miles are operated by steam locomotives and the last 6 miles by electricity. This last 6 miles connects the city at an elevation of 12,200 ft., located within a gorge, with the steam line 1500 ft. higher on a plateau. The air-line length is about a mile and a half, but loops are put in the line to bring the grade down to a maximum of 6 per cent. The steam passenger and freight cars, which are of light construction, are brought down this grade. No other electric railway exists in Bolivia. The subject of concessions and franchises in Bolivia is an interesting one. These words, when applied to a public service enterprise, are understood as giving an exclusive right to carry on the business specified. The constitution of the country, however, guarantees the freedom of industry, and it is believed by many lawyers in Bolivia that this clause will permit a public service company to continue its business, although not on an exclusive basis, after the expiration of its concession. Oruro, Bo-

livia, has granted a concession to a German firm for a mule line. The concession contains some singular conditions.

Valparaiso, 200,000, and Santiago, 400,000, in Chile, have good transportation facilities. Double-deck cars are used. Women conductors are largely employed, and perform their duties in a serious spirit. They are active in jumping on and off cars in motion, climbing to the upper deck, and in their other duties. These women were employed originally when the men were called away to some war, and proved so satisfactory that they have since been retained. They receive as wages about $20 in gold per month. A stranger finds it hard to accustom himself to this field of their usefulness. The company in Santiago has been charging 1½ cents, United States gold, for first-class tickets and three quarter cent for second-class tickets, and has lost money from these fares, so that they have recently been doubled with the consent of the municipality pending negotiations for a final basis. In Valparaiso the fares are the same as now charged in Santiago. As a general thing the street railway companies in South America operate both first and second-class cars and the fares are quite low, but no transfers are given. Transfers are employed, however, in Lima. Upon paying fare in Lima one receives a ticket with a serial number; the transfers also have serial numbers, and these tickets participate in a lottery drawing at the end of each month, This is the means taken to encourage traveling and to insure issuance of a ticket for every fare paid. This is the only remaining authorized lottery drawing in Lima.

There are twelve tramway companies in Chile and eleven different gages of track. This condition offers an inviting field for some of our standardization committees.

Buenos-Aires, Argentine, with a population of nearly 1,000,000, has an extensive tramway system operated by a number of different companies. Many of these roads are now electrified. J. G. White & Company are now completing the electrification of one of the largest lines and are building several hundred miles of steam line out into the country in connection with this line. The horse-car drivers in Buenos-Aires carry cornets to warn other street traffic of the approach of the cars in place of the whistles, gongs and other means of alarm used in this country. These cornets hang from the canopy by a cord at the proper level for convenient use. Many drivers become very expert in the use of these cornets and formerly would blow tunes as the cars traversed the streets. This practice, however, became so objectionable that the city authorities finally had to suppress the unnecessary use of these horns. They give a musical note and are an interesting feature of street traffic in Buenos-Aires.

Rio Janeiro, in Brazil, seems to have good tramway facilities. The principal business street is a wide boulevard which has been cut through the heart of the city for a mile or more within three years. It is lined with beautiful new buildings on either side and connects with a long marine boulevard, also newly constructed. This work has been completed with marvelous expedition and thoroughness.

Las Palmas, in the Canary Islands, has a dummy line using steam locomotives in the business street, and seems much behind the times in this respect.

The San Diego Electric Railway Company, of San Diego, Cal., has decided to make the experiment of using steel ties on sections of its car line in this city, and to that end has placed an order with the Carnegie steel works for 250 ties.

HANDLING TRANSFERS AT OKLAHOMA CITY

All transfers are carefully accounted for by the Oklahoma City Railway. Conductors are supplied with separate envelopes for returning used transfers, void transfers and unused transfers. The used and the void transfers are placed in the envelopes each half trip and are turned in at the office at the end of each trip. The unused transfers are of course, returned in the proper envelope at the termination of the run. Each conductor is required to keep

OKLAHOMA CITY RAILWAY CO.

Conductor's Daily Report ________ 190__

Sheet No. _____ Badge No. _____ Car No. _____

Route ________

Register Ending - - - - -		Condr's
Register Starting - - - -		Punch O
Fares Registered - - - - -		Cut

Brought Forward										Transfer Serial No Beginning Each ½ Trip
Trip	Direction	Time Hr.	Time Min	No. Cash Fares	Transfers	Tickets	Total Fares	Register Reading		
1	Out		M							
	In		M							

REPORT FOR TEN-TRIP MAXIMUM. SPACE IS LEFT AT BOTTOM FOR NAMES OF CAR CREW

Route ________

Conductor ________

TRANSFERS ISSUED

Time Started Hours	Time Started Minutes	Serial No. Starting	Serial No Ending	No Used
Total Number Used				
Punched and Not Used				

DELAYS

Delayed From	To	Cause	Place	Total Time Delayed
M	M			
M	M			
M	M			
M	M			
M	M			

OTHER REPORTS

BACK OF CONDUCTOR'S DAILY REPORT

record on a special form of the serial numbers of the transfers issued and of the number returned unused and void for each half trip. Record of the serial starting number, the ending number and total number of the transfers used for each run is kept on the conductor's car report shown. The Globe Ticket Company's transfers are used.

LUBRICATION IN THE POWER PLANT

BY AN OIL EXPERT

In considering the best manner of getting the oil into an engine cylinder to secure results which will be both satisfactory and economical, the question arises, does the gravity lubricator meet the requirements, and especially of modern engines? Aside from cylinder oils and their quality entering the question, the application of any lubricant used externally or internally will figure in the answer. All admit that proper distribution on the rubbing surfaces is an essential, yet it is found in practice that the faces of cylinders and valves are cut and scored in streaks, and other parts of the surface show that the lubricant has performed its function in an unsatisfactory manner.

There has been more or less doubt as to the reliability of the existing arrangements for lubricating the valves and cylinders of modern engines, particularly those operating with the higher pressures and steam temperatures of latter day practice. It often happens that the best lubricating oils will fail to distribute properly on the rubbing surfaces, even when introduced or injected in two or more locations in the pipe, steam chest or the valve bonnets of engines.

Leaving aside questions as to the quality of the oils or the amount used, does not the evidence in the majority of cases point to the fact that a proper distribution cuts the larger figure in the sum of the satisfactory results obtained in cylinder lubrication?

Take a piece of tubing with a smooth interior, swab its inner surface with good cylinder oil, allow steam to pass rapidly through the tube for a few moments, and it will be noted that the interior of the tube has been cleaned from all oil by the process. Such evidence proves that the steam itself is a good medium for oil distribution, provided, however, its velocity rate is sufficient to pick up the oil, atomize and combine with it during its passage. If this be true, does it not prove that the velocity of steam at the valve pot edges contributes materially to the diffusion of the oil in the cylinders, although the valve surfaces lacked lubrication in their bearing ends, the latter being practically dead ends so far as the steam flow is concerned? From this line of reasoning, it follows that a proper distribution would require that the steam be combined with the oil prior to its reaching the rubbing surfaces. General experience shows, however, that a reliable means to accomplish this is lacking, or in other words, any good result is more or less accidental.

The problem seems a complex one, as it will be admitted that some of the best results in lubrication, or properly speaking, distribution, has been obtained by ordinary means; yet a close inquiry into conditions will show that some overlooked feature exists to promote satisfactory results. For instance, take an engine or pump, throttled at its steam supply and the lubricant entering above the throttle valve; then, we have the steam wire-drawing at the throttled opening. The oil for lubrication in this case combines with the increased steam velocity at the contracted openings, resulting in a better distribution than where the oil entered below the throttle. As this condition, however, does not exist in the modern units where the low velocity at the throttle entry is demanded and provided for by large openings, it is very probable that the oil has little chance to be atomized until it reaches the valve faces; at that location it is then swept by the steam, and in a more or less atomized condition into the cylinder.

Such varying results in oil distribution invite a better means for accomplishing the desired end, and the positive oil feed is a step in that direction. It seems to offer a means to saturate the flowing steam with the lubricant, delivering the lubricant at every stroke of the engine, so that the entire rubbing surfaces of valves and cylinder walls are positively lubricated by the oiled steam.

It is possible also that the best lubricant may not give satisfaction, owing to its not being properly distributed on such surfaces, and that the lower grades of oil often give better results, some of the latter possessing the quality of better diffusion (if such a term may be used) by the temperature of the entering steam, the better oil lubricating in streaks due perhaps to viscosity or some other quality which, in a measure, prevents it from being effectively atomized by the steam at the point of oil entry.

The most interesting experience that the writer has had in regard to this subject occurred in a power station containing six 36-in. x 62-in. x 60-in. E. P. Allis Corliss cross-compound engines of 2000 hp each. The cost of cylinder oil used averaged from 20 to 24 cents per 1000 kw-hours, which proved that enough oil was used to get the best results. Having perfect confidence in the cylinder oil, it was very difficult to locate the reason for this high cost.

Tests were made for moisture in the steam, which only showed about 2 per cent on full load. The amount of boiler compound was reduced, and in fact discontinued for a time. The points of delivery were changed, and other new ideas given a fair trial, yet with the same results.

The engines were stopped and the heads taken off at once, but no trace of oil could be found. The valves and cylinder walls were perfectly dry. After several months of this trouble the chief engineer concluded to replace the gravity lubricator on one engine with a sight feed oil pump. The result was beyond the expectation of every one concerned, and proved so satisfactory that all the old gravity sight feed lubricators were discarded and replaced with this type of pump. The change not only stopped all the cylinder and valve troubles, but reduced the cost per 1000 kw-hours, so that the total cost for all oils has been reduced to 14 cents per 1000 kw-hours.

A review of this whole situation proves that it was not the oil, but the method of application. The gravity lubricator did not deliver the oil into the cylinders as was supposed. While a drop was passing through the gravity lubricator for every four revolutions of the engine, it undoubtedly accumulated in the pipe until there was a quantity of it, leaving the engine to make from 12 to 14 revolutions before receiving any oil; or if the oil did pass into the cylinders, it went in in such large drops that it did not get a chance to vaporize and evenly distribute itself throughout the cylinder.

With the sight feed pump the oil is delivered into the steam at every stroke or revolution of the engine, feeding the oil into the steam in minute quantities, thus giving it a better chance to atomize and thoroughly saturate the steam. It can be readily understood how great a saving can be accomplished by this method. The pump starts and stops automatically with the engine, giving the valves and cylinders lubrication on the first revolution. The sight feeds are easily adjusted to any number of drops per minute, and the drops are all uniform in size, thereby giving the most perfect conditions for cylinder lubrication.

This type of pump was preferable to the ratchet type of oil pump, as the ratchet type does not feed oil into the steam with each stroke, but is set for the number of revolutions desired for each drop of oil. It is only an improvement over the gravity lubricator inasmuch that when it does feed it is positive.

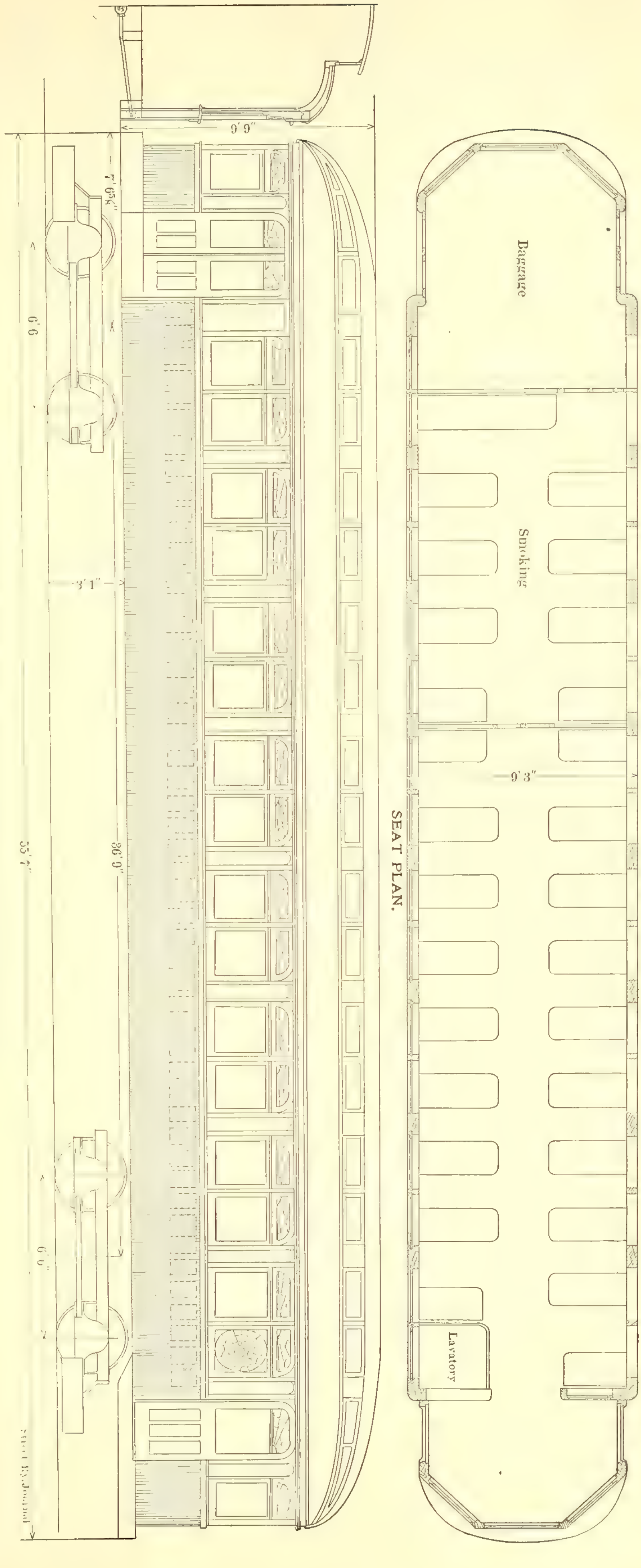
After studying the subject of cylinder lubrication for two years the writer has come to the following conclusions: The power-house valve oil will do the work under all conditions; the gravity-feed lubricator is a failure, as it is not reliable; a ratchet pump is only better than the gravity lubricator as to its positive feed; and that the best results can be obtained by feeding a minute quantity of oil with each stroke of the engine, thereby being sure of the oil atomizing and reaching all the working parts in the cylinder.

NEW CARS IN TORONTO

The Toronto & York Radial Railway is building in its own shops a number of very handsome interurban cars. They will be used for the long through run between Jackson's Point, the Lake Simcoe terminus of the metropolitan division, and Toronto, a distance of some 55 miles, and are constructed for speed, comfort and safety.

The sill construction is principally steel, and double floors, with several thicknesses of felt between, deaden the sound from beneath and add warmth to the car. The seats are high, roll-back, rattan-covered "Walk-Overs," and were supplied partly by the Heywood Bros. & Wakefield Company and partly by Hale & Kilburn. The heating is by hot-water pipes from a small furnace in the baggage vestibule. The heater was supplied by the Gurney Foundry Company, of Toronto. Pantasote curtains are used. A glance at the plan shows the arrangement of the car. The front vestibule, in which the motorman stands, is large enough to carry the heating apparatus, and allows plenty of space for baggage, etc. The smoking room comes next and seats twenty-four persons, and lastly, there is the main passenger compartment, which seats comfortably about thirty-eight people, and contains lavatory, drinking-fountain, hat-racks, coat-hooks, etc. The interior finish is in antique quarter-cut oak, and all color work, such as the leaded glass transoms, deck lights, etc., are in subdued tones of brown and green, giving to the cars a very restful sensation—in fact, they are probably the finest cars of their kind that have yet been put in commission in Canada.

The motor equipment is composed of four of the new GE No. 73 motors of 75 hp each, giving 300 hp per car. The type M control is used, the first instance, it is said, of its employment in Canada. The side elevation herewith gives some idea of the general appearance of these new cars. The total weight of the car equipped with No. 27 G Curtis trucks and motors, as described, is about twenty-eight tons. The length over all is 55 ft. 7 ins., and the width is 9 ft. 3 ins.



PLAN, CROSS SECTION AND SIDE ELEVATION OF TORONTO CAR

GASOLINE MOTOR CARS FOR RAILWAY SERVICE

The meeting of the New York Railroad Club held on Friday evening, April 19, was devoted to the reading of and discussion on a paper on Gasoline Motor Cars for Railway Service, by W. R. McKeen, Jr., who, as superintendent of motive power and machinery at Omaha, is in charge of the gasoline motor-car development of the Union Pacific Railroad.

Mr. McKeen opened his paper by a brief reference to the success his company had had in operating gasoline engines for work in pumping and co[illegible]g stations. It appears that these are delivering power at [illegible] per hp-hour, compared with $1.92 per hp-hour by stean [illegible]ngines.

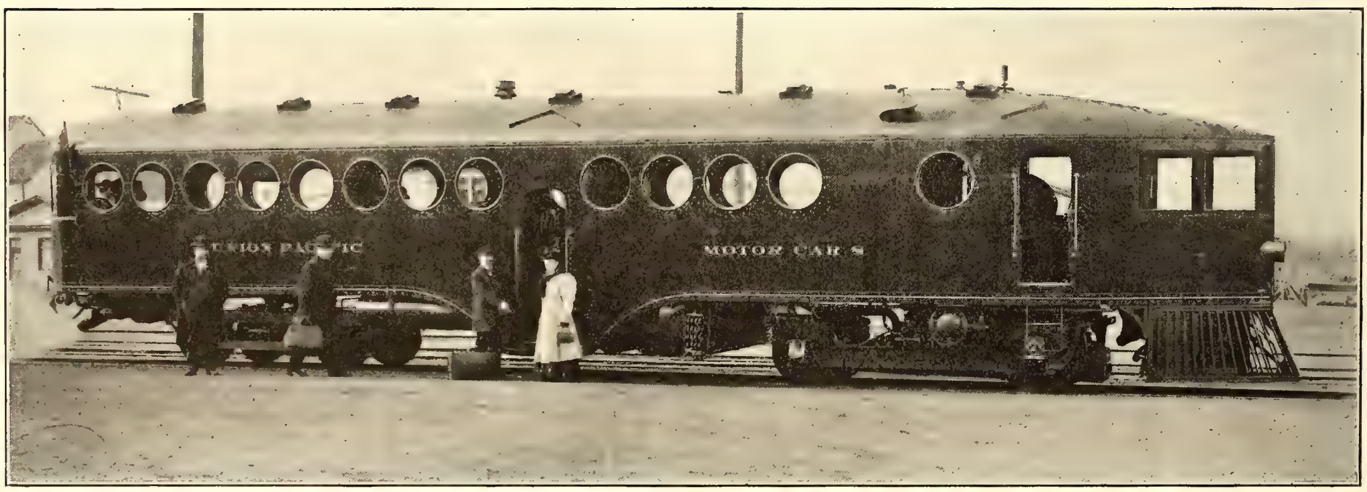
Operating without locomotives had proven popular, as in the case of electric railways, because it enabled the carriage of passengers and freight by small power units at frequent intervals. Since electrification requires a heavy line investment, the car for sparsely settled districts must be of the self-propelled type. Some steam-railroad men still look favorably upon the steam car, but he did not believe there had been sufficient improvement in the steam motor since the dummy days to justify their view.

The modern locomotive and steam-motor car, with high steam pressure and the attendant flue and firebox troubles, are much more complicated than the gasoline motor car, in which, technically speaking, there is nothing present but the vehicle, engine and transmission. As a mechanical man it seemed to him that a gasoline motor car, built with the same skill as a locomotive, is a much less vulnerable machine than a locomotive, and should give more continuous service without failures.

To meet the demand for a low-cost-of-operation, self-propelled passenger car it seemed necessary that gasoline motor vehicles be designed for the special conditions of steam railroad work. Branch lines collect freight and feed the main line, and the limited passenger business can be handled economically when turned over to the main line. Hence the steam train could be replaced by a motor car, a great saving could be made in the operating expenses and passenger traffic would be encouraged by the greater frequency of service. The number of trips, cost of operation, etc., is entirely dependent upon the density of traffic and the length of the branch line. On steam railroads in competition with the frequent service of electric lines, a motor car of high power is necessary to obtain the rapid acceleration and high speed required for this class of service. These cars should be constructed, not along the conventional lines of an electric car, a steam passenger coach or railroad locomotive, but on entirely new lines; in other words, on lines particularly adapted for this class of service.

In designing the car body of the motor car three points must be considered, viz., weight, cost, and strength. For years in steam-car construction the tendency has been toward a more elaborate interior finish, additional conveniences and numerous other improvements, all of which have added materially to the weight; the length of the cars, large windows, improved couplers, improved draft rigging, trucks, air brakes, etc., has also increased the dead-weight of the car, each ton of added weight making the cost of hauling passengers more expensive. As a result of this trains and locomotives have become so heavy without being correspondingly strengthened that in case of a collision the cars are subjected to such severe shocks that they telescope or go to pieces.

Now that an innovation is being made it seems logical that advantage should be taken of the vast experience in building steam passenger cars by including in the new design all the recent demands for improvements that will insure the safety of passengers should the car get into a wreck or turn over. Hence the Union Pacific car is of steel only. The ocean lin[illegible]s are so designed that a collision results only [illegible] a h[illegible]eing punched in the side of the vessel, but, as a rule, the other parts of the frame are not damaged; the same idea might be applied to car design. Instead of having an underframing of excessively heavy sills with a light cracker-box framing above, his company had endeavored to make the whole car body a unit structure. The underframing comprises but one moderately heavy center sill; the side sill is a light-weight continuous channel extending around the body of the car. From this outer channel bar continuous steel ribs run up the side through the roof and down the other side of the car, secured to each other by suitable cross-braces. The sides of the car form a truss, the plate of the car being the top chord and the sill the bottom chord. This framing is well tied together at all points, and is further re-enforced and strengthened by the sheet-steel covering. The ends of the car are strengthened by the round shape at the rear and the pointed lines in front. In a collision this car could be punctured or bent, but it could not be telescoped. One of these cars in an accident struck a switch locomotive while running at about 30 miles an hour. The car was struck in



EXTERIOR OF UNION PACIFIC GASOLINE CAR

the rear and but slightly damaged; the steel plates were bent up, the ribs of the car were broken loose and badly bent, but the frame of the car was not in any way damaged except at the point of contact with the locomotive. Beyond where the car was struck the paint was not even cracked, showing that even under this severe shock there had been no unequal movement of the members of this steel frame.

The latest design, with metal-frame round windows, enables the diagonal braces of the steel frame to be brought very close to the top of the car, and by lowering the roof and bringing the plate of the car closer to the side still a great increase is secured in the strength of the car side which approaches the girder form.

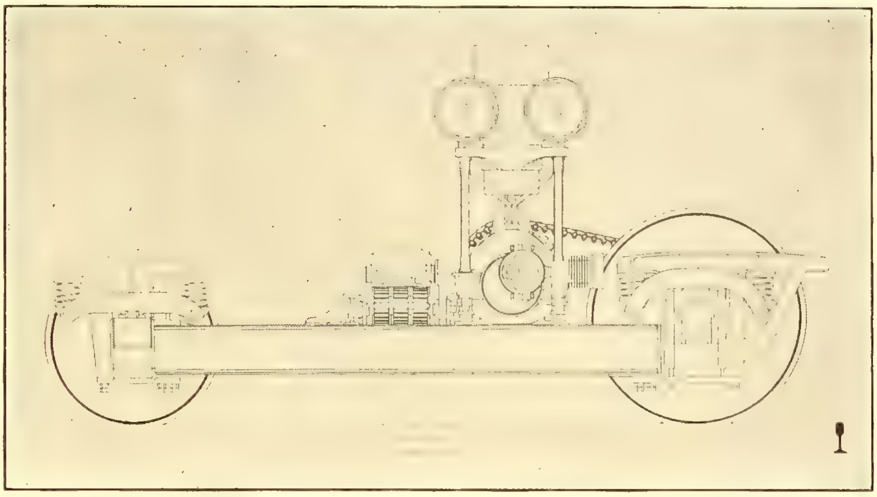
Mr. McKeen then quoted some data from the Berlin-Zossen and Electric Railway Test Commissioners' reports on air resistance in explanation of the parabolic design of car front adopted by his company.

The power transmission system after the car is once in motion consists simply of an engine and a sprocket mounted on a crank-shaft, the power being transmitted therefrom through a chain and into a second sprocket keyed on the driving axle. There are no noisy gears or complicated mechanism for absorption of the power.

Speaking of the engines, Mr. McKeen said that it is generally conceded that a gasoline engine is a constant-speed machine; that used as a power generator any variation in speed must be secured by mechanical methods. The gasoline engines used for stationary purposes are all regulated by a governor and maintained at a constant speed. In the automobile business it is particularly noticeable that foreigners figure on controlling the speed of the automobile by a multiplicity of gear speeds, often as high as four or five, thus admitting the gasoline engine should run at a certain fixed speed. American builders of automobiles frequently control their machines with only two gear speeds, although many of them use more.

For a motor car to operate on a steam railroad where a single machine is almost imperative under all conditions such that an operator with a reasonable amount of experience may direct his mind to guiding the car from station to station, the gasoline engine and machinery for propelling the car must be flexible of control and of itself require very little attention; in other words, it must be analogous to a steam locomotive—able to stand hard service, hard work and abuse, and yet at the same time so reliable in its performance that there will be no stoppages between stations to complicate the operation of the regular train service.

The Union Pacific motor cars were originally designed and developed on the basis of controlling the speed of the car by varying the speed of the engine; accelerating the speed by opening the throttle, thus giving the engine more gasoline, this being analogous to opening the throttle on a locomotive, and advancing or retarding the spark being analogous to varying, by the reverse lever, the valve motion and the lead of the valve on the locomotive. Motor car No. 8 was equipped with a 200-hp gasoline engine, designed and built at the Union Pacific shops at Omaha. The hope for a flexible-control engine has been fully realized, the engine being able to start and accelerate the car from zero to 60 miles an hour simply by varying the speed of the engine. If the car attains 50 miles an hour and it is desired to run more slowly this can be accomplished by closing off the throttle, reducing the consumption of gasoline and therefore saving fuel. Thus one controls the horse-power developed in the engine by means of the gasoline supply, and the cost of fuel consequently is in proportion to the power demanded from the engine. In his opinion this saving in a gasoline engine is proportionately greater than in a steam locomotive. This flexible control of the gasoline engine is obtained through the following: (1) Utilization of 6 cylinders, giving a power impulse to the shaft three times each revolution; (2) by balancing the crank-shaft and reciprocating parts the uniformity of speed is improved; (3) the gasoline vapor pipes from the carburetor to the cylinders are all equally divided, so the distance the vapor travels is the same in every case and thus no one cylinder takes its charge of gasoline at the expense of another; (4) the dimensions of the cylinders, the opening and closing of the inlet and exhaust valves and the relative timing of these valves to each other, as well as to the piston, have all been of particular importance; (5) as before mentioned, the valve motion of a six-cylinder gasoline engine is analogous in many ways to the valve motion of a steam locomotive. The idea in the valve motion of the motor-car gasoline engine is to operate the valves to produce as nearly as possible uniform horse-power by these cylinders at various speeds.



ARRANGEMENT OF GEARING

The throwing on or off of the friction-clutch is the only move necessary to vary the speed of the car. Even though the car reduces to a speed of 2 or 3 miles an hour simply by throwing in the clutch, the load will be assumed and cared for by the engine without the bucking often experienced with automobiles and other constant-speed engines. The throwing on or off of the clutch is actuated by air, controlled by an operating valve, the lever of which is small and in the hands of the operator. Hence it is easy for him to keep his head out of the window, watch the brakeman, the movements of the car and handle the gasoline-engine mechanism.

The expense for fuel, repairs, cleaning, etc., runs very uniformly, but as the cost per mile is so largely dependent upon the number of miles run per day, as well as on the wages paid the car crew, comparisons are very unsatisfactory. In actual service cars run some months as low as 10 and 11 cents a mile; whereas cars in other localities will run as high as 16 and 18 cents a mile, and in one case, where a 100-hp motor car and trailer has replaced a steam loco-

motive and train, the cost of operation runs as high as 20 cents a mile. On branch lines the motor car should make not less than 100 miles a day. To man the gasoline car with a steam crew is exceedingly expensive and does not produce proper results; to man the gasoline motor car crew would be equally unsatisfactory. A well-paid mechanical man to have entire charge and run the motor car, with an assistant to collect tickets, seems the best and most economical arrangement.

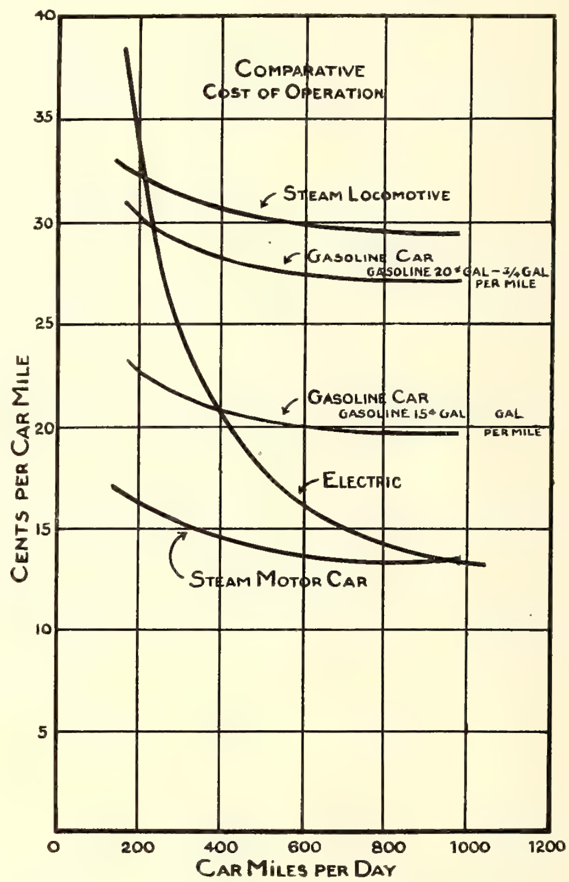
DISCUSSION

H. G. Chatain, of the railway engineering department of the General Electric Company, said he agreed with the structural features of the car developed by Mr. McKeen, because its shape certainly affected a decrease in wind resistance. He was not willing to agree with him, however, on the method of transmission. It appeared to be a common opinion that because gasoline-electric drive involved extra machinery it did not deserve much consideration. It was true that the car developed by his company weighs 30 tons as against the 26 tons of the Union Pacific car, but this difference could not be ascribed entirely to the extra equipment. With electric transmission it would not be necessary to use a truck of more than 6 ft. 3 ins. wheel base, while the like power with mechanical transmission would require a truck of, say, 9 ft. wheel base. This point brings out one weight compensation in favor of electric drive to make up for the additional weight of the generator and motor. Aside from the question of better speed control, gasoline-electric drive meant that the machinery could be placed to better advantage for operating convenience and inspection. As to net efficiency of drive, he was willing to admit an efficiency of about 92 per cent for mechanical drive and only 81 per cent for electric drive. Real efficiency, however, is the gasoline consumption. In the long run this should be less with gasoline-electric transmission because the latter permits the engine to run at its most efficient point all the time.

B. D. Gray, of the American Locomotive Company, gave some statistics about the gasoline consumption per mile of automobiles. The point of his argument was that the larger the engine the greater the period when it would be running at an uneconomical speed. Referring to Mr. McKeen's statement that the car is run on high gear all the time, he admitted that it was certainly desirable to keep down the number of gears to a minimum, but he did not see how it was possible to start from zero on the high gear, especially to reach speeds up to 60 miles per hour. He thought there must be a great slip on the clutch at starting, and wanted to know of what those clutches were made, what became of the heat lost in friction, at what point does it slip, what is the principle of construction, and what are the r. p. m. of the engine at that time. It seemed to him that the horse-power then must be much less than 200. Mr. Chatain had mentioned that the efficiency of the gasoline electric transmission developed by this company was 81 per cent. When he was in Europe the engineers of one building company claimed only 65 per cent, but perhaps this difference may be due to the fact that they used smaller motors, about 30-hp to 35-hp.

He also gave the following figures on the cost of operation of motor cars on the Hungarian State railways, which has thirty-seven for passenger and light-goods service. Of these, 32 are of the gasoline-electric type. Ten cars are of 70-hp capacity, weigh 20 tons, run 2.9 miles per gallon at an average speed of 35 miles an hour; the 35-hp cars weigh 40 tons, including two trailers, and run 3.75 miles per gallon at an average speed of 20 miles per hour.

Among the other figures which he had secured abroad of motor-car operation he presented the following: Great Western Railway, England, steam car, 250 hp, weight of train with one trailer 55 tons, operating cost per train mile 13 cents, including fuel, oil, repairs and driver's wages, cost of fuel practically $3 a ton delivered, driver's wages $1.75 per day, 20 lbs. of coal per train mile, average speed 35 miles per hour; Northeastern Railway, England, gasoline-electric car, 85 hp, claimed gasoline consumption equal to 3½ miles per gallon, average speed 30 miles, cost of gasoline about 25 to 30 cents per gallon, operating cost estimated 15 to 16 cents per train mile; Paris-Orleans Railway, steam car with 260-hp boiler, weight of train 50 tons including one trailer, operating cost 8 cents per train mile; coke $6 per ton; driver's wages $1.04 a day; fuel consumption 21 lbs. per mile; average speed 35 miles per hour. On the Hungarian State railways a Ganz steam car weighed



CAR-MILE COST CURVES OF STEAM LOCOMOTIVES, GASOLINE, ELECTRIC AND STEAM MOTOR CARS

35 to 40 tons, including two trailers; operating cost 7½ cents per mile, coke $5 per ton, driver $1.20 per day, fuel consumption 9.6 lbs. per car mile, average speed 25 miles per hour. Another car was of the gasoline-electric type, rated at 70 hp, weighed 20 tons, operating cost 7.3 cents per mile, cost of gasoline 10 to 11 cents per gallon, ran 2.9 miles per gallon, and had an average speed of 35 miles. A second car of the gasoline-electric type, of 35-hp capacity, weighed with two trailers about 40 tons, cost 5.7 cents per mile, ran 3.75 miles per gallon, and had an average speed of 25 miles per hour. A steam car on the Austrian State railways of 100-hp capacity weighed 50 tons including two trailers, cost of fuel $3.25 per ton, operating cost 5 cents per train mile, wages $1.25 a day, fuel 15 lbs. per mile, and the average speed was 25 miles per hour.

Charles Ducas, of New York, spoke in favor of the Ganz

steam car, of which over 200 are in regular operation. Mr. Ducas submitted the accompanying curve-sheet giving the total cost on a line assumed to be 30 miles long with stops every 5 miles, and a maximum speed of 35 miles, making 3, 6 or 9 trips a day. The highest curve was that of the steam locomotive corresponding to a cost of 30 to 32 cents per mile. The next curve was that of the gasoline car corresponding to 25 cents per mile, this figure being a compromise between two assumptions, one that one gallon would be needed per mile at 20 cents per gallon, and the other on the basis of half a gallon per mile at 15 cents per gallon. The lowest curve was that of the Ganz steam car used on the Hungarian State Railways: this showed a coal consumption of 12 lbs. per mile, working out to a cost of 15 cents per car mile. The curve for electric-car operation demonstrated that for low traffic densities its cost may be even more than that of a steam locomotive, but that it rapidly decreases with the number of car miles per day, dropping below the gasoline car at about 300 car miles per day, and below the steam-motor car at about 900 car miles per day.

A. W. Wikeford, of the Lehigh Valley Railroad, said that he had been associated with Mr. McKeen in the early work on the Union Pacific gasoline cars. Looking at it from the standpoint of the mechanical man, he did not see why it should be necessary to add electrical complications to gasoline machines when straight drive was sufficient to answer the purpose. As to objections against the gasoline engines, no form of power devised for railway motor cars was free from the likelihood of trouble, as, for instance, the boiler and engine of a steam car.

G. R. Henderson said that he would like to know the cost of the car and also the cost per hp-hour.

Mr. McKeen resumed the floor to take up some of the points hinted at in his paper or mentioned by the preceding speakers. As to double-end and single-end cars, he was inclined to follow interurban electric railway practice, which seemed to be tending toward the single-end car and for the reasons usually advocated for this practice, namely, saving in apparatus and increase in seating capacity. He did not want it understood that he had said the horse-power was uniform throughout. The losses due to the uneconomical running points of a gasoline engine were like those found in any steam locomotive, which, at times, is very extravagant of power. A similar criticism could be made with regard to electrical machinery, for everyone knows that the method of control involves resistance losses. With regard to the friction-clutch used, this was of cast-iron on cast-iron, being nothing more than a disc with wood inserts capable of absorbing almost any amount of power. It is true that it heats, but not so much as to affect the operation. The driver can let the clutch slip for 10 ft. to 40 ft., as he prefers, in easing the load on the engine. He did not believe that the engine would work as effectively with boiling water as when the temperature of the water is at, say, 180 degs., but he did know that it made no great difference in service. It was amusing to hear statements that mechanically driven gasoline cars were not a success. If any had doubts on that score they were welcome to come to the Missouri River, where they "would be shown" at 2 cents per mile. As to Mr. Ducas' gasoline-car estimate based on 1 mile per gallon, he had succeeded in geting 3.5 miles per gallon on the Union Pacific. He could not comply with Mr. Henderson's request for the cost per hp-hour and the cost per car, as the first had been figured on the mileage basis and the second was still indefinite.

TABLE I.—COMPARATIVE COST OF OPERATION.
(Cents Per Train-Mile.)

	Steam Motor Cars.			Gasoline Cars.			Electric Cars.			Steam Locomotives.		
Car-miles per day	180.	540.	960.	180.	540.	960.	180.	540.	960.	180.	540.	960.
Repairs to motor equipment	2.0	2.0	2.0	2.2	2.2	2.2	0.7	0.7	0.7			
Repairs to cars	0.3	0.3	0.3	0.3	0.3	0.3	0.3	0.3	0.3	0.3	0.3	0.3
Repairs to locomotives	...	....	....							7.0	7.0	7.0
Repairs to overhead construction and sub-station	....	....					7.0	2.4	1.4			
Wages, engineers and assistant				3.2	3.2	3.0						
Wages, engineer and fireman	3.2	3.2	3.0							3.2	3.2	3.0
Wages, motormen							1.7	1.7	1.25			
Wages, conductors	1.6	1.6	1.6	1.6	1.6	1.6	1.6	1.6	1.25	1.6	1.6	1.6
Wages, sub-station attendant							1.4	0.5	0.4			
Cleaning, light repairs, inspection	1.5	1.5	1.5	2.0	2.0	2.0	§	§	§	3.8	3.8	3.8
Fuel	1.8	1.8	1.8	15.0†	15.0	15.0				10.0	10.0	10.0
Fuel and water station, operation, repairs, etc.	0.3	0.3	0.3							0.8	0.8	0.8
Cost of power*							6.8	3.7	3.2			
Oil, waste and other supplies	0.4	0.4	0.4	0.6	0.6	0.6	0.1	0.1	0.1	0.8	0.8	0.8
Interest, insurance and depreciation	5.3	2.7	2.5	5.5	2.7	2.5	17.2	6.0	4.7	4.9	2.5	2.1
Total	16.4	13.8	13.4	30.4	27.6	27.2	36.8	17.0	13.3	32.4	30.0	29.4

* Includes fuel, labor, repairs, supplies. † Based on consumption of ¾ gallon per mile, 20 cents per gallon. § Included in items of repairs.

TABLE II.—COMPARATIVE INVESTMENT.
(Dollars.)

	Steam Motor Cars.			Gasoline Cars.			Electric Cars.			Steam Locomotives.		
Car-miles per day	180.	540.	960.	180.	540.	960.	180.	540.	960.	180.	540.	960.
Motor cars	(2) $35,000	(3) $52,500	(5) $87,500	(2) $35,000	(3) $52,500	(5) $87,500	(2) $16,000	(3) $24,000	(5) $40,000	......	......	....
Steam locomotives	......	......	.....	....	..	.....		.....	..	(2) $20,000	(3) $30,000	(5) $50,000
Cars		..	..							(2) 12,000	(3) 18,000	(4) 24,000
Overhead construction and bonding				...			68,250	68,250	68,250	...	......	...
Sub-station	.....	.....					3,500	3,500	7,000		.....	....
Gasoline storage	......	..	..	1,000	1,000	1,000				.....	....	...
Power station	......	......	......	....			25,000	25,000	50,000	.....	......	....
Total	$35,000	$52,500	$87,500	36,000	$53,500	$88,500	$112,750	$120,750	$165,250	$32,000	$48,000	$74,000

THE FORT WAYNE & SPRINGFIELD SINGLE-PHASE RAILWAY

The Fort Wayne & Springfield Railway, which is the third single-phase railway to be completed in Indiana, was recently put in operation between Fort Wayne and Decatur, Ind., a distance of 21.6 miles. This road has the distinction of being one of the few 6600-volt, single-phase systems in the country. The power generating and distributing system is of particular interest because of its simplicity. The

INSULATED SECTION OF TROLLEY AT DECATUR

high voltage used permits the road to be operated from the station at one end of the line without substations, and without feeders parallel to the trolley. Only two circuits leave the power house. One, a single 6600-volt line, continues to the 6600-volt trolley only, while the other supplies a low-voltage section of the trolley in Decatur. Current is generated at 6600 volts so that no step-up transformers are employed in connection with the system. Except for the a. c. feature, the road corresponds in construction with the best of practice in interurban work. The line passes through comparatively level country and very little grading was required to obtain a maximum grade of 1.08 per cent; in fact the deepest cut is only 10 ft. deep. There are two 5-deg. and two 3-deg. curves on the line, but other than these all curves are of long radius. The only steel structure of any consequence is a 155-ft. truss span across the St. Mary's River at Decatur. There are, however, nine short steel spans across waterways, all resting on concrete abutments. For the smaller waterways sewer pipe up to 24 ins. in diameter and concrete arches were employed.

The line was constructed on private right of way alongside a highway for practically its entire length. The right of way varies from 30 ft. to 150 ft. in width and the greater portion of it was purchased. The road is partially ballasted with gravel. The remainder is being ballasted as fast as weather conditions will permit. To obtain a 5-acre gravel bed near to the line a 210-acre farm was purchased outright. The ties are of chestnut and oak, placed 2 ft. center to center. The rails are 70 lbs. in weight and are in 30-ft. lengths. They are bonded with Ohio Brass Company No. 0000 bonds and are connected with six-bolt angle-bars. The standard poles are 30 ft., but poles of varying length up to 60 ft. were employed. The standard distance between poles is 120 ft. The distance, however, was in many instances shortened to 100 or 80 ft. to avoid road crossings or farmers' gates. On curves the poles are placed 60 ft. apart. The fact that the road was built alongside the highway made it advisable to put the poles all on that side of the track opposite the highway in order to reduce the liability of people coming in contact with them. The higher poles were used to carry the high-tension lines through the towns.

The overhead construction is that of the Ohio Brass Company. On straight track the T iron brackets are 10 ft. long, but on curves with poles on the inside they are 1 ft. 3 ins. longer in order to align the trolley properly. The messenger is supported on a triple petticoat, Locke No. 3 insulator bolted above the bracket and the No. 0000 trolley wire is supported from the messenger by hangers placed 10 ft. apart. At the center of the span the hangers are 7 ins. long, while those nearest the brackets are 18 ins. in length. At intervals of ¼ mile and at each end of curves the trolley is braced by "bridles." At these points the messenger passes under the cross-arm and is supported by a short span wire between

TROLLEY CONSTRUCTION ON CURVES, SHOWING "BRIDLE" IN THE FOREGROUND

two insulators placed underneath the arm. The trolley is also secured direct to the insulators. On curves where the poles are on the inside the trolley is pulled away from the poles by a short guy attached to an insulator placed underneath the end of the bracket. Where the poles are on the outside of the curve the same construction is employed, except that the insulator is placed between the pole and the messenger. Through Decatur a potential of 500 volts a. c. is employed on the trolley, and in Fort Wayne the potential is 550 volts d. c. At each end of the line where the change

from 6600 volts is made in the trolley potential there is an insulated section of trolley about 200 ft. long. By means of switches placed in boxes on poles near each end, the insulated section at Fort Wayne may be connected to either the high-tension a. c. or to the d. c. circuits and the section at Decatur may be connected to the high-potential or low-potential a. c. circuit. The cars are operated by running them under the insulated sections, and then by means of the switches connecting the insulated section with the trolley in advance of the car. The line is protected by lightning arresters placed at ¼-mile intervals.

POWER HOUSE

The power house and shops are located on a 14-acre tract of land in Decatur donated to the system by the city. The generating station is located in a structure measuring 86 ft. x 68 ft., built of concrete blocks and with steel roof-trusses. The station contains two generating units, each consisting of a Buckeye cross-compound condensing engine with cylinders 18 ins. x 36 ins. x 36 ins., direct-connected to a 400-kw, single-phase, 6600-volt, 25-cycle Westinghouse generator. The generators are excited from an exciter driven by a belt from the fly-wheel of the engine. The boiler equipment consists of three Stirling 228-hp hand-fired boilers. Feed water and condenser water are obtained from the St. Mary's River adjacent to the power station. The water flows through a 15-in. sewer pipe to a well 25 ft. deep and 10 ft. in diameter, from which it is drawn by the pumps. The condensers are of the jet type, and, together with the condenser pumps, are located in a pit in the rear of the boilers. Immediately above them is a tank used in securing a vacuum in starting the engines. The boiler feed pumps built by the Platt Iron Works, with cylinders 7 ins. x 4½ ins., are employed. The piping is such that either pump may be used for low duty or as a boiler feed pump.

STEEL SPAN ACROSS ST. MARY'S RIVER AT DECATUR

These pumps, as well as the other auxiliary apparatus, discharge into a Cookson feed-water heater. For the 550-volt trolley in Decatur the voltage is lowered from that of the machine potential by an oil-cooled transformer located in the generating station.

CAR SHOP AND CAR HOUSES

Adjacent to the power house is a car house constructed with concrete blocks.. The building is 33 ft. wide, 151 ft. deep, 22 ft. high, and contains two tracks. Each track is provided with a concrete pit 60 ft. long and 4 ft. deep. The machine shop and general repair shop is located in the rear of the building, the machine shop being supplied with a lathe, a shaper, drill-press and an emery wheel. Heavy work, such as turning wheels and pressing them on and off axles, is done at the brass foundry in Fort Wayne. The machinery in the shop is driven by a direct-current motor. Current for this is obtained from a generating set installed in the power station, consisting of a Westinghouse generator, direct-connected to a Westinghouse engine. The shops are steam heated from the boilers in the power house, the coils being placed in the pits.

CARS

The rolling stock consists of three passenger cars, a baggage car and fifteen flat cars used in construction work. The passenger cars, which contain three compartments, are

SHOPS AND POWER HOUSE AT DECATUR

53 ft. long over bumpers and 8 ft. 4 ins. wide. The width was limited because of the narrow devil strip in Fort Wayne. The cars are finished in mahogany and have plush seats in the main passenger compartment and rattan seats in the smoker. The baggage car is 44 ft. in length. The cars are heated with Peter Smith improved hot-water heaters.

The standard truck is of the Baldwin type with a 6-ft. 10-in. wheel base. Steel-tire wheels, 34 ins. in diameter, with 3-in. treads and ⅞-in. flanges are employed. All of the cars are equipped with four 106-A Westinghouse motors, each motor being 75 hp. The control equipment is of the Westinghouse electro-pneumatic a. c. and d. c. type.

Other than the terminal cities there are no large towns on the line. The country, however, is rather thickly populated and averages 652 people per square mile, taken 2½ miles on each side of the line. Decatur has a population of about 5000, while the population of Fort Wayne is approximately 60,000. This is the fifth interurban road and the second single-phase road to be built into Fort Wayne.

The road was constructed entirely by the railway company, under the direction of W. H. Fledderjohann, president and general manager. T. W. Shelton, superintendent and electrical engineer of the road, was in immediate charge of the construction work.

REPORTS OF THE COLUMBUS CONVENTION

The reports of the Columbus Conventions of the Engineering Association, the Accountants' Association, and the Claim Agents' Association have just been published. They are bound in the distinguishing colors of the three organizations and contain the official reports of the proceedings of the 1906 conventions. The typographical work on each is excellent, and speaks well for the plan of issuing the transactions of the affiliated associations from one office. These pamphlets will well bear re-reading and are valuable contributions to the art.

ANNUAL CONVENTION OF THE IOWA STREET AND INTERURBAN RAILWAY ASSOCIATION

The fourth annual convention of the Iowa Street and Interurban Railway Association was held at the La Fayette Inn, Clinton, Iowa, Friday and Saturday, April 19 and 20. The meeting was well attended, the papers presented were carefully prepared, and much interest was taken in their discussion.

The first session was called to order Friday morning at 10 o'clock. Mayor H. U. Crockett, of Clinton, in a few appropriate remarks welcomed the convention to Clinton, adding that he would turn the keys of the city over to Vice-President P. P Crafts, of Clinton. C. D. Cass, of Waterloo, responded to Mayor Crockett's address in a timely manner, after which President F. J. Hanlon addressed the convention.

In his address President Hanlon said the association's most important work of the year was that concerning legislation. Owing to the effective organization many harmful bills were sidetracked. Among the most important were those prohibiting running-boards, Sunday closing, wire regulation bill, and the securing of a 10 per cent minimum on the two-cent-fare bill.

Before presenting his report Secretary and Treasurer L. D. Mathes announced that the offices of the Clinton Gas Light & Coke Company, of the Iowa & Illinois Railway and of the Clinton Street Railway were open to the use of delegates. Likewise the Elks' Clubs extended to delegates the use of the club-rooms. Mr. Mathes also announced that membership badges served as passes on the Iowa & Illinois Railway, the Clinton Street Railway and the Tri-City Railway at Davenport, Rock Island and Moline.

In his report as secretary and treasurer Mr. Mathes said that the heartiest support had been given him by all of the members. The only criticism was that some were tardy in answering correspondence. He requested in his report that all members becoming involved in Supreme Court proceedings forward to him 20 copies of the briefs for distribution among the members. The report showed a balance of $230.92 in the treasury.

On a motion by George B. Hippee, of Des Moines, the reports of the secretary and treasurer were accepted as read and published.

The first paper to be presented was that by H. W. Garner, general manager of the Oskaloosa Traction & Light Company, entitled, "Amusements—How Should this Feature be Handled by Operating Companies?" This paper was printed on page 696 of the STREET RAILWAY JOURNAL of April 20.

DISCUSSION ON AMUSEMENTS

In the discussion following, Mr. Hippee said he thought the character of the amusement features to be put into parks was governed by local conditions. He agreed with Mr. Garner that railways should go slowly in developing amusement parks and not too heavily at first. In Des Moines, he said, they started with nothing but a park. There were no buildings nor attractions. A moving-picture outfit was the first amusement feature. Now there are numerous amusements, and vaudeville entertainments are given in a theater every evening during June, July and August. These features usually are operated by amusement companies on a percentage basis. He had heard managers say they depended altogether on bands to attract people. In Des Moines it had been proven that the people would not patronize bands; it was necessary to have a good vaudeville show, and the people insisted on a good show, too. The park in itself had never paid expenses. However, traffic on the park line had been increased 50 per cent. The theater performances were advertised as being free, but occupants of seats near the stage were charged 10, 15 and 25 cents. The coming season will see a slight increase in charges, making them 10, 15, 25 and 35 cents.

P. P. Crafts, general manager of the Iowa & Illinois Railway, extending 36 miles between Clinton and Davenport, said he would like to give the association the benefit of the experience of his road with a rather peculiar park proposition. Owing to attractions at each end of the line and the great amount of equipment necessary to care for short-haul traffic, he had concluded not to develop a general amusement park. Instead, he had established a picnic park at a midway point. This had a large wooded area, with conveniences for picnic parties, including a dancing pavilion. Band concerts were given two and three times a week.

The fare was usually 50 cents round-trip from terminals, but for special excursions it was made 40 cents and sometimes for Sunday-school picnics it was reduced to 25 cents. The receipts from the refreshment stand paid for all park expenses, exclusive of music. Although he had gone into the proposition with misgivings he felt the enterprise had been fairly successful, and he believed an interurban line could conduct a park of this character successfully.

R. M. Howard, general manager of the Clinton Street Railway, wanted an expression of opinion regarding charges for park admission. He had found that all money for attractions came out of the fares and had almost concluded to make a charge of 10 cents for admission to the park.

Mr. Crafts said that a few years ago at Saginaw, Mich., a charge of 15 cents round-trip to the park was made and 5 cents credited as admission to the park.

Mr. Hippee said that three or four years before starting their present park at Des Moines they had tried to charge admission to another park. The proposition ended in a flat failure. He thought it depended a good deal on the way the people were educated. In general, however, parks should be operated free, as people will spend their money after they get in.

Secretary Mathes said that he believed railway companies educated the people wrongly at times. At Dubuque their park showed earnings of $7,500 per month for a season of three months. Attractions cost about $4,000 per month. He would like to put on a gate fee, as they had about 25,000 people per week for 12 weeks. At present everything is free and he was a little afraid to put on a charge. With regard to the moral atmosphere of their park it was regarded locally as a great moral uplift because it drew people away from worse places. The educational authorities and ministers felt that the company was doing much good for the town by operating the park.

Mr. Hippee told of a scheme used two or three days a season in Des Moines to increase attendance at matinée vaudeville performances. Twenty-five dollars was distributed in envelopes—$10 in one, $5 in two, and $1 in five envelopes. It was then advertised that with every ticket purchased an envelope would be given and among these would be those containing the money. This scheme always resulted in crowded houses.

Mr. Mathes asked Mr. Hippee if there was any objection by patrons to paying for seats in the theater. Mr. Hippee said they seemed to want to pay for them. The 10-

cent seats had the least sale of any on every night except Sunday, when the theater was patronized by a different class of people who took their families with them. Seats could be reserved at a down-town office before going out to the park, and frequently over half of the high-priced seats were sold before night. On the park lines there was an increase of over 500,000 passengers during June, July and August.

J. G. Huntoon, general superintendent of the Tri-City Railway, thought it a good plan to add special features or novelties to the regular entertainment features at times throughout the season. To explain what was meant by a novelty he related an incident at their park. An unkempt, vagrant-like individual presented himself at the railway office and offered to make an engagement to walk across Rock River at the park on a tight rope. The performance was well advertised and drew a large crowd. The performer, however, overestimated his ability, for he fell into the water after taking only a few steps. The performance was, in truth, a novelty to the spectators. Mr. Hippee said he had gotten Hagenbeck to drive his elephants into the river, and this drew a crowd.

C. D. Cass, general manager of the Waterloo, Cedar Falls & Northern Railway, brought up the subject of Chautauquas. The Chautauqua held at their park had been growing larger every year for 10 years. Its meetings continued from 1 to 4 weeks. Last year the Chautauqua put up a $20,000 building seating 6000 people. The association cost the railway company practically nothing. Last season the Chautauqua engaged Thomas's Orchestra to give afternoon and evening concerts for a week at a cost of about $10,000, and although it lost about $1,500 the orchestra has been engaged the coming season.

R. A. Leussler, assistant manager of the Omaha & Council Bluffs Street Railway, said with his company the park experiment had always been carried on at a loss, but the receipts from increased travel were far greater than the loss on the park. He thought the greater the variety of the attraction the greater the attendance. At their park was a lake 4 miles long and 2½ miles wide. The row-boats and electric launches proved great attractions. He found the roller coaster the greatest moneymaker. A coaster costing $9,000 or $10,000 would pretty nearly pay for itself the first year. In other places it had been shown that this amusement device drew pretty nearly as many people the second, third and fourth as the first. With them the "merry-go-round" was second as a moneymaker, and the row-boats third.

STORAGE BATTERIES

After the close of the discussion on amusement features J. M. S. Waring, of the Electric Storage Battery Company, gave a well-prepared talk on storage batteries.

Up to three or four years ago, Mr. Waring said, there were two general classes of batteries in railway work: One type — the power-house battery — was installed in direct-current power houses with regulating apparatus of such a nature that the battery ordinarily discharged under heavy load and was charged when the load was light. The other type of battery was a line battery, either without booster or with a booster at the power house or at the battery. Recently, however, the field has broadened greatly, principally due to the use of alternating current in railway work; and now, besides the two classes of batteries mentioned, several types had been developed to work in connection with alternating current. Mr. Waring divided these batteries into four classes. Batteries of the first class are installed in cases where the entire a. c. power-house load is to be regulated and turned out partly as alternating current and partly as direct current. The battery discharges not only at times of heavy load on the direct-current side, but also with heavy loads on the alternating-current side; a battery of this type is installed on the Oneonta & Mohawk Valley Railroad, New York. Batteries of the second class are installed where the entire load on the power house is alternating current; a battery of this type has been installed by the Spokane & Inland Railroad in connection with a motor generator set, consisting of a three-phase induction motor, a 550-volt direct-current machine and a 25-cycle alternator. The battery is connected across the direct-current machine. Under heavy loads the battery discharges through a motor and supplies the line; and conversely, when the load is light, the direct-current machine gives out power to the battery and charges it. Batteries of the third class are installed where there is both a fluctuating a. c. load and a fluctuating d. c. load, as there will be in the new Indiana Steel Company mills now being built at Gary, Ind. The a. c. load will vary from 2000 to 14,000 hp in from 5 to 10 seconds. The direct-current fluctuations will be caused by the motors driving the unloaders on the batteries; in this case the battery is across the a. c. bus-bar and connects the d. c. and the a. c. systems. The heavy a. c. load is thrown partly on the d. c. buses and the battery takes the heavy loads thrown on the a. c. buses. The fourth case is where there is an a. c. supply and an a. c. demand, and the battery is connected to the system through proper transforming apparatus. Mr. Waring also mentioned three methods of installing line batteries. The first was where the battery was installed at the end of a line without a booster. Assuming an average voltage of 500, a minimum voltage of 200, and a maximum voltage of 650, without the battery, the battery would be installed to operate at 500 volts, and with such a battery the voltage would fluctuate between 450 and 500 volts. The second case was where the battery was installed at the end of a trolley line with a booster at the power house. In addition to increasing the average voltage, the booster furnished a means of controlling the battery. The third case was where line batteries were installed, as on the elevated roads in Chicago. Boosters are installed at the batteries and an attendant is required. A battery of this type installed at Robey Street on the Metropolitan West Side Elevated road, he said, cost less money than the copper that would have been required to maintain the proper voltage, and it had the added advantage of regulating the load on the power house.

In enumerating the functions of a battery he said they improve the efficiency of the generating apparatus, and that they reduce the number of generators required and thereby eliminate construction expenses. On the Metropolitan West Side Elevated System, Chicago, on a certain day in January before the batteries were installed a trial was made and a similar test the same month a year after the battery was installed. Although the load had increased 25 per cent on peaks in the meantime, the total load factor on the station had been improved and the actual boiler hours during the test were 10 per cent less than when no battery was installed. The decreased boiler hours resulted from the fact that without the batteries the boilers were maintained banked, ready for emergency; while after the batteries were installed this practice was abandoned, as the battery would carry the load until the boilers were fired up. He also spoke of the reserve features of batteries

or their ability to take care of the load for a short time in case of a breakdown.

At the conclusion of Mr. Waring's talk Secretary Mathes wanted to now what the depreciation on storage batteries was as compared with that on engines, boilers and other equipment. Mr. Waring said the depreciation varied according to the nature of the service. It was very severe on the elevated roads in Chicago, where there were two peaks to be taken care of per day. In this class of service the depreciation was about 5 per cent per annum. Everything else being equal, he said the depreciation on the positive plate was proportioned to the ampere hours discharged. An installation for railway work in Wisconsin had, after 12 years, shown a maintenance cost of less than 3 per cent per annum, and part of this was for attendance. The depreciation in batteries was not exactly the same as with engines and generators. After fifteen years these were usually obsolete, and this was kept in view in determining the rate of depreciation to be charged. With a storage battery, however, a charge of 5 per cent not only maintained the battery but also kept it up-to-date.

H. B. Noyes, chief engineer of the Omaha & Council Bluffs Railway, said, with regard to depreciation on other railway apparatus, that it varied from 5 per cent on a pole line to 8 per cent on generating apparatus.

TRAIN DISPATCHING

At the afternoon session H. H. Polk read a paper, entitled "Modern Train Dispatching Methods on Electric Railways." This paper was printed in the STREET RAILWAY JOURNAL of April 20 on page 695. Mr. Crafts started the discussion on dispatching by giving a few of his ideas. Under general conditions he said he thought we depend too much on steam-railway methods. Where train movements were absolutely regular and cars were on time he did not think it necessary to get train orders and clearance cards. It should be an unusual condition that called for a clearance card. On his line he had a standing stop order. A train 33 minutes late must report to the dispatcher. A train crew arriving at a meeting-point and not finding a car there must report for an order. Right of way was not given to cars going in one direction. If a train was late it was pulled through as quickly as possible. He believed that making the unusual occurrence call for a train order rather than the usual one tended to eliminate accidents.

Mr. Polk said Mr. Craft's idea of running on a time-card was very good, but he thought running on a time-card and on train orders, too, doubled the precaution. On the Des Moines interurban lines all inbound trains had the right of way over outbound trains, as it had been found that it was easier for outbound trains to make up time. Regarding surprise tests, he frequently went out on the line and took off switch-lights or reversed them from green to red. On such tests his men never ran against a red light, but he had trouble in getting them to report dead-lights.

Mr. Crafts said he had frequently turned switch-lights and always found his men on their guard. He could not give cars in one direction right of way over the others, because there was a city at each end of the line.

Regarding switch-lights Mr. Hippee said it cost the Des Moines interurban roads over $75 per month to take care of oil switch-lamps. Mr. Crafts said oil switch-lamps cost him about $655 per year.

Mr. Cass said conditions on his road were different because it was operated partly by steam. Steam-road practice was used entirely. He suggested that to avoid switches being left open stub-end switches should be employed.

Mr. Crafts objected to the time required to head-in and back-out when these switches were employed. At the two regular meeting-points on his line there were spring switches, and cars were slowed down for them.

FREIGHT HANDLING

An animated discussion followed the reading of a paper by Mr. Crafts on "Freight Handling by Electric Lines," published on page 699 of the STREET RAILWAY JOURNAL for April 20.

In reply to Mr. Polk's question as to whether he had any stockyards along his line, Mr. Crafts said he had not, and added that his road had no joint-rate agreement with steam roads, and that the farm products handled consisted of only corn, oats and feed. Mr. Polk said his line got about 30 per cent of its gross receipts from freight. He said that Eastern men who say it costs $1.50 to handle $1.00 worth of freight evidently don't know how to handle it.

Mr. Hippee said a few years ago, when promoting their first interurban line, the financial men inquired about the passenger earnings only and said nothing about the freight earnings.

Against the claims of some who said interurban roads were not built to stand freight traffic Mr. Crafts said he failed to see why an electric railway operating 30 to 50-ton cars at a maximum speed of 50 miles per hour could not stand freight traffic. When his line went into the express business a car with standard motors and trucks was purchased so that in the event of failure the express body could be sold and the trucks and motors put under a passenger car. He believed that when the passenger business warranted the construction of from 30 to 50 miles of road there were chances for good freight business. He said the earnings from freight on his road were from $15,000 to $16,000 per year, while the expenses of handling freight were about $8,000. But the business had reached a point where the increase in gross earnings was not followed by a corresponding increase in expenses.

A. Parks, who is promoting the Des Moines, Winterset & Creston Railroad, wanted to know if there was anything in the operation of cars by electricity which would prevent handling carload-lot freight.

Mr. Polk said there could be nothing except the question of power. He had never made any tests between steam and electric haulage. However, when trains of over 10 or 12 cars were to be handled he thought steam operation the cheaper. One advantage of the use of electricity was that when trains were sidetracked no power was being used.

President Hanlon said with 60-lb. rails he could not see where there could be difficulty in the handling of 40,000-lb. cars with loads of 100,000 lbs. He did not believe in delivering to store doors. He had tried it and thought it a useless expense. It consumed too much time. He thought interurban terminals should be close to the business portion of cities. He did not believe in cutting steam-road rates; it destroyed standing with them. As to billing forms, he thought the steam-road methods the best that could be gotten.

STEAM MOTOR CARS

The paper prepared by W. G. Wagenhals, of St. Louis, entitled "Steam Motor—Its Value for Interurban Service," in the absence of Mr. Wagenhals was read by Secretary Mathes. Before reading it Mr. Mathes said the paper had been put on the program as a counterpart to a paper presented by Mr. Hild on the self-propelled motor car at the

session last year. Accompanying the paper which was published on page 698 in the Street Railway Journal of April 20, were photographs showing some of the features of Mr. Wagenhals' steam-motor car.

At the conclusion of the reading of the paper Mr. Hippee wanted to know the number of men required to run the car described.

Mr. Polk said he did not see why the car should require any more help than a steam automobile. He said a good many lines could be built in Iowa if it was not necessary to electrify them. He believed a self-propelled car would enable such roads to be built. As a possible location for such a line he spoke of two towns 24 miles apart where a connecting line would serve only about 10,000 people. Only three or four trips of passenger cars would be required per day. Freight could be handled by a steam locomotive. Mr. Hippee thought a steam car for interurban service should have a non-explosive boiler. There was an element of danger in a high-pressure steam boiler.

J. E. Osmer, master mechanic of the Northwestern Elevated Railroad, Chicago, endorsed Mr. Hippee's remarks. He thought, from the standpoint of safety, a flash boiler should be used. He objected to the truck design of the Wagenhals car, saying he preferred inside to outside-hung brakes because of the tipping in stopping if the brakes were not released before the car came to a stop.

Mr. Crafts said the cars of the Union Pacific Railroad were the simplest self-propelled cars he had seen. Mr. Hippee replied that he understood the cars were not very reliable. He suggested that in case of a head-end collision of the Wagenhals car the fuel oil would be scattered and a big fire would be started.

JOINT TRACK OPERATION

The paper by Isaac B. Smith, traffic manager of the Cedar Rapids & Iowa City Railway & Light Company, on "Joint Operation of City and Interurban Cars Over City Tracks," consisted mainly in a discussion of the laws recently passed by the Iowa Legislature regarding this subject. The reading of the paper was followed by a very interesting discussion.

Mr. Hippee said an interurban company should use as few miles of city track as possible. It was not necessary that interurban cars get to a terminal loop in the heart of the city. In Des Moines he said they expected to make a separate loop for interurban cars and keep them off the city loop. The interurban cars would be brought to the business district of the city, but to one side of the central portion. He thought it of the utmost importance that the city schedule should not be disarranged by the interurban cars, as the city people must be given the service they demand. At least 5 minutes were required to unload and load an interurban car, and where city and interurbans were operated on the same terminal loop the city service suffered. He favored a separate interurban terminal such as that at Indianapolis, where baggage as well as passengers could be taken care of.

President Hanlon wanted to know which should be given preference in joint operation—interurban or city cars?

Mr. Crafts said he had been able, with the co-operation of the city roads, to have the interurban cars given the preference. But if they are late they drop behind the city cars. He had spent several thousand dollars to cut off a mile of city track. He thought that under all conditions the interurban should use as few miles of city track as possible. To catch the traveling man he thought interurban cars should take them direct to the hotels and the business district. He thought the interurban depôt should be on the outgoing end of the loop, when a loop was used, and the loop should be a short one. To show the delays possible when interurban cars follow city cars, he said on one occasion a city car got ahead of an interurban car and delayed it on the city tracks 4 minutes. This killed the interurban meeting-points and caused the interurban car to reach the end of the run 15 minutes late.

In reply to Mr. Craft's statement that interurban cars should be given preference over city cars in order to compete with steam roads on through-business, F. L. Diserens, superintendent of the Cedar Rapids & Marion City Railway, said that although their time between Cedar Rapids and Marion was about twice that of the steam road and that the fare was higher on the electric line, passengers deserted the steam road to take the electric line.

With regard to reduction in running time, Mr. Crafts said the running time between Clinton and Davenport was, first, two hours and fifteen minutes; later it was reduced to one hour and forty minutes, and later to one hour and eighteen minutes.

GENERAL MATTERS

At the close of the discussion concerning the operation of interurban cars in city streets, Secretary Mathes asked for expressions regarding whether or not the new anti-pass bill applied to city cars.

Mr. Hippee said it not only included street cars but that it applied to hacks, cabs and all public conveyances and common carriers. It applied to everybody except those who gave all of their time to the railway. However, a clause provided that where the terms of a franchise included the hauling of certain officials the terms of the franchise were to hold.

E. L. Kirk, manager of the Sioux City Traction Company, wanted to know how people having park concessions would be treated under the anti-pass law.

Mr. Hippee said they would have to pay fares as they did on his line now. The company paid them and he saw no reason why they should not pay their fares.

Secretary Mathes announced that inasmuch as the question of depreciation was a very broad one and was before the national convention, it would be dropped from the program.

On a motion by Mr. Cass the secretary was instructed to convey to the officials of the Iowa & Illinois Railway the Clinton Street Railway, and the Clinton Gas Light & Coke Company the thanks and appreciation of the association for the excellent manner in which the association had been entertained.

On behalf of the entertaining companies Mr. Crafts said that if the officers had been able to make the stay pleasant for the members they were happy.

The nominating committee, composed of R. A. Leussler, G. B. Hippee and E. L. Kirk, reported that in view of the efficient and satisfactory service rendered by the present officials that it recommended President F. J. Hanlon, of Mason City; Vice-President P. P. Crafts, of Clinton; and Secretary and Treasurer L. D. Mathes, of Dubuque, be re-elected for another year. The secretary was instructed to cast a unanimous vote for these officials. The invitation of Mr. Hippee to hold the next convention at Des Moines was accepted.

Mr. Garton, on behalf of the supply men, said that the supply men were most grateful for the treatment accorded them. The arrangements provided for exhibits were most satisfactory.

Mr. Hippee suggested at the next meeting instead of giving all the time to the reading of papers that subjects relating to operation be selected and several members be appointed beforehand to lead in the discussion.

Before adjournment considerable time was spent in considering the question of handling rush-hour or peak traffic on city lines.

Mr. Kirk said that at Sioux City they had gone to the extreme in the use of trailers. They were not able to trace a single accident to the use of trailers in the last five years. He believed where extra equipment was not required more than forty or fifty days a year that trailers should be used. The trailers were operated by one man. Hand-brakes had been used in the past, but recently straight air-brake equipments had been purchased. The cost of trailers was about $1,000, as against a cost of $2,000 for a motor car. The maintenance was almost nothing. They were pulled around a loop down-town, but at the terminal of the park line a "drag-out car" was employed. This car, which was passed by the train on a siding, backed in, was coupled to the trailer and pulled the latter on the return trip. This plan required the use of one extra motor car.

Mr. Huntoon said that at Davenport they used trailers on some lines and raw trippers on others. He could not agree with Mr. Kirk that no accidents were due to trailers; most of those occurring were running-board accidents. Mr. Kirk explained that he regarded these accidents as due to open cars and not to trailers.

G. E. Miller, superintendent of the Union Electric Company at Dubuque, said they ran trailers last summer and had only one trailer accident. They could not maintain a fixed schedule during the rush hours — cars were closed up regardless of all schedules. Men were put out along the line to keep the cars moving. These men were put at central points where traffic was heaviest. They did not let all the cars go from one end of the line to the other. On one line there were four turning-points and certain cars were assigned to short hauls. Mr. Miller believed it paid to use trailers on big days. The avoidance of trailer accidents was all in the training of men. It was necessary to get the men together frequently and drill into them the importance of observing the rules. Men were required to signal by whistles; no hand signaling was allowed.

John A. Higbee, superintendent of the People's Gas & Electric Company, said that at Burlington they used trailers quite extensively. They were employed on a park line on which there was a 4½ per cent grade three-quarters of a mile long. One trailer and a motor car were used up the hill, and frequently the trailers were stored on top of the hill and two trailers were carried down behind a motor car. A conductor was put on each trailer. Motormen were signaled by a bell.

At the end of the discussion the convention adjourned.

EXHIBITS AT THE IOWA CONVENTION

At the annual convention of the Iowa Street and Interurban Railway Association and the Iowa Electrical Association, held at Clinton, Iowa, April 19 and 20, a departure was made from the usual practice of having the exhibits arranged in the rooms of the hotel, the basement being given over to the exhibits. The basement was wired for both alternating and direct current, furnished gratis by the local companies, and was filled with well-decorated booths built on either side of a central passageway. Among the companies exhibiting apparatus and which were represented at the convention, were the following: Allis-Chalmers Company; American Steel & Wire Company; Atlas Railway Supply Company; Benjamin Electric Manufacturing Company; Buckeye Electric Company; Electric Service Supplies Company; Electric Storage Battery Company; W. R. Garton Company; General Electric Company; Gould Storage Battery Company; H. W. Johns-Manville Company; Kalamazoo Railway Supply Company; National Carbon Company; National Conduit & Cable Company; National Brake & Electric Company; Ohio Brass Company; Ohmer Fare Register Company; St. Louis Car Wheel Company; Standard Underground Cable Company; W. T. Van Dorn Company; Wagner Electric Manufacturing Company; Westinghouse Electric & Manufacturing Company, and the Western Electric Company.

ENTERTAINMENT AT THE IOWA CONVENTION

Delegates at the Iowa Street and Interurban Railway Convention, held at Clinton the 19th and 20th, were well entertained by a series of events arranged by the entertainment committee, consisting of P. P. Crafts, general manager of the Iowa & Illinois Railway; R. M. Howard, general manager of the Clinton Street Railway; and Thomas S. Crawford, general manager of the Clinton Gas Light & Coke Company. Membership badges served as passes over the Clinton Street Railway, the interurban railway between Clinton and Davenport and the lines of the Tri-City Railway in Davenport, Moline and Rock Island. Friday afternoon a party of about forty accepted the invitation of G. E. Lamb, president of the Iowa & Illinois Railway, to accompany him on an excursion on the Mississippi River in his houseboat. Friday evening a smoker and Dutch lunch was held in the dining-room of the Lafayette Inn, at which the entertainment features consisted of music and of story-telling by members and trade representatives. Saturday afternoon two carloads of members and trade representatives made a trip in special cars over the Iowa & Illinois Railroad to Davenport. Here special cars of the Tri-City Railway conveyed the party to the United States Arsenal on Rock Island. The party, after inspecting the Government and Tri-City Railway water-power plants and the Tri-City Railway steam-generating station, were met in Rock Island by special cars, and after a trip through the residence portion of Davenport were conveyed to the Davenport Commercial Club, where dinner was served. Hon. Joseph R. Lane, of Davenport, acted as toastmaster at the dinner and introduced the speakers, including George B. Hippee, L. D. Mathes, and Mayor Crockett, of Clinton.

FIELD GLASSES FOR LINE INSPECTION

The inspection of overhead lines, if done with care, is a matter of considerable physical difficulty. It involves much walking, sometimes a large amount of pole climbing, and generally uses up a great deal of nervous energy if the inspector is conscientious. The labor may be considerably decreased by the use of a light field glass, and in climates where the percentage of sunshiny days is liberal the glass can be made much more effective by the use of a small hand mirror in connection with it. By taking the proper position on the ground beneath the line and reflecting the rays of the sun upon the insulator, tin, wire or crossarm under observation through the field glass serious defects can be located almost as well as though the inspector were at the top of the pole.

DEPRECIATION IN CLEVELAND

The following description of the policy of the Cleveland Electric Railway Company in charging for depreciation was made public last week. It is from the 1906 report of the secretary and treasurer of the company, H. J. Davies, to President Andrews:

Track Depreciation—Following the suggestion made in my last annual report, a charge has been made each month to expense, and a corresponding credit to a number of reserve accounts, which we have called "Depreciation Reserves," for wear and tear of track, equipment, etc., in addition to the ordinary repair charges. The rule of the Street Railway Accountants' Association, as expressed in the Standard Classification of Operating Expense Accounts, provides that all expenditures for repairs and renewals shall be charged to maintenance (expense) accounts. This rule, if not incorrectly expressed, is likely to be misinterpreted and misapplied. The rule should provide that there be charged to expense all expenditures for repairs as distinguished from renewals, and, in addition, each month, by way of reserve, a sum large enough to take care of or provide for the wear of the month, this sum to be such a proportion or percentage of the cost of renewal as the month bears to the probable life of the property; so that when a piece of track or equipment is entirely worn out and replacement must be made, a reserve sufficient to pay for the replacement will appear on the books. The reserve and the value of the property ought to equal at any time the cost of replacement. It would be still more accurate and scientific to charge to maintenance expense a certain sum per car-mile run in each month, large enough to cover both ordinary maintenance charges and the month's proportion of the probable cost of renewals, crediting this sum to a "Renewal Reserve" account.

To follow strictly the rule of the association would require that the cost of renewals be charged to expense in the year or month in which the renewals are made, throwing an abnormal burden on the summer months, when track-laying is done, whereas the wear on the track is as great per car-mile run in the winter months as in summer. If, instead of charging the cost of renewal to expense at the time the expenditures are made, the cost be spread over several future months or years, as was our custom until recently, the subsequent periods will show a much larger maintenance expense than the period immediately following construction. The first few years after construction, if no charge is made for renewal, will show very low maintenance cost; the first few years after renewal, if the cost of renewals is made and spread over a term of years, will show very high cost of maintenance. This method of accounting has deceived stockholders and the public as to the earnings of street railway companies, and as to the cost of carrying passengers. No provision having been made in the early years of operation for renewal reserves or funds, the owners of street railway properties have had to provide additional capital for renewals; and this had led in many cases to over-capitalization. And this process of renewing from new capital has been repeated by some companies several times.

Provisions should be made from the current earnings of the company for depreciation of its property by reason of wear, for depreciation by reason of progress and improvements in the arts of manufacture and in methods of operation, and for decrease in the value of franchise due to lapse of time. There is less excuse for neglecting this provision on the part of companies possessing short-time franchises than on the part of those, like the New York and Pennsylvania companies, that have franchises running for ninety-nine or 999 years. But I know of no railway company in the country that is making adequate provisions for this deterioration and depreciation.

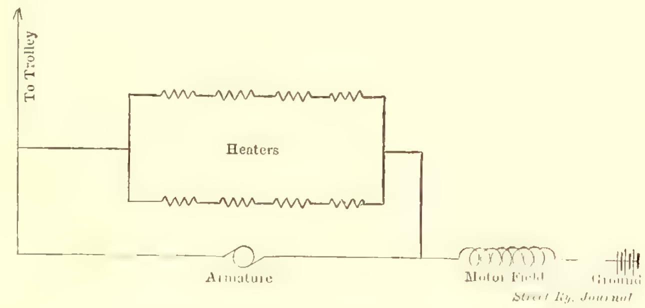
Depreciation of Cars—We own 876 passenger cars. If they were all of our new convertible type, we might be able to do the present business with 800. Eight hundred convertible cars, with trucks, motors, air brakes and other accessories, would cost us now, new, nearly $4,000,000. Their life would probably not exceed ten years. To provide funds for 800 new cars when these wear out, we should, therefore, charge to expense, in addition to expenditures for ordinary maintenance, or, at least, should deduct from income in some way and put in a renewal reserve for cars and motors, nearly $400,000 per year. As before stated, we charged off $20,000 for this purpose last year.

Our total depreciation charges amounted to 1.24 per cent of our capitalization of $31,426,000; to 2.6 per cent of $15,000,000, Mayor Johnson's estimate of the cost of reproducing the entire property.

METHOD OF FINDING THE EFFECT OF STRONGER FIELDS

The method employed in a Western interurban railway repair shop of finding out what would be the effect of putting more turns in the fields of a motor may be of interest to some who suspect that the faulty action of a motor is due to weak fields. This test was employed after the failure to locate in the armature or in the setting of the brushes the cause for excessive sparking at the brushes of a motor. The proposition of winding a set of fields with square wire and a greater number of turns to test the effect of stronger fields was being considered, but this would have been rather an expensive procedure.

The accompanying diagram illustrates the manner in which the effects of additional field turns were obtained



HEATERS IN SHUNT AROUND ARMATURE

with very little trouble and with practically no expense. The diagram shows the heaters of the car placed as a shunt around the armature of No. 1 motor. When the motors were thrown in multiple the effect of the connections illustrated was simply to increase the current through the fields while the armature current remained practically the same as without the shunt, because the drop in voltage in the fields of a railway motor is very small, as compared with the drop in the armature. In the test cited the heaters were connected to permit of three gradations of current, and with both of the heater circuits connected in, the current through the field, by actual measurement, was about twice that through the armature, that is, the fields were as strong as they would have been with double the number of turns on them.

Between St. Louis and Springfield, Ill., a distance of about 96 miles, the McKinley system of interurban lines charges 2 cents per mile on its limited trains. The fare for the round-trip averages less than 2 cents per mile. The average fare in one direction is, approximately, 2 1/10 cents per mile; the average fare on a round-trip is, approximately, 1 3/5 cents per mile. This is the basis of the schedule on practically all the company's roads. The system runs eight trains from St. Louis to Springfield and eight from Springfield to St. Louis every twenty-four hours. The trains are known as the Corn Belt Limited and the Capitol City Limited. The trip of 96 miles is made in about four hours. The fare from East St. Louis to Springfield is $2. The fare for the round-trip is $3.15. Seven trains passing through Springfield are operated each way between St. Louis and Bloomington.

SPECIFICATIONS FOR CREOSOTED WOODEN BLOCKS AND SUB-STRUCTURE

The use of treated wooden blocks for paving would seem especially attractive to the street railway company because a pavement of this character can be so easily taken up whenever track inspection is required.. It would be wrong, however, to deny that this advantage is nullified by improperly shaped blocks whose interstices permit water percolation or if the wood is of such character that it will swell and thereby throw the rails out of gage. Hence it is essential that the blocks as well as sub-structure for this class of pavement should comply with the most rigid specifications. The nature of these requirements is well illustrated by the methods followed by the Wyckoff Pipe & Creosoting Company, of Stamford, Conn.

The blocks are cut from sound yellow pine or gumwood, free from knots, shakes, worm holes, rot, or other defects. The blocks are rectangular, and dressed on all sides except the top and bottom. None is allowed to vary more than 1/32 in. in length or width and 1/16 in. in depth.

The standard size is 8 ins. long, 3 ins. wide and 3, 3½ or 4 ins. deep; but all the blocks used in any one contract have the same depth. The grain of the wood stands vertical, the ends of the grain forming the top and bottom.

The completed blocks are thoroughly waterproofed and otherwise freed from decay by treatment with live steam between 220 degs. F. and 275 degs. F. at 30 to 40 lbs. per square inch, in a closed cylinder, from 3 to 6 hours, according to the condition of the wood and the season. At intervals during this process a valve is opened at the bottom of the cylinder to drain the condensed steam and sap. When the steaming has been completed the sap and condensed steam are blown out of the cylinder through an opening at the bottom and the remaining steam is allowed to escape through the top of the cylinder. After this the exhaust valves are closed and a vacuum pump is immediately applied to maintain a 24-in. vacuum until all moisture has been exhausted. During the entire process the wood is kept hot by steam coils within the cylinder.

The preservative treatment begins by at once filling the cylinder with creosote at a temperature of at least 175 degs. F. This is pumped in until the wood has absorbed the specified amount—between from 12 to 20 lbs. per cubic foot. The oil is required to have a specific gravity at 38 degs. C. of at least 1.06 and not more than 1.2; be liquid at 15 degs. C.; leave no more than a trace of residue on a filter paper at 15 degs. C.; not contain more than 3 per cent water; upon heating to 235 degs. C. to retain at least 80 per cent of the original volume; and to contain no acetic acid nor acetates.

Before these blocks are laid the earth foundation or subgrade should be brought to an even surface, parallel with the grade proposed for the pavement, by making the necessary excavation or embankment. Soft or spongy earth or other material not affording a firm foundation should be removed and the space filled with sound stone, broken as specified for concrete, which shall be solidified by ramming or rolling. The sub-grade surface should be compacted by a steam roller which will give a pressure of not less than 250 lbs. per lineal inch of roller. Any portion not accessible to the roller should be thoroughly compacted by ramming. When the rolling and ramming are completed the surface should be true and smooth, 6½ ins. plus the depth of the blocks below the proposed finished surface of the pavement. On this sub-grade there should be laid a bed of Portland cement concrete 6 ins. thick, made of 1 part Portland cement and 4 parts of clean, sharp sand thoroughly mixed dry and then made into mortar by adding clear water and again mixing; 7 parts of crushed limestone, other approved stone or screened gravel, free from dust or dirt, drenched with water, but containing no loose water in the heap, should then be incorporated immediately with the mortar. Each batch of concrete shall be thoroughly mixed, the mixing to be continued until each piece of stone is completely coated with mortar; it should then be spread and at once be thoroughly compacted by ramming until free mortar appears on the surface. The broken stone should not measure more than 2 ins. on the longest diameters, and not less than ¼ in. on the smallest diameters.

The upper surface of the concrete should be made smooth and exactly parallel with the proposed surface of the pavement and lower than the proposed surface of the pavement the depth of the blocks, plus ½ in.

After the concrete foundation has set it should be covered by a ½-in. bed of cement mortar, composed of Portland cement and clean, sharp sand, mixed in the proportions of 1 part cement to 2 parts of sand. This mortar should be rammed into place with concrete rammers until all the unevenness in the concrete is taken up, and then "struck" to a true surface exactly parallel to the top of the finished pavement. The wooden blocks should be immediately laid upon the unhardened cement mortar and driven together as closely as possible.

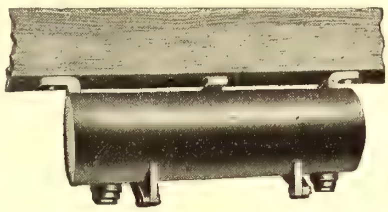
Expansion joints of bituminous cement should be placed at the outer edge of the gutter and across the street at intervals of 50 ft. The gutter joints should be 1 in. wide and the cross joints ½ in. wide. To make these a plank the proper thickness should be inserted and the blocks laid snugly against it. The blocks being laid the plank is removed and the crack thus left filled with bituminous cement of at least 300 degs. F. The pavement is then rolled with a hand roller until the tops of the blocks are even.

The bituminous cement used throughout should not flow at 120 degs. F., nor become brittle at 0 deg. F. It should be absolutely proof against water and street liquids, and pliable rather than rigid; thus providing for any possible expansion and contraction. After the pavement has been rolled, bituminous cement heated to at least 300 degs. F. should be poured along, and completely filling the crack between each block. The bituminous cement should be poured on the cracks only when the blocks are perfectly dry. This cement should be perfectly hardened, and the cement mortar beneath the blocks set before the street is open to travel.

The report has just been announced of the judges of the prize trolley-trip story contest, which was conducted by the passenger department of the Boston & Northern and Old Colony Street Railway companies during the winter months, and closed March 1. The department offered a prize of $25 in cash for the best story of the best trolley trip taken on the lines of either of these two companies, $15 for the second best, and $10 for the third best. By the decision of a board of newspaper men the first prize has been awarded to Katherine Keife, of Danvers; the second to Mary I. Coggeshall, of Melrose; and the third to Ellen M. Dole, of Salem. The winning story is printed in this month's issue of the Tri-State Tourist, the monthly publication of the passenger department.

A MALLEABLE IRON RAILWAY CUT-OUT BOX

A railway cut-out box, made from malleable iron, to eliminate breakage due to the rough usage occurring in railway work, is offered by the Chase-Shawmut Company, of Newburyport, Mass. These boxes are japanned for protection from the weather, and contain a slate base with terminals for clamping and soldering the leads. The bases are made to take the National Electric Code Standard enclosed fuses, which are especially convenient on cars. When the box is closed the fuse is held firmly in place by a fiber stop, which is attached to the cover. On opening the box the fuse is very readily removed. The cover is held closely by a spring clasp. These cut-outs are made in three sizes to take fuses of, respectively, 61-100 amp., 101-200 amp., 201-400 amp. capacity.


MALLEABLE IRON CUT-OUT BOX

A NEW PORTABLE COMBINATION METER

The demand for the Victor combination voltmeter, ammeter, wattmeter and horse-power meter, designed for switchboard use and placed on the market about a year ago by the H. W. Johns-Manville Company, of New York, has led to the production by the company of a type of this instrument in a portable form suitable for testing.

This meter consists of two separate and complete instruments in a single case, the one giving readings in volts and the other in amperes. The third and fourth readings are obtained on a scale plotted at the center of the dial, giving the product, or power consumption, in watts or kilowatts and horse-power. These readings are taken at the points of intersection of the two indicators. The power scale is calibrated in "watts" or "kilowatts" on one side and "horse-power" on the other.

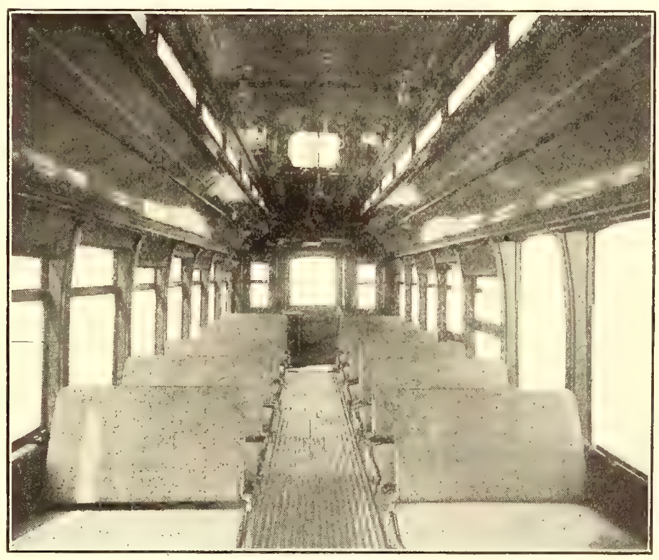
PORTABLE COMBINATION METER

The convenience of having in one instrument a portable meter giving readings in volts, amperes, watts and horse-power is readily appreciated at a glance, as this meter is adapted for rapid testing in the laboratory, while for field work it is almost indispensable. It has been found especially suitable for taking readings on electric cars, electric elevators, etc. If desired, multiple shunts and extra multipliers are furnished in connection with the volt and ampere scales for additional readings, and a table containing the multiplying factor to be used with these various combinations when reading the central scale. The calibrations are carefully and accurately made, and the instrument is reliable and permanent.

NEW ROLLING STOCK FOR USE AT JAMESTOWN

Twenty grooveless post semi-convertible cars, built by the J. G. Brill Company, are now running on the Norfolk Division of the Norfolk, Portsmouth & Newport News Company; and 20 cars, similar in every respect, are being delivered as fast as possible by the same builders to relieve the traffic on the Norfolk & Atlantic Terminal line. New open trail-cars will also be distributed over these two divisions in about the same proportions. A detailed description of these two routes to the exposition grounds was given in the Street Railway Journal of April 6, 1907, and the article also set forth the very adequate transportation facilities provided by the railway company, going on to say that it will be possible to run a motor car and trailer over each of the lines mentioned every 2½ minutes, and during the rush hours every three-quarters of a minute. Besides the rolling stock mentioned, there has been ordered from the Brill Company one combination semi-convertible passenger and baggage car and a baggage and express car, and the American Car Company has already delivered six large interurbans for exposition service; these cars, which also contain the grooveless-post semi-convertible feature, measure 42 ft. over the end panels and are divided into three compartments—passenger, baggage and smoking—located in the order named. The car illustrated is 30 ft. 8 ins. over the end panels and 40 ft. 7 ins. over the vestibules; width over sills, including sheathing, 7 ft. 10½ ins.; height from rail over trolley board 12 ft. The seats in all the semi-convertibles built by the Brill Company are of that builder's make, as are also the numerous patented specialties with which the cars are equipped. The type of truck used on both lots of cars is the No. 27-G1.


EXTERIOR OF EXPOSITION CAR


INTERIOR OF EXPOSITION CAR

FINANCIAL INTELLIGENCE

WALL STREET, April 24, 1907.

The Money Market

The past week has witnessed a further decided improvement in monetary conditions both at home and abroad. In the local market the banks and individual lenders have managed to hold rates for practically all classes of accommodations at last week's level, but they have experienced considerable difficulty in making new contracts on that basis. Stock commission houses continued to draw their supplies from the call loan dpeartment rather than to commit themselves for fixed periods. The inquiry from railroads and other corporations has been extremely light, and apart from the placing of some small amounts of bonds, the demand for fresh capital has been unimportant. During the week announcement was made of the successful flotation of a block of 4 per cent debenture bonds in the European markets by the New York, New Haven & Hartford Railroad Company. Railroads as a general thing are disposed to go slow in making expenditures for improvements, etc., and it is said that one of the large Western roads has decided to expend $2,000,000, which is considerably below the original amount thought to be necessary for such work. Money at all the principal interior points is reported in active demand, but conditions West and South are strong. Increasing strength developed in the foreign exchange market, rates advancing sharply, as the result of a general disposition on the part of bankers and merchants to liquidate their obligations abroad. Money and discounts at all of the European financial centers have displayed increasing ease. The Bank of the Netherlands, at Amsterdam, Holland, reduced its discount rate one-half of 1 per cent to 5 per cent, and similar action was taken by the Imperial Bank of Germany, which institution reduced the rate from 6 to 5½ per cent. In London, open market discounts rule somewhat lower than the official rate, and it is expected that the Bank of England will order a reduction in the minimum rate in the near future. Paris continues to draw gold from London, and in well informed quarters the belief prevails that the Bank of France also will find it convenient to reduce the rate of discount. At the close of the week the general monetary situation was encouraging, and there appears to be nothing in the situation calculated to disturb existing conditions. The bank statement published on Saturday was disappointing. Lons increased $25,347,800, and was attributed to the shifting of loans from other institutions to the clearing house banks. Cash increased $2,477,300, but as deposits increased $26,501,600, the reserve required was $6,625,400 larger than in the preceding week, thus cutting down the surplus by $4,148,100. The surplus now stands at $11,704,825, as against $16,366.725 in the corresponding week of last year, $11,448,050 in 1905, $34,203,704 in 1904, $10,985,475 in 1903, $9,461,050 in 1902, $14,922,100 in 1901, and $24,894,350 in 1900.

The Stock Market

Speculative opinion developed more confidence during the past week, notwithstanding some rather adverse reports regarding the winter wheat crop outlook, and the price movement, while tending upward, showed considerable irregularity at times as a result of profit-taking sales. The speculation was almost entirely professional, and the volume of commission house business was such as to confirm this statement. At one time the market developed pronounced strength, and prices advanced in a manner which suggested a revival of active operations on the part of large interests, hitherto opposed to any extension of commitments on the long side of the market. The dominant influence in the betterment was the improved position of the money market both here and abroad, as indicated by the decline in the rate for time money here, and by further reductions in open market discount rates at the principal financial centers in Europe. The general ease in the money markets abroad was reflected in a reduction in the official discount rates of ½ per cent each by the Bank of the Netherlands and by the Imperial Bank of Germany, and it is probable that the Bank of England and the Bank of France will also reduce their minimum rates in the near future. The crop situation is now attracting the usual attention at this time of the year. During the week some very unsatisfactory reports were received, but were partially verified later by the Government report, the publication of which was followed by a sharp advance in wheat. The report that a large electric concern had reduced the working force from 25,000 to 20,000 since last July attracted considerable attention, but its influence upon values was slight, as the action is the result of special rather than general conditions. The iron and steel trades continue active, and considerable interest attaches to the quarterly report of the United States Steel Corporation, to be made public at the end of the current month. It is expected that the report will make a very gratifying showing, both in the way of earnings and the volume of unfilled orders on hand, but in well-informed quarters no increase in the common dividend rate is looked for at this time. Aside from the influences referred to the market was influenced by the strength in the Pacific stocks, especially Union Pacific, which is said to be earning considerably more than dividend requirements. The Hill stocks also displayed strength and substantial advances were made in American Smelter, the Southern group of stocks and in some of the specialties.

There has been no material change in the traction situation, and these shares consequently moved in sympathy with the general market.

Philadelphia

Trading in the local traction shares was only moderately active during the past week, and while the general tone was firm the improvements in prices were confined to the small fractions. Exceptions to the general rule were United Companies of New Jersey, which rose 2½ to 250 on light purchases, and Consolidated Traction of New Jersey, which moved up a point to 73½. Philadelphia Rapid Transit was the active feature of the group, and after a reaction to 17 on sales to realize profits, it advanced to 19¼, and held most of the gain. Union Traction was also pressed for sale early in the week, the price yielding to 57, but subsequently there was a rise to 59⅜. American Railways sold at 49¾ and 50, and Philadelphia Traction brought 94⅛ and 93⅞. Philadelphia Company common was dealt in at 44 and the preferred at 45⅞ and 45.

Chicago

The developments in the local traction situation were of an extremely favorable character during the past week. The decision of the Supreme Court of the State of Illinois declaring the Mueller law certificates invalid, not only puts municipal ownership of the traction lines by the city of Chicago out of the question, but it also removes about the only serious obstacle in the carrying out of the plans already formed to give the city of Chicago an up-to-date service. Plans for the reorganization of the various properties are being worked out, and the situation is now clearer than at any time for several years. Trading in the shares of the street railway companies, however, ruled quiet. About the only activity developed in West Chicago, which sold to the extent of about 700 shares at from 32 to 30. North Chicago stock sold at 35, and City Railway brought prices ranging from 180½ to 185, an advance of 5 points. South Side Elevated sold at 80 and 81½. Metropolitan Elevated preferred at 65, and Chicago & Oak Park preferred at 15.

Other Traction Securities

Little interest was manifest in the traction shares at Baltimore. Trading was extremely light and price fluctuations were narrow. United Railway 4s sold at from 86¾ to 87¼. The incomes brought 54 and 54¾, and the funding 5s sold at 84⅞ and 85. Several hundred shares of the deposited stock brought 13. Augusta Railway & Electric 5s sold at 101½ for $5,000. The Boston market was unusually dull. Boston Elevated, after an early decline to 141½, recovered to 142½. Massachusetts Electric sold at 17 and the preferred at 59⅜ and 59. Boston & Worcester advanced to 25¼, and the preferred moved up from 71 to 73.

Owing to the fight that has been waged for some time, Cleveland Electric stock dropped 6¼ points on the Cleveland Stock Exchange Monday. These securities had kept up well until the past week or two, but with no support in the shape of a pool they have been dropping gradually until they are something like 10 points lower than two weeks ago. Only a few hundred shares were sold at the lower figures, and they were apparently thrown upon the market by those who had call loans at banks to take care of and others who are tired of the fight that is being waged. It is also suggested that with perfect unanimity among the stockholders of the company a pool would have been formed to protect the stock. The drop, however, seems to bother the larger stockholders very little. Forest City securities have varied but little from where they stood a week ago. Some small lots of Northern Ohio stock have changed hands within the past week, as well as some others, but the market has not been active. Most of them have held their own, notwithstanding the depressed condition of the money market.

Security Quotations

The following table shows the present bid quotations for the leading traction stocks, and the active bonds, as compared with last week:

	April 17	April 24
American Railways	50	49½
Boston Elevated	141½	142
Brooklyn Rapid Transit	60⅛	57⅞
Chicago City	180	180
Chicago Union Traction (common)	4¾	4
Chicago Union Traction (preferred)	15¾	14
Cleveland Electric	58¾	51½
Consolidated Traction of New Jersey	72	73
Detroit United	73⅛	73½
Interborough-Metropolitan	25	24⅞
Interborough-Metropolitan (preferred)	60	60½
International Traction (common)	50	50
International Traction (preferred), 4s	72½	72½
Manhattan Railway	138	139¼
Massachusetts Elec. Cos. (common)	16¾	16
Massachusetts Elec. Cos. (preferred)	a59½	59
Metropolitan Elevated, Chicago (common)	24	24
Metropolitan Elevated, Chicago (preferred)	65	64
Metropolitan Street	94	—
North American	73½	72½
North Jersey Street Railway	40	40
Philadelphia Company (common)	44½	44
Philadelphia Rapid Transit	17¾	20¾
Philadelphia Traction	94	94
Public Service Corporation certificates	64	62
Public Service Corporation 5 per cent notes	93	92
South Side Elevated (Chicago)	80	82
Third Avenue	108	110
Twin City, Minneapolis (common)	95½	95½
Union Traction (Philadelphia)	57	59¾

a Asked.

Metals

An increasing demand is reported for Northern and Southern iron for nearby delivery, but the inquiry for shipments for the second half of the year is not large. Steel making and foundry irons are strong. The demand for finished steel products continues large. The bookings for rails for 1908 are below expectations.

Copper metal is strong and unchanged as to price. An active demand for electrolytic is reported at 25 and 25¼c.; Lake is quoted at 25½c.

AGITATION STOPS TROLLEY BUILDING IN CENTRAL NEW YORK

It is stated that because of the agitation against railroads, which has made investors cautious about putting their money in bonds and stock of new corporations likely soon to come under strict regulation, trolley building in Central New York will be curtailed. The Syracuse & Utica line, built by New York Central interests on the West Shore route, is constructed and will be in operation within a month, but the Central syndicate has no other present projects The other suburban lines out of Syracuse will be built by a syndicate headed by Clifford D. Beebe, with whom are associated Hendrick S. Holden, William Nottingham, A. K. Hiscock, Frank C. Soule, H. S. Wilkinson and others, of Syracuse. The syndicate planned this year to extend the Rochester, Syracuse & Rochester from Lyons to Syracuse, making a through trolley line from Syracuse to Rochester; to extend the Lakeside road from Baldwinsville to Oswego, and to rehabilitate the defunct South Bay line, partially constructed from this city to Oneida Lake. But the men in the syndicate do not propose to invest money in an enterprise which may be limited by State regulation to a 5 or 6 per cent return, and they find a similar unwillingness among the money lenders of New York to buy bonds of a railroad which may be thus handicapped. The Rochester road will be constructed to Port Byron, so that cars may be taken by a branch road to Auburn and thence by the Auburn & Syracuse into this city. The Oswego line will not be built and the South Bay road, in which more than $1,000,000 was invested by the former owners, will be left as it is until prospects brighten.

THE CLEVELAND SITUATION

A few days ago the Low Fare Railway Company attempted to connect its tracks with those of the Cleveland Electric at Euclid Avenue and East Fourteenth Street. After the work had proceeded for a few hours an injunction was issued from Judge Ford's court stopping it. The Low Fare officials claim they have a right to make the connection on the ground that free territory covers that district, but they will now have to fight the matter out in the courts. The Cleveland Electric so far has allowed the truce to remain unbroken so far as all other matters are concerned, but the officers felt that they could not stand by and see competing companies making arrangements to use their tracks in their efforts to defeat the old company in its contentions.

President A. B. Du Pont, of the Municipal Traction Company, sent an offer to the Cleveland Electric Railway Company to purchase its tracks and other equipment on Central Avenue and Quincy Street for $149,993.19, at the same time stating that cash would be paid for the property. He also said that his company would purchase the car houses and other property not named in the first offer, including cars, if the right kind of a price was named.

The proposition of the Cleveland Electric in answer to this must have been a surprise. In his letter, President Andrews said his company would be willing to sell the tracks, poles, trolley wires and feeders on the two streets named and on East Ninth Street, between Central Avenue and Quincy Street, and the car yards, houses and special work connected with these lines for $448,473. From all that can be learned, however, the Mayor did not object to the figures as much as he did the fact that the company did not state in its offer that it would bind itself not to interfere with the operation of cars on these lines by the new companies. The officers of the Cleveland Electric said they would not tie their hands in any way. The letter stated as a condition that, if the offer was accepted, the cash should be deposited with the Citizens' Savings & Trust Company before April 23; and, further, that if the offer was not satisfactory, the company would be willing to leave the value to a board of arbitration, consisting of fair minded men, and stand by their award. In case the figure fixed was lower than the price asked, the bank was to refund the difference, and if larger, then the purchaser should pay the difference into the bank.

On their decision to refuse this offer the Mayor, City Solicitor and other officials expressed the belief that the Forest City Railway Company could operate its cars over these lines in spite of the objections of the Cleveland Electric, if that company ceased operations at midnight on April 23, as it had given notice it would do. They based their idea on the fact that public necessity would give the companies a right to furnish service, but the decision of the Supreme Court of the United States, which declared the company's franchise had expired, also stated that the tracks, poles and other property in the streets belonged to the company, and in that event it certainly has the right of protection.

A resolution of the City Council ordered the Cleveland Electric to remove its tracks from the streets, and it at once applied for a permit, but this was not forthcoming until Saturday evening. It is said that the city officials spent several days in studying out a permit that would make the removal of the track difficult

and at the same time force the company to allow the cars of the other companies to operate its tracks until they are removed, the new track being laid as the old track is taken up.

The permit orders that only one track shall be taken up at a time, and work may begin only in certain stated place. Not more than 700 ft. of track shall be up in any one place at a time, and permission must be given to build cross-overs, so that other cars may be run around these places. The poles and wires must be taken down last, and there are restrictions in regard to this that will allow the other companies to make use of them until their own are in position. The tracks on Central Avenue must be taken up first and then work may begin on Quincy Street, and the tracks must be taken up in the same way.

The Forest City Railway Company secured a permit and has built a temporary transmission line from its west side line across to the Cleveland Electric's lines that feed the trolley wires on these two streets. It will probably be ready to furnish current as soon as the cars of the Cleveland Electric cease operation, but it is expected that any attempt to connect the lines will be followed by a legal fight that will leave the people of that section without service for some time to come.

The Cleveland Electric Railway Company has rejected the permit given it to remove its tracks on Central Avenue and Quincy Street. Attorneys, answering the note of the board of public service, informed the members that the conditions of the permit are unreasonable and framed to favor other companies, instead of allowing the Cleveland Electric to remove its property from the street and in a proper and peaceable manner. It is further stated that a general ordinance provides that the company shall remove its property from the street within thirty days after abandonment, and put the pavement in proper condition after the work, to the satisfaction of the street commissioner. This ordinance, they state, is made a part of the contract between the city and the Cleveland Electric, and that if the board does not see fit to grant a permit, the company will proceed to remove its property under this contract.

On Tuesday an extra force of police was placed along these two streets to see that the tracks were not interfered with and an additional force is ready at the central station to enforce the orders of the Mayor, who seems to think that he has been enthroned with authority to carry out his wishes, no matter what happens. His contention is that the new companies may take possession of the tracks and use them as their own, and in this he has been advised by City Solicitor Baker, who is a young man and has had little experience in legal matters of this kind. The rule they have adopted is that the rights of the people to use certain street car lines are paramount to the rights of the owners. But 1500 residents of those two streets sent a petition to the City Council Monday evening, asking that the old company be given a new franchise on the basis of seven tickets for a quarter. The paper may have as well been blank, so far as any attention was paid to it by the Mayor and his Council.

On Wednesday, April 24, cars ceased operation on the Central Quincy lines, and the new company was barred off the streets by injunction. The court decided that the franchise of the Low Fare Company on Euclid Avenue east of the square is invalid, as the consents of property owners are lacking. This prevents the company's cars reaching abandoned lines.

SUPREME COURT DECISION IN CHICAGO CASE—UNION TRACTION REORGANIZATION

The Supreme Court of Illinois handed down its decision in the case in which the legality of $75,000,000 worth of Mueller law certificates, which ex-Mayor Dunne wanted issued, was challenged. The court decided against the certificates. In doing so it practically made the law itself inoperative. The Mueller law still stands intact, but the power of putting it into effect, so far as Chicago is concerned, has been taken away from it. The city can own and operate street car lines if it wants to, but the method of getting money to buy or build them has been taken away from it. The proposed certificates were declared invalid by the court for the reason that they would be an addition to the bonded indebtedness of Chicago, and this city is already fully up to its constitutional limit. The decision also finds fault with the certificates because they are a mortgage, not only on what street car properties the city might acquire under them, but also on the streets of the city as well. The Mueller law provides that in case there is a default in the payment of the principal or interest of these certificates the owners of the properties in foreclosure not only would acquire them, but also a twenty-year franchise to operate them. As the case now stands, the only way in which municipal ownership of street car lines is possible in Chicago reduces itself to these alternatives. The city can buy up all its outstanding bonds so as to leave a clear field for the issuance of bonds with which to buy street car lines. At this time it could not issue more than $30,000,000 of bonds, and a traction system covering the whole city could not be built or bought for this. It can save up the 55 per cent net receipts of the companies it will receive under the recently adopted ordinances until the total amounts to enough to buy a system. It is said that a rehearing will be asked by the city.

Purchases of new material to be used in the rehabilitation of the electric railway properties will be made under specifications issued by B. J. Arnold. Mr. Hamilton, secretary to Mr. Mitten, of the Chicago City Railway Company, has confirmed the purchase of 10,000 tons of steel rails, already noted in the STREET RAILWAY JOURNAL, and states that 300 additional cars are being built. This is considered the big end of the purchases for the rehabilitation, as the Chicago City Company is in pretty good shape as regards car houses; the overhead was fixed up last summer. There is no connection between the purchasing department of the Chicago City Railway and the Union Traction Company.

The agreement dated April 22, 1907, between the Chicago Union Traction committee, consisting of J. N. Wallace, John W. Castles, Robert M. Gallaway, H. B. Hollins, James Jourdan and Alfred Skitt, and such holders of preferred and common stock of the Chicago Union Traction Company as may become parties to the agreement by depositing their certificates of stock, has been issued. The agreement says that the Chicago Union Traction Company is the lessee of the railways of North Chicago Street Railroad Company and the West Chicago Street Railway Company. The total debts for which said three companies are directly or indirectly liable exceed in bonded indebtedness $26,000,000 and in floating debts $5,000,000. The agreement reviews the traction situation in Chicago since the properties went into the hands of receivers in 1903 and to the ordinance passed Feb. 11, and approved by vote of the people of Chicago at the election on April 2 for vesting in a new corporation, known as the Chicago Railways Company upon the terms and conditions set forth in the ordinance. The stockholders of the Union Traction Company are asked to deposit their stock with the Central Trust Company, assigning to the committee the stock so deposited so that the committee is vested under the terms of the agreement as trustee with the legal title to all shares of stock which may be deposited. The committee shall have power to prepare a plan for the reorganization of the Chicago Union Traction, alone or in conjunction with any other corporation, or to confer in and accept any plan prepared pursuant to the provisions of an ordinance passed by the city council on Feb. 11, 1907.

ST. LOUIS EARNINGS

The United Railways Company returned a satisfactory percentage in net earnings and net income in the official statement for March. Both these items showed a decrease for January and February this year compared with the corresponding period in 1906. Last month the gross earnings show a substantial gain of $112,000. The increased expense account, however, cut this down to $37,000 gain in net earnings. The report shows as follows:

Month of March—	1907	1906
Gross earnings and other income....	$903,145	$790,838
Expenses, taxes and depreciation....	596,247	521,329
Net earnings	$306,898	$269,509
Charges	230,868	231,475
Net income........................	$76,030	$38,034
Fiscal year, Jan. 1 to March 31—		
Gross earnings and other income....	$2,494,162	$2,286,291
Expenses, taxes and depreciation....	1,722,595	1,475,738
Net earnings	$771,567	$810,553
Charges	693,734	695,521
Net income	$77,833	$115,032

REORGANIZATION OF PHILADELPHIA & WESTERN RAILROAD

In order that the Philadelphia & Western Railroad may be reorganized and its stock and bond issue brought more on a parity, the property will be sold at West Chester on May 20 to the highest bidder. It is explained, however, that this will be a mere legal proceeding, and will in no way affect the running of the new line, which will be opened for traffic next month. The sale will be conducted by the Trust Company of North America, which is the trustee for the $15,000,000 bonds, and the technical reason for offering the property at auction is given as failure to pay interest on a portion of the outstanding bonds for a period of more than sixty days. Henry G. Brengle, second vice-president and treasurer of the Trust Company of North America, is quoted as stating:

"The sale is merely a legal proceeding toward the expansion of the company. There is no financial embarrassment. The original bond issue of $15,000,000 was found to be too small, and the company now intends to float a mortgage of $50,000,000. The default of the interest on the mortgage was a necessary step in order to sell the property."

MR. PIERCE ADVOCATES MEASURES FOR RESTORING CONFIDENCE

Henry P. Pierce, president of the International Railway Company, of Buffalo, advocates an extra session of the Legislatures of the various States to investigate charges against the public service corporations. The occasion of Mr. Pierce's remarks was the banquet given by the Buffalo Chamber of Commerce Thursday evening, April 18, following the dedication of the magnificent new home of the body. Besides reiterating the statement already made in the Street Railway Journal, that improvements involving $2,000,000 proposed to be made to the International Company's property would be suspended for the present, Mr. Pierce formally said that they would not be made until public confidence in railroads was restored. Mr. Pierce's plan is for the Governor of each State to call a second Legislature, to be composed of the heads of Chambers of Commerce, and to meet at the capitol after the regular Legislature had adjourned. Mr. Pierce is quoted as follows:

"This Legislature should not meet for a day, but for weeks, if necessary." It should discuss every question of interest or at issue in any way affecting the public service of the people. Its members should aid to bring about a thorough understanding of corporation business from the business standpoint. It would result in a better understanding, and during that time, if later the laws needed to be amended, the State's Chief Executive and other officials would ascertain the practical business side, for subsequent use in such amendment as might be found necessary.

"The convening of such an assemblage would mark a new era in our country's development. Certainly no harm could come from hearing all sides of every question. Then we could ascertain just what charges of corruption, if any, in public service corporations were true, and just what accusers and accusations were untrue.

"Here in our own State the people surely would uphold the Governor if he should call in conference representatives of all of the Chambers of Commerce of the State and discuss with them questions pertaining to the regulation of public utilities, and invite the criticisms and suggestions of these practical men.

"I believe the Governor would find that they, knowing the wants and necessities of the corporations which they represent, would be able to give him advice and suggestions that he would be glad to accept, and that, as a result, a measure, if any were deemed necessary, would be drafted whose requirements could be observed without hardship by the corporations, and that would, while safeguarding the interests of the people, meet the approval of business interests, and that the State of New York would have a public utility law that would be so workable, sane, and practicable that it would be a model likely to be adopted by the other States."

Vice-President J. B. Thayer, in an address on railroad problems, made reference to the inability to secure capital in this country to carry on projected improvements. Governor Hughes referred to the importance of public confidence, saying that business and commerce must have stability, which they cannot find unless the public confidence is maintained. The public is entitled to be assured that business conducted by right of franchises is conducted as the public interest requires.

A NEW HAVEN OFFICIAL ON THE SITUATION IN RHODE ISLAND

E. G. Buckland, vice-president of the New York, New Haven & Hartford Railroad, with offices in Providence, who also is largely responsible for the operation of the lines of the Rhode Island Company, made some interesting statements at a meeting last week of the East Providence Business Men's Association. Mr. Buckland outlined the situation to be met by the Rhode Island Company in the operation of its lines in Providence, Pawtucket, Central Falls and other cities, and also discussed in a general way the traffic situation which confronts the New York, New Haven & Hartford in operating into Providence. In connection with the operation of the steam lines into Providence, Mr. Buckland referred briefly to the equipment of the Providence tunnel, to which reference has been made before in these columns. He said that in his opinion Providence should be not only the traffic center of Rhode Island, but the center of traffic of Southeastern Massachusetts, and as such should care for all freight and passenger traffic from Fall River, New Bedford and vicinity which now goes by way of Boston and Middleboro. One obstacle that has stood in the way of making Providence the central point has been the necessity for transferring across the city from Fox Point to the union station. A surface road was at first proposed and a charter granted by the Legislature; later an elevated road from Fox Point was considered. Mr. Mellen, on taking charge of the New Haven property thoroughly considered the matter and finally decided that a tunnel through the hill was the only solution of the problem. The question of motive power for the tunnel, Mr. Buckland said, had not been finally settled, but he expressed the hope that the experiments with electricity about to be begun on the New Haven line between New York and Stamford would prove successful, in which event the tunnel line would be equipped for electric operation. Mr. Buckland then said that the next work of the company, if the experiment with electricity proved successful, would be to extend the line from Stamford to New Haven, and that finally the entire New Haven system would be equipped with electricity. Continuing, Mr. Buckland said: "A few words about the electric cars of the Rhode Island Company. Dec. 20 last, I came to Providence to assume charge of the electric car line known as the Rhode Island Company. I found that there were many things that were being criticised. Some of these have been corrected, some are under consideration, and others will be corrected as fast as I can do so and make both ends meet.

"The transfer matter I considered to be of the most importance and gave it my first attention. I did not think that is was right that the transfers should be of such a limited character, and I gave instructions to have a material broadening of their scope, so that a person could use a transfer upon any line of cars except that upon which the transfer was originally issued. I hope that this system may be in operation by the first of May.

"I have been importuned by many to extend the transfer zone This is a question that must receive careful consideration. If we attempt to grant an extension on one line it becomes a question of similar treatment for all lines. I hope to be able in the near future to extend the transfer zone in several directions. But I must ask for a chance to catch my breath.

"It is of no use for you to tell me that you ought to have transfers to Broadway Six Corners. I know all about it, and I may say that I am ready to concede it. I cannot promise any extension of the transfer zone at this time, but I shall work out the problem and will give you the assurance that when it is possible to do so without entailing too great a loss of revenue to the road you will get an extension. I hope that this may be in the near future.

"It is not the purpose to make any money out of the Rhode Island Company at this time. It is simply a strategical factor in the plans of the New York, New Haven & Hartford Company. When that company develops the numerous plans that it has under consideration and under way we believe that we can liberalize the charges to passengers so as to give them such facilities as will prove the company to be a common carrier indeed.

"The cars of Providence are much over-crowded and it is something that must be cared for. Already we have taken steps to do so, and before snow flies we will have sixty new cars, each 35 feet in length and of the latest improved type, on our lines. I have received from the company the authority to expend nearly $2,500,000 in Providence and vicinity during the coming years in improvements, repairs and extension work."

THE POULSEN PLAN TRIED AT CONEY ISLAND

Plans were recently made for a test at the Culver terminal of the Brooklyn Rapid Transit Company's lines in Coney Island of the plan which Neils Poulsen, of Brooklyn, has insisted for some time would materially relieve congestion at the Manhattan terminal of the Brooklyn Bridge, and accordingly a test of the plan, slightly modified to meet the ideas of Nelson P. Lewis, chief engineer of the Board of Estimate, was made at Coney Island on Sunday morning, April 21, before the rush to the island began, in the presence of city officials, representatives of the Brooklyn Rapid Transit Company, and a number of railroad officials and experts in and about New York.

The layout of the tracks at the Culver yards is somewhat similar to that at the Brooklyn Bridge. There are five platforms for the use of passengers and four pockets into which the trains are run. The latter were numbered 1, 2, 3 and 4, and, according to the Poulsen plan, three trains would always be ready for the unloading and loading of passengers, for which one and a half minutes would be allowed. As train Number 4 enters its pocket and the last car has left the main track, train Number 3 goes out. Another train immediately runs into this vacant pocket; Number 2 then goes out and so on. The trains carried the various signs denoting the route over which they traveled and would seldom return to the same pocket from where they started.

Engineer Lewis objected to any such plan on the ground that unless each train had a specific pocket, the conditions would be made no more tangible than at present. He contended that unless passengers knew exactly from which platform they could board the train the congestion at the bridge would be more complex and the people wishing to go to Bay Ridge would find themselves on an East New York train and vice versa. Mr. Poulsen stated that any such objection could be overcome by the placing of signs at the rear of the platforms, indicating the train to leave next. Mr. Lewis still claimed his plan to be the best and it was decided to try that one first. The proceeding proved to be a slow one and twelve minutes were consumed in running the first eight trains, while the present system at the bridge allows the running of sixty trains an hour. It was then too late to try the plan originally proposed by Mr. Poulsen.

The Brooklyn Rapid Transit Company refused to discuss the test, stating that as a courtesy it had supplied the trains and crews in accordance with its policy to accept suggestions and further projects submitted which give promise of proving of value to the company and its patrons.

SITUATION AT HARRISBURG, PA.

With less than one month in which to complete its labors, and with about 500 bills yet in committee, there is much work ahead of the House of Representatives. The second and third reading calendars are large and the latter include the Reynolds bills, designed to enforce the constitutional provisions on transportation. One prohibits passes absolutely. The remaining four bills forbid the absorption of competing or parallel lines by lease or sale, with a fine of $20,000 for the offending corporation, and as much for each transgressing official; discrimination in freight or passenger rates, with a $20,000 fine for the company and $1,000 for the officers; the manufacture, mining or production by the railroads or transportation company of any commodity which is transported over its line, with $20,000 penalty, and not more than $5,000 for each officer implicated, in addition to not more than three years in jail; rebating or preference in furnishing cars or motive power, with a penalty of $2,000 for the corporation, and from $1,000 to $10,000 for the responsible officers, who may also be sentenced from one to five years. These bills will likely pass both branches.

A resolution was offered in the House last week to take from the Committee on Electric Railways a bill providing that all suburban electric cars be equipped with lavatories. The committee had the bill for some time and refused to act upon it. The resolution was laid over until Monday.

Representative Creasy charged Chairman Riebel, of the House Electric Railways Committee, with neglecting to report promptly the Mayer bill, which the committee had voted to recommend for passage. Speaker McClain, in answer to Creasy's inquiry, decided that delay was not permissible, and later in the day Riebel reported the bill, which enlarges the rights of trolley companies to cross steam lines, either at grade overhead or underground.

Members of the Legislature are receiving many letters commending their action in passing the trolley freight bill, which is expected to be of much benefit to farmers, and even the steam railroads themselves. Among the companies which propose to engage in the transportation of freight are the Shamokin & Edgewood, which will now proceed with the building of its Sunbury extension. Another line will be the proposed Perkiomen Valley Traction Company, which applied to Governor Stuart on April 22 for a charter. This company has completed its preliminary surveys and proposes to build a line 11½ miles in length through a populous rural district in Montgomery County, extending from Collegeville to Green Lane via Schwenksville and Perkiomenville. At Green Lane the line will connect with the proposed Lederachville & Pennsburg branch of the Montgomery County Rapid Transit Company, and at Collegeville with the new line of the Schuylkill Valley Traction Company.

On April 23 the Governor signed the trolley freight bill, which takes effect immediately. The house has passed finally the bill authorizing street railway companies, chartered under act 1889, to issue bonds payable at such time after date thereof as may seem best to directors.

PENNSYLVANIA TUNNEL EXTENSION INTO NEW YORK

A. J. County, assistant to third vice-president of the Pennsylvania Railroad, discussing "The Economic Necessity for the Pennsylvania Railroad Tunnel Extension Into New York City" in the Annals of The American Academy of Political and Social Science for March, says, in part:

The plans of the company, since their first inception, have been materially broadened, as the general recital of the physical features of the extension indicates, and the total cost, including real estate, will probably be not less than $90,000,000.

Summing up, the Pennsylvania Railroad Company's New York tunnel extension is a line of railroad from Newark, N. J., to Port Morris, N. Y., through the Borough of Manhattan and Queens, having for its principal purposes:

The construction of a large passenger terminal centrally located in the city of New York.

Making the Long Island Railroad an integral part of the system.

Affording the Boroughs of Brooklyn, Queens and the balance of Long Island abundant opportunities for development; and,

Binding the New England States with those of the west and south by means of the New York Connecting Railroad.

The reasons for its construction apparently were:

First—To provide for the future by enlarging the present facilities for freight and passenger traffic, because of the continuous growth in passenger and freight traffic, and to accomplish it before the cost becomes almost prohibitive, or the task impossible, because of the construction of other underground transportation lines.

Second—To run its passenger trains into a central location in the city of New York, instead of a station on the west bank of the Hudson River.

Third—To open to the people in the thickly populated borough of Manhattan, the residential sections of Long Island, and to offer to Newark and other populous towns in New Jersey direct and quick access to the resorts on Long Island beaches.

Fourth—To provide a highway for all-rail traffic to New England.

Fifth—To give the boroughs of Brooklyn and Queens, with their population of over 1,500,000, direct railroad connection to and from the New England, Southern and Western States, and to supply freight facilities with similar connections in these boroughs, thereby properly serving the entire area of Greater New York through freight stations suitably located to develop its commercial interests

Sixth—To provide additional freight facilities and shorten the water transportation trip for the New England traffic across New York harbor from about twelve miles to three and four-tenths miles.

Seventh—To make its Long Island investment remunerative within a comparatively short period.

Eighth—To obtain a proper share of the golden future by judicious expenditure in a territory having abundant promise, whether viewed from the growth of traffic in the past or the outlook for the future.

INTERBOROUGH-METROPOLITAN ORDERS CARS

The Interborough-Metropolitan Company has just placed orders for a total of 250 cars. Fifty of the cars will be of all-steel construction, and will be used in the subway. The remaining 200 cars, of which 116 will be trail cars and 84 motor cars, will be used on the elevated. The 50 subway cars are to be built by the American Car & Foundry Company. The contract for the 200 elevated cars has been divided between the St. Louis Car Company and the Wason Company, the trail contract going to the St. Louis Company and the motor car contract to the Wason Company.

It was announced early in the week that President Shonts, of the Interborough Company, would soon contract for forty all-steel cars of new design for use on the lines of the New York & Queens County Railway, one of the Belmont properties. The cars are to be 38 ft. long, and will have cross seats and seating accommodations for forty-four passengers each. The approximated cost of each car is $8,000, a total expenditure of $320,000 for rolling stock for the Belmont lines in Queens County. It was learned that the cars are to be so constructed that they may be operated in the Steinway Tunnel, which is really the primary reason for adding to the present equipment of the Queens County lines. Under the franchise granted several years ago, before August Belmont entered the metropolitan traction field, nothing was said about the operation of fireproof cars exclusively, however. The tunnel under the East River has been constructed under the franchise, the legality of which has been questioned.

NEW YORK LEGISLATURE TO END MAY 16

Plans are being laid for adjourning the New York Legislature on May 16. A number of important matters are still to be disposed of, but it is thought they will all be cared for so as to carry out the plan for adjourning which has been mentioned. The assembly committee on railroads and Speaker Wadsworth spent many hours in the latter part of last week in consideration of the Public Utilities bill, and Chairman Merritt, introducer of it on the Assembly side, expresses the opinion that within a day or two they will be ready to confer on the bill with the subcommittee of the Senate judiciary committee. It is probable that the Assembly committee will make few material changes in the measure. The real battle is expected on the Senate side. It is not impossible that the bill as passed upon the joint committee will be ready for presentation to the two houses the last of this week, but it is more likely that it will not be reported in either house before next week.

It does not seem likely that the Public Utilities bill can come before the two houses of the Legislature from the committees having the measure in charge until after May 1. The Assembly railroads committee took up the bill April 18. It will consider the bill section for section and make any amendments that may be suggested by the briefs both of friends and opponents of that measure. Its work will probably not be completed before the middle of next week. Then, according to the plan which has been adopted, the Assembly railroads committee will go over the bill again in joint session with the judiciary committee of the Senate, to which body it was referred to in the upper House.

CONTRACT LET FOR ELECTRIFICATION OF BALTIMORE & ANNAPOLIS SHORT LINE

A contract has just been closed between J. G. White & Company and the Maryland Electric Railways Company, whereby White & Company will draw plans for the electrification of the Baltimore & Annapolis Short Line and supervise the work of changing the motive power of the road. The plan of the Maryland Company for making this change has been referred to before in these columns, but the letting of the contract to White & Company is the first really significant move that has been made. The details are all to be arranged, and there is nothing of a definite nature available at this time about the plans.

The stretch of road that it is proposed to convert to electric operation is about 25 miles long and extends from Baltimore to Annapolis. The short line was recently merged with the Maryland Electric Company, in accordance with the terms of an agreement with the United Railways & Electric Company. After the consolidation the Maryland Electric Railways Company authorized an issue of $8,000,000 first mortgage 5 per cent twenty-year gold bonds to the Mercantile Trust & Deposit Company, as trustee, the proceeds of which are to be used for the purpose of acquiring by purchase, construction, etc., car houses, rolling stock, etc., in accordance with plans outlined in the Street Railway Journal, in connection with the financing of the improvements of the United Railways & Electric Company.

Early this year the company concluded an arrangement by which it secured the Bay Ridge summer resort property, situated about 4 miles from Annapolis. With this property was included the railway between Annapolis and Bay Ridge, along which traffic will be conducted as soon as the line is electrified. The property consists of about 350 acres, laid out as an up-to-date amusement resort.

It has not yet been decided where entrance will be made to Baltimore. Neither has the question of power been settled. It is stated, however, that the privilege may be taken advantage of which the United Railways Company has of securing power from the McCalls Ferry Electric Power Company.

REPORT OF THE OHIO RIVER ELECTRIC RAILWAY & POWER COMPANY

The report of the Ohio River Electric Railway & Power Company for the year ended Dec. 31, 1906, has just been made public. Compared with the previous year the report shows as follows:

	1907	1906
Motor car miles	290,557	285,633
Freight car miles	12,702	12,956
Gross receipts	$58,981	$53,196
Operating expenses	36,224	30,125
Net earnings	$22,756	$23,071
Fixed charges and taxes	17,808	17,790
Net income	$4,947	$5,280

The decrease in the net is accounted for by extraordinary expenditures extending to all parts of the service. The following figures from the report of the superintendent are given as of special importance:

PASSENGER RECEIPTS		
Cash fares	$33,842.25	
Commutation tickets	12,673.75	
		$46,516.00
FREIGHT RECEIPTS		
Sale of parcel tags	$1,202.95	
Delivery local H. V. Railway	463.92	
Carload freight to and from H. V. Ry.	4,345.70	
		6,012.57
MISCELLANEOUS RECEIPTS		
Carrying United States mail	$148.51	
Sale of advertising privilege	200.00	
Sale of power	5,194.46	
Sale of store-room supplies	427.84	
Sale of scrap material	470.30	
		6,441.11
Total gross receipts		$58,969.68

Passengers carried in 1906		1,008,344
Passengers carried per car mile		3.47
Passenger car miles run		290,577
Freight car miles made		7,737
Locomotive miles run		4,993
Current output for year d. c.	467,822 K. W.	
a. c.	238,410 K. W.	
Total	706,232 K. W.	
Cost of producing current at switchboard		.01.09
Current consumed by passenger cars		397,521 K. W.
Current consumed per passenger mile		394 Watts
Current consumed per passenger car mile		1,368
Current consumed by locomotive		22,206 K. W.
Current consumed per freight and locomotive mile		1,744 Watts
Current output, commercial lighting		181,985 K. W.
Current output, municipal lighting		56,425 K. W.
Number of hours municipal lights burned		2,638
Average pounds coal consumed per kw-hour		12

SUBSCRIPTIONS TO CANADA

Owing to the new postal regulations in Canada, the postage on second-class mail matter has been increased from 1 cent to 4 cents per pound. Partly to meet this increased cost the subscription price of the STREET RAILWAY JOURNAL to Canada hereafter will be $4.50 per annum. All prepaid subscripitons will be carried to their expiration at the old rate, but all renewals and new subscriptions will be at the new rate.

TO REPORT ON PUBLIC OWNERSHIP

Chairman Melville E. Ingalls, of the Public Ownership Commission of the National Civic Federation, has called the committee of twenty-one to meet in New York on May 6 to consider the report of a sub-committee, consisting of Edward E. Bemis, Milo R. Maltbie, Walton Clark and Charles L. Edgar. The committee of twenty-one has completed its investigations both in this country and in England, and the work of the engineers, experts and accountants will form the basis of the report of the sub-committee.

RUNS ON THE ELECTRIFIED WEST SHORE

Some practice runs were made last week on the newly electrified West Shore Railway between Utica and Syracuse. The work has practically been finished to Canastota and with that place and Utica as terminals the conductors and motormen who are candidates for positions on the road are operating the cars back and forth. The first car was taken over the line by General Manager Allen, of the Utica & Mohawk Valley Railway Company, on April 9. It was No. 500, one of the fifteen recently received from the J. G. Brill Company for service between Utica and Syracuse, and is equipped with four 75-hp motors. The official opening will occur soon.

QUICKER TROLLEY SERVICE TO REVERE BEACH

The Boston Elevated Railway Company is planning an extension of its East Boston tunnel car service to Gladstone Avenue in Orient Heights. The agreement for this service is now being drawn up with the management of the Boston & Northern Street Railway Company, whose tracks are in part involved in the project. A short section of track will be laid from the Boston Elevated terminus at Orient Heights to connect with the Boston & Northern lines. The result of the arrangement will be to give tunnel passengers a quicker and more direct connection with Revere Beach, which is now one of the most popular and largely patronized beach resorts on the North Atlantic coast.

CONTRACT LET FOR CONNECTING NEW YORK BRIDGES BY SUBWAY

The New York Rapid Transit Commission has awarded the contract for the construction of the first section of the subway loop between the East River bridges to the Degnon Contracting Company. There were only two bids on the work, the other being the Cranford Company, of Brooklyn. The Degnon Company bid $2,952,000 for the tunnel construction and $83,000 extra for building pipe galleries. Six votes were required to pass the resolution awarding the contract, and Morris K. Jesup, though ill, came from his home to make up the necessary number. While he was present the plans for changing the subway and elevated stations at Third Avenue and 149th Street were also put through. George L. Rives of counsel has reported to the board that to make the changes in the subway at Ninety-Sixth Street, suggested by the chief engineer, and calculated to do away with the switches at that point, exactly the same steps would have to be taken as would be necessary in building a new line. Consents of property owners will have to be obtained, and all other formalities will have to be gone through. The matter was referred to the committee on plans.

SOME SUGGESTIONS FOR GETTING PERUVIAN TRADE

In view of the statements made elsewhere in this issue by Mr. Theodore Stebbins regarding the possibilities of South America, the suggestions made by Consul General Samuel M. Taylor, reporting to the Department of Commerce and Labor from Callao, regarding trade in Peru are especially pertinent. Mr. Taylor among other things says:

The prevailing products of the United States in this market are sewing machines, typewriting machines, cash registers, and certain classes of electrical appliances; and closely following these are agricultural implements and machinery, certain lines of children's toys, especially of the "express wagon" class, and chemicals. Other things being equal, naturally these various nationalities favor the country of their birth in their selection of goods and in recommending to customers. Assuming that we have "as good goods" the problem is to give better prices and quicker delivery; and this people needs to get goods at less price. As a people their purchasing power is very limited, yet the cost of living is from 10 to 30 per cent greater than in the United States, and 50 per cent greater than in Europe. Comparatively speaking, nothing is cheap here, except what a favorable climate makes unnecessary. Climatic conditions being so equable, mild, and dry, make certain articles of wearing apparel, as rain coats, heavy topcoats, overshoes and umbrellas unnecessary, except in the mountainous districts; and certain articles of domestic economy, as coal and other fuel, stoves and grates, for heating purposes, are likewise unnecessary. But for the rest there is no escape from the increased cost.

With practically no manufacturing competition at home the people are dependent on foreign-made goods and products of nearly every kind. Except on implements for agricultural and mining purposes, typewriting machines, and a few other favored articles there is an average tariff duty of 45 per cent. The cost of an article, then, to the consumer is the price of it when it left the country or origin plus transportation, plus handling, plus 45 per cent tariff (the consumer in this case, for want of home competition, pays all the duty), plus profit, usually large, plus breakage of 10 per cent, plus commission charges. This foreign trade is handled largely through commission merchants, who, having established their connections, are not particularly interested in exploiting the goods of new aspirants for this market.

Quick sales and small profits is not a maxim that animates the retail trade here to any great extent. On the contrary, one sale and three profits is preferred. The effect of this policy is greatly to retard consumption. Some American manufacturers in established lines are forestalling this practice by fixing the price, usually the United States price, which the retailer must not exceed, and they do their own advertising, where mention is made of the retail price. I think it safe to say that were retail prices more reasonable there would be from one-third to one-half more goods consumed here. The tariff is credited with the high prices, but in many instances the tariff is a subterfuge, as a little figuring shows profits of 100 to 125 per cent over and above all expenses. Again, when prices are not fixed by the manufacturer, there is an asking price and a final selling price, and the price obtained ranges all along between.

Here, so far at least as the native population is concerned, the foreign manufacturer is given a free hand. There are no prejudices against the products of his factories. There is no feeling that the goods he may bring here will supplant home industries and home labor. He is welcomed, first, for what he is and then for what he represents. He may enable the people to obtain goods at less price hence he is a benefactor, a visitor that helps. Again, after distances have been more or less eliminated by superior shipping facilities, two essentials remain to be considered. This trade is not here for the mere asking, and those firms in the United States who think they can build up a demand by simply letting the people here know by letters and pamphlets that they have certain things to sell are about certain to meet with disappointment. On the other hand, those firms in the United States that have had the courage and pluck to send competent salesmen here, with a thorough knowledge of their business and able to explain it in the Spanish language, are getting good returns on their investments.

When the goods have been sold, a most important matter is the packing. If firms are not prepared to pack their goods to stand the roughest kind of treatment, or if they feel they can not assume the additional expense that such packing entails, they had better not attempt to send the goods at all.

MANUAL ON INSULATING VARNISHES AND COMPOUNDS

The Sherwin-Williams Company, of Cleveland, has recently issued a manual on its Ajax insulating varnishes and compounds, which goes considerably further than the catalog usually published by manufacturers. It is, in fact, practically a treatise on insulating compounds, their application and the proper methods of testing for faults. The book, which is bound in board covers, states in the introduction that three years ago the manufacturers decided there was a great opportunity to improve electrical insulation through higher quality and better adapted varnishes and compounds than then existed. For this reason they established a laboratory and placed it in charge of an expert with complete authority to conduct all tests necessary to determine the electrical efficiency of the products of the company. The catalogue then describes in detail the various Sherwin-Williams insulating varnishes and compounds, including the different baking and air-drying varnishes and impregnating compounds which have become well known through the trade name of Ajax. Each is for a different purpose, and for each minute directions are given for securing the best results. The compounds are designed especially for use with the vacuum drying and impregnating process of treating electrical coils, whether used in transformers with a cooling bath of oil or under ordinary conditions. The subject of baking ovens is then considered in detail. The pamphlet describes their proper construction, and illustrations are given of the proper methods of securing heat distribution, good ventilation and conveniences for handling the work. This chapter is followed by some hints on proper baking. Following this section is one on dipping tanks, with hints on dipping coils and armatures and instructions as to the proper method of securing correct specific gravity. An illustration is given of a typical dipping tank and japanning machine with convenient devices for holding the armature, etc.

The latter part of the book is devoted to insulation tests. The reader is instructed as to satisfactory methods of testing insulation, of making aging, moisture proof, oil proof, penetrating and acid tests, and of determining baking, cementing and sticking qualities and the ability of the insulating materials to conduct and radiate heat. The book concludes with a useful description of a single high-potential transformer testing set, and other devices for testing coils. The experience of the Sherwin-Williams Company in the manufacture of paints and varnishes has been so extensive that a brochure issued by the company on this subject cannot but be very instructive.

STREET RAILWAY PATENTS

[This department is conducted by Rosenbaum & Stockbridge, patent attorneys, 41 Park Row, New York.]

UNITED STATES PATENTS ISSUED APRIL 9, 1907

849,393. Car Replacer; Charles H. Hess, Steamboat Rock, Iowa. App. filed Dec. 21, 1906. An inclined rail provided with a bottom flange tapered at one end, and a shoe adapted to rest on the track-rail, said shoe having depending flanges, flared at one end, and a raised portion at the top, tapered at one end, to abut against one end of the inclined rail, and carry the car-wheel flange diagonally across the track rail.

849,432. Electric Locomotive; Elmer A. Sperry, Cleveland, O. App. filed Nov. 26, 1902. An electric track rail locomotive which may also be used by the ordinary adhesion to the rails. Novel means for mounting the gears.

849,457. Trolley Controller; Willis C. Burdon, Louisville, Ky. App. filed Jan. 27, 1906. A rack is vertically mounted at the rear of the car and a heavy block slidably mounted thereon engages the teeth of the rack when abruptly moved upward. Has connection with the trolley pole to lock the same in case it leaves the wire.

849,503. Trolley Pole; Quinto Saudelli, Fall River, Mass. App. filed Jan. 23, 1906. The trolley wheel is mounted on a support of the toggle lever or lazy tong type, having parallel motion links which give the wheel an absolutely vertical spring impelled movement above the center of the car.

849,460. Safety Signaling Device for Railway Switches; Prosper Cloutier, Three Rivers, Quebec, Canada. Provides a locking device which locks the switch in its closed position, the arrangement being such that the act of raising the semaphore unlocks the switch, and the act of closing the switch unlocks the semaphore.

849,515. Roller Side Bearing for Railway Cars; Frederick B. Townsend, Chicago, Ill. App. filed Dec. 29, 1906. Details.

849,550. Air Brake Mechanism; Charles G. Lundholm, Otis, Cal. App. filed July 16, 1906. Relates to that class of brakes in which the braking power is determined by the load on the car and consists of a brake-cylinder for controlling the brake-lever, a lifting mechanism independent of and disconnected from the brake mechanism and valve mechanism for controlling said lifting mechanism.

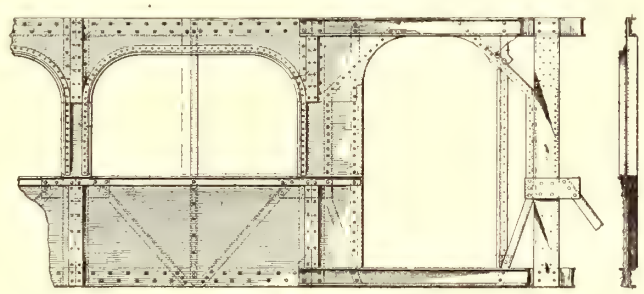
849,596. Seat End; Edward G. Budd, Philadelphia, Pa. App. filed July 18, 1906. Details of construction.

849,657. Rail connection for Car Seats and the Like; Edward G. Budd, Philadelphia, Pa. App. filed April 26, 1905. Means for supporting a sill or rail of angular cross-section at either end thereof.

849,703. Electric Railway; Samuel B. Stewart, Jr., Schenectady, N. Y. App. filed April 29, 1901. A novel construction of contact shoe for protected third rails. Relates to the spring support of the shoe.

849,791. Railway Tie; Louis Blessing, Jackson, Mich. App. filed Dec. 17, 1906. Two reinforced concrete blocks, one for each rail, rigidly connected by metallic bars.

849,722. Brake Shoe; Charles W. Booth, Milwaukee, Wis. App. filed June 19, 1905. Comprises an integral body portion and attaching-lug of cast metal and a tie-plate secured to the



PATENT NO. 849,826

back thereof, comprising a skeleton portion which extends upwardly and is embedded in the attaching-lug, said skeleton comprising lateral webs and a transverse web which connects the lateral webs outside of the keynote in the attaching-lug, forming a hole or opening in alinement with the keyway in the attaching-lug.

849,749. Controller for Electrically Propelled Vehicles; John S. Raworth, Streatham, England. App. filed Jan. 25, 1906. Designed to make changes from motors in series to motors in parallel and vice versa, and answer the standard conditions imposed in dealing with the heavy currents of this class of apparatus.

849,773. Third-Rail Protecting Mechanism for Electric Railroads; Hamlet Corrigan, Pittston, Pa. App. filed May 3, 1906. The third rail is surrounded by a protecting tube, the cover of which is slidably displaced during the passage of the train, so as to expose the rail for contact.

849,798. Composition Railroad Tie; Joseph Le Favour and Robert F. Brammer, Albany, Ind. App. filed Nov. 5, 1906. A composite tie equipped with a plate having a central upstanding portion provided with interiorly screw-threaded end tubular portions, and a screw bolt engaging a tubular portion and effective to engage the rail base or flange.

849,826. Passenger Car Construction; Francis McFarlan Brinckerhoff, New York, N. Y. App. filed Dec. 14, 1906. Details of construction of a trussed side wall.

849,828. Car Construction; Francis McFarlan Brinckerhoff, New York, N. Y. App. filed Dec. 14, 1906. The platform end sill is so constructed that it provides for the support of a radial draw-bar without the usual sector-bar construction.

849,838. Motor Driven Truck; Archibald H. Ehle, Philadelphia, Pa. App. filed Oct. 16, 1906. A trailer truck coupled to the truck frame, has a gas engine mounted thereon, and means for transmitting the power to the main truck wheels.

849,871. Trolley; Richard W. Walker, Topeka, Kan. App.

filed Oct. 15, 1906. A pair of inwardly impelled spring fingers mounted on the trolley harp and which close over the wire in use, but which can be displaced to form guides when the wheel is being positioned on the wire.

849,970. Amusement Device; Paul Boyton, St. Louis, Mo. App. filed Aug. 27, 1904. Details of a "shoot-the-chutes" apparatus, whereby space is economized and the operation facilitated.

849,994. Acute Angle Crossing for Electric Railways; Edward E. Gilmore, Philadelphia, Pa. App. filed Sept. 27, 1905. An overhead crossing for electric trolley systems comprising a body and end runners pivotally secured thereto and adapted to hold the trolley wire on the body.

850,117. Electric Railway; William B. Potter, Schenectady, N. Y. App. filed Sept. 24, 1902. Relates to electric railways of the type having normally de-energized sections which are connected with the feeder successively as the car proceeds. Provides means by which the switches are actuated by a local battery circuit on the car which is also used for the auxiliary motors, the lighting and heating.

PERSONAL MENTION

MR. C. N. JELLIFFE, formerly auditor of the American Light & Traction Company, has been elected secretary of the company to succeed Mr. James Lawrence, who in turn succeeds Mr. Jelliffe as auditor.

MR. ALVA REYNOLDS, formerly roadmaster of the Hoosac Valley Street Railway at North Adams, and Delaware & Hudson Railroad, has taken a similar position with the Pittsfield Street Railway Company.

MR. ROBERT DUNBAR, superintendent of the Haverhill and Salem divisions of the New Hampshire Electric Railway Company, has resigned from the company to develop as a model farm a large tract of land which he has purchased near Salem.

MR. IRVIN J. BROWER, president of the Montgomery & Chester Trolley Company, of Phœnixville, Va., died April 18 from an attack of pneumonia, aged 60 years. He was a native of Phœnixville, and prominently identified with many of the business enterprises of this section.

MR. T. I. PEACOCK, in charge of the new business department of the Sedalia Light & Traction Company, of Sedalia, Mo., has tendered his resignation to assume charge of the new business department of the Menominee & Marionette Light & Traction Company, at Menominee, Mich.

MR. DE WITT C. McMONAGLE has been appointed general manager of the Wallkill Transit Company, of Middletown, N. Y. Mr. McMonagle, who is about sixty-five years old, has been a resident of Middletown practically all his life and has been identified with various local enterprises in that city. For twenty years he was senior member of the wholesale drug firm of McMonagle & Rogers. When he retired from the company he became manager of the Consumer's Light & Power Company and remained with the company until it was sold to the Orange County Lighting Company. Mr. McMonagle is vice-president of the First National Bank, and also is treasurer of the Orange County Telephone Company.

MR. A. R. WHALEY, superintendent of the New York division of the New Haven Railroad, is to enter the employ of the New York Central on May 1. He will become general manager of the New York Central terminal and general superintendent of the electric zone, to succeed Mr. Ira McCormack. Mr. Whaley began his railroad career as freight brakeman of the Providence & Worcester Railroad and worked his way up. For two and a half years he has had charge of the New York division of the New Haven system, with headquarters in the Grand Central Station. For the New York Central he is to be the directing head of one of the most difficult of positions. Every train, whether propelled by steam or electricity, running in and out at the Grand Central Station will be subject to his orders. Mr. Whaley is 45 years old and has been in railroading for twenty-seven years.

MR. R. E. DANFORTH, who was recently appointed general manager of the Public Service Corporation of New Jersey, at the suggestion of President Horace E. Andrews, of Cleveland, and Vice-Presidents William K. Vanderbilt, Jr., and John Stanley, will not formally relinquish his duties at Rochester on May 1, but will continue for a time to divide his time between the Rochester and the New Jersey properties until the details of the operation at Rochester are thoroughly familiar to Mr. Wilcoxen and Mr. Stanley, who eventually will divide between them in a manner still to be decided the responsibility of managing the property. Mr. Andrews will probably spend part of each week in Rochester, just as he now spends a portion of his time in Syracuse.

MR. F. J. DOYLE has been appointed master mechanic of the Schenectady Railway Company, of Schenectady, N. Y., to succeed Mr. L. L. Smith, whose resignation from the company to become master mechanic of the Chicago & Milwaukee Electric Railway was noted in the STREET RAILWAY JOURNAL for April 13. Mr. Smith was born in Buffalo, N. Y., in which city he was educated. In 1894 he located in Schenectady and entered the employ of the General Electric Company, with which he served in the armature department, railway motor test laboratory and on the experimental third rail line at the company's works. In 1901, after seven years general experience, covering the branches mentioned, Mr. Doyle became connected with the Schenectady Railway Company. He served here successively as instructor of motormen, barn foreman and general foreman of operating barns and repair shops.

MR. THOMAS A. CROSS, who, as noted in the STREET RAILWAY JOURNAL for April 20, was elected general manager of the United Railways & Electric Company, of Baltimore, Md., to succeed Mr. William A. House, is a native of Baltimore and has been connected with the street railway companies in that city since a young man. His first work was with the North Avenue Electric Railway Company, whose service he entered in 1890. Later this company became the Lake Roland Elevated Railway Company and Mr. Cross was advanced until in 1893 he was selected by the Baltimore Traction Company to take charge of its overhead work, motor equipment and power stations. When this company was consolidated with the City & Suburban Company in the name of the Consolidated Electric Railway Company, Mr. Cross' duties were still further increased, and in 1899, when all the lines were merged in the United Railways & Electric Company, Mr. Cross was formally elected to the position of superintendent of overhead work, cables, etc.

MR. E. J. WILCOXEN, superintendent of transportation of the Rochester Railway Company, has been appointed general superintendent of the company, filling the vacancy caused by the resignation of Mr. D. F. Carter, which took effect Jan. 1. Mr. Wilcoxen was born April 27, 1871, at Seneca Falls. On leaving school he entered the car service department of the Buffalo, Rochester & Pittsburg Railroad in 1888, locating at Bradford. He moved to Buffalo to become secretary to the assistant manager of the Wagner Palace Car Company. This place he relinquished to become assistant superintendent of the State reservation at Niagara. After leaving the employ of the State, Mr. Wilcoxen returned to railroading, becoming general passenger agent of the Geneva & Cayuga Lake Railroad. After serving the road for some time Mr. Wilcoxen came to Rochester to superintend the construction of the Rochester & Sodus Bay Railroad, and on completing this work accepted the place of general freight agent. Later he became general superintendent.

COL. ALEXANDER R. PIPER has been appointed general freight agent of the Brooklyn Rapid Transit Company, in addition to his duties as superintendent of the American Railway Traffic Company, which is identified with the B. R. T. interests. Col. Piper was born at Staten Island in 1865, and was graduated from the U. S. Military Academy in 1889. He was appointed second lieutenant in the infantry, and later promoted to first lieutenant. In 1896 he was promoted to be captain and commissary of volunteers and assigned to the first corps. In May, 1898, he was made captain of infantry, from which post he retired July 31, 1899. Col. Piper participated in the Sioux campaign of 1890 and 1891, and in the Spanish War. Upon his retirement from the army, Col. Piper became general manager, secretary and treasurer of the Seamless Metalware Company, of Ossining, N. Y., with which he remained until it was absorbed by the American Can Company. Later he became superintendent of final disposition in the department of street cleaning of New York, under Commissioner Woodbury, and subsequently was appointed by Mayor Low as second deputy police commissioner, in which position he remained during Mr. Low's administration. His appointment as superintendent of the American Railway Traffic Company dated from March 20, 1904.

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NOTICE TO SUBSCRIBERS

REMITTANCES.—Remittances should be made by check, New York draft, or money order, in favor of the Street Railway Journal.

CHANGE OF ADDRESS.—The old address should be given, as well as the new, and notice should be received a week in advance of the desired change.

BACK COPIES.—No copies of issues prior to September, 1904, are kept on sale, except in bound volumes.

DATE ON WRAPPER shows the month at the end of which the subscription expires. The sending of remittances for renewal prior to that date will be much appreciated by the publishers.

NOTICE TO ADVERTISERS

Changes of advertising copy should reach this office by 10 a. m. Monday preceding the date of publication, except the first issue of the month, for which changes of copy should be received two weeks prior to publication date. New advertisements for any issue will be accepted up to noon of Tuesday for the paper dated the following Saturday.

Of this issue of the Street Railway Journal 8300 *copies are printed. Total circulatation for* 1907 *to date* 147,150 *copies, an average of* 8175 *copies per week.*

Traffic Counts by Students

In connection with the location of stations on the proposed Cambridge subway route several counts have recently been made by Harvard students of the surface car passenger traffic volume and distribution in the territory under consideration by the Cambridge authorities and the Boston Elevated, with a view toward getting a more definite set of facts to assist in the placing of stations. Taken by itself and in relation to the particular day, hours and weather conditions prevailing, the data secured are certainly interesting; but it is a serious question if such a limited number of observations should carry much weight against the judgment of the company's officials as to the number of stations needed, based, as it is, upon daily observation of the traffic and accurate records of the business handled by each car at all seasons of the year, and at all hours and kinds of weather.

Of course, it is not the practice of street railways, except at rare intervals, to make records of the length of journeys of individual passengers. Such a record could only be made by actual count and would be very expensive, but the observation of inspectors and conductors upon any given route should furnish valuable general information as to the density of riding at practically all points covered. The repeated transit of a route by an employee whose business it is to gage the traffic by fare collections, register readings or personal study of the way in which the schedule meets the offered business inculcates a much closer knowledge of the characteristics of the route than can be gained by observations taken on three or four days in the same season of the year. Furthermore, it is difficult to predict the increase in through business which will follow the building of a rapid transit route through local territory, and which should be accommodated by fast service at the expense of fewer stops in the regions nearer to the terminals. It is to be hoped that the judgments of the operating company in the Cambridge situation will not be set aside on the basis of these restricted traffic counts by students, interesting though they may be.

The Chemist in Electric Railway Work

It is well recognized by the management of good sized electric railway properties that the services of a first rate chemist are necessary in the most economical operation. Many of the larger roads have such a man in their employ, and consider the expense amply justified. In the power station alone is great need for him. Not only the fuel and water, but the ashes and smoke may be profitably examined, periodically, by the practical, intelligent chemist. While the important fact to be determined relative to fuel, its heating value, is determined by the calorimeter, an investigation which is the work of the physicist, nevertheless important work is also found for the chemist in fuel analysis. The analysis of boiler feed-water is, of course, one of the electric railway chemist's chief duties, and he must be able, not only to diagnose, but also to prescribe intelligently. A chemical examination of ashes and flue gases will indicate the extent to which the available heating value of the fuel is being utilized. Oils, paints and insulation, all offer prom-

ising fields of investigation to the practical chemist, while a thorough investigation of the salts present in many so-called electrolysis troubles will often tend to lift the blame for the corrosion of gas and water pipes from the electric railway's "stray currents."

If such talent is useful in the economical operation of large properties, it should be, to a similar degree, in the case of the smaller roads. The expense of maintaining a chemical department with the necessary laboratory facilities would be too great for the results obtained on most of the roads not large enough to use the "system" cognomen. It is entirely possible, however, for several such companies in the same vicinity to combine in securing the entire services of a competent chemist for a study of their chemical problems, and the results obtained should prove the expense, shared between the roads concerned, a first-class investment. Much better results would be obtained in this manner than by the independent employment of consulting chemists by the individual roads. There is also an opportunity here for the specialist in matters of this kind to cater to a large clientele after the manner of the successful physical laboratories which have taken up electrical work. One who devotes his entire time to the study of problems connected with electric railway operation will be much more valuable in the solution of these problems than the general chemist who has no such opportunity to specialize.

Our local associations have become active in adopting inter-road tickets, mileage books, exchange of baggage, and other schemes for increasing revenues by collectively offering advantages impossible for any individual road. It seems that arrangements tending to decrease expenses by collectively taking advantage of opportunities not available to individual roads, such as outlined above, might be profitable.

Interference of Freight Traffic with Passenger Service

A few weeks ago we printed some comments upon the interference of suburban passenger trains with the freight service of steam trunk railways. Conversely, it may perhaps be apropos to consider in this issue some of the objections which exist to the operation of freight trains on electric railroads. Occasionally the managements of interurban properties consider that any receipts obtained from heavy freight traffic are direct additions to the total receipts of the road. With this idea in mind, they develop freight traffic to a point that requires several trains per day in each direction to handle it. In considering this business, however, it should be remembered that practically all existing electric interurban railway systems were constructed for passenger service. For this they are peculiarly adapted and this is their legitimate field rather than the haulage of freight. The fact that they give frequent service, are free from dirt, and that usually they haul people to the business centers of towns and cities gives them manifest advantages over the steam roads so far as this branch of their traffic is concerned. But with freight traffic the opposite is true. Ton for ton the steam roads can usually transport freight, especially when the hauls are long, at a lower cost than the electric road. This does not mean that the latter should not undertake this class of service; simply that before going into it heavily all facts should receive careful consideration. In many cases it may be profitable, but the management should be sure that it is a real profit. Every precaution should be taken to see that the service does not interfere with the passenger trains, as is very apt to be the case if the latter are operated on an hourly schedule. Otherwise it is possible that the loss of passenger traffic caused by such delays will more than offset the net receipts from freight.

The operation of heavy freight trains may interfere in many ways with the movement of passenger cars. In the first place, freight locomotives require so much current that if there is not an unusual amount of copper in the direct-current distributing system the voltage supplied to the passenger car motors is considerably lower than it would otherwise be. Again, derailments occasionally occur, and unless the sidings are always located at the points where they are needed and are long enough to accommodate the freight trains, delays are occasioned through switching at these points.

Reliability of passenger service should be uppermost in the minds of the management of a system which gets the greater portion of its receipts from this service. There is hardly any limit to the amount of travel that can be developed in any territory. It will increase in proportion to the conveniences and accommodations offered, and on the other hand it will decrease or will be discouraged in proportion to inconveniences. These facts should be considered in any review of freight earnings.

Hold the Schedule

Some prominent officer of the Ananias Club once laid down the maxim: "A lie well stuck to is better than the truth half told." As this distinguished body has been mentioned so frequently lately in the daily press we might paraphrase the saying to give the truthful proverb: "A fifteen-minute schedule lived up to is better than a ten-minute schedule half observed." We have in mind two parallel streets quite near together in a city of medium size. On one there are run twelve cars per hour, on the other four. Yet in spite of the discrepancy in mere numbers the latter street has the better service and many people who could readily take either line choose the one with the fewer cars. The reason is not far to seek. For some cause that is not altogether obvious those fifteen-minute cars are almost invariably on time. Go to the corner at the appointed minute and the car promptly pokes its dashboard around the curve just above. One could almost set his watch by it. On the other street the cars run without the least regard to the quality of the service given. Two sets of them are scheduled so that they run in pairs almost together and the third is generally late enough to join the others, so that one either hits or misses the trio. Sometimes four or five cars will go by almost together and then there will be none for ten or twelve minutes.

Now it chances strangely enough that all these cars are operated by the same company, so that there is no actual competition between them. If there were the fifteen-minute schedule would very quickly be shortened and the manager of the other line would be wondering why the receipts were falling off—and with such good service—twelve cars an hour! On city lines where so many cars are run that there are no long waits it is equally important to hold closely to schedule, lest these cars get blocked, but it is on

the suburban and interurban lines that close adherence to schedule brings the best returns. A really regular fifteen-minute service is vastly better from the standpoint of earnings than more cars loosely run. It is cheaper to operate and until overcrowded to the point of inconvenience it will give much better satisfaction to the community. Just how to preserve a rigid adherence to schedule is a little hard to say. Strict regulations and care in picking out motormen and conductors will do much. Perhaps it would be worth while to set up a little healthy rivalry among car crews by a competitive premium on punctuality. There is a good bit of help toward it, too, in not trying to make too high mileage. Up to a certain point increased mileage tends to economy, but we think it is not infrequently overdone. The result is insufficient time for proper inspection, increase of repairs, and lack of reserve power for emergencies. Cars not pushed to their speed limit can pull through their schedule week after week without delays, while a little quickening of the running time would make it very easy to disorganize the service and block the cars. A little extra power is mighty convenient when things begin to go awry, and while every car has to be overloaded and pushed hard now and then, the one least persistently overworked is the one to depend on in an emergency.

The Operation of a Successful Interurban

The full operating article on the well-known Boston & Worcester Electric Railway published in this issue contains some interesting lessons in modern railroading. The line in question is typical of good recent practice, and has amply made good its claims to success from its very start. It has done a very large business, and when it gets its freight and express service in full operation it may be expected to give some effective lessons upon those features of traffic which have as yet been very little developed by any of the New England roads. From the standpoint of the electrical engineer the center of interest is the power house and the electrical distributing system, whose complete operative features are described. We are fortunate in being able to present a rather full schedule of the cost of power generation and of operation generally. The power station itself at South Framingham is thoroughly well equipped for economical operation. The main unit is now a 2000-kw Curtis turbo alternator, and the subsidiary units are engine-driven alternators of 500 and 1000 kw, respectively, all being wound for the transmission voltage of 13,200. The feature of the power house is the cooling tower system installed to tide over the times when the Sudbury River is too low to furnish the necessary water. The towers are three in number, each large enough to take care of 1000 kw easily and to maintain a vacuum of not less than 27 ins. A rather high grade of West Virginia coal is used with which the results obtained by hand firing are probably nearly or quite as good as could be obtained by mechanical stokers.

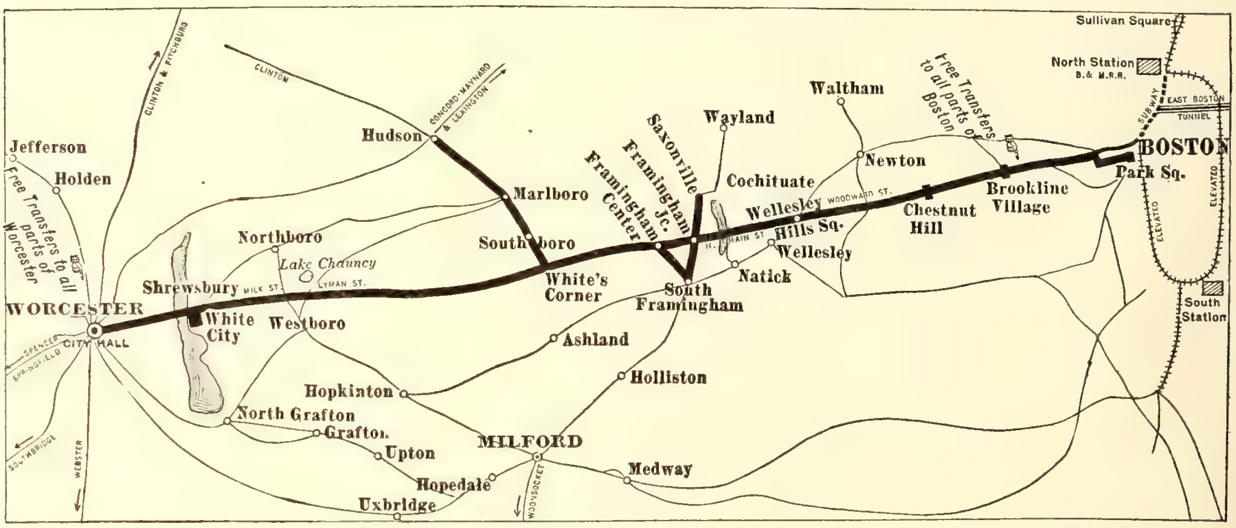
There are four sub-stations all told with eleven rotary converters of 250, 400 and 500-kw capacity. The aggregate converter capacity is 3800 kw, very little in excess of the station capacity of 3500 kw, so that the load factor conditions are more favorable than in many cases that could be named. The station report shows the operating costs to be well proportioned, only 20 per cent being chargeable to labor, and fuel being 71 per cent. The coal consumption per unit of energy at the a. c. switchboard comes to 2 2-3 lbs. per kw-hour, costing about 0.54 cent. This figure is almost as good as that obtained in the average station of the Boston Elevated System, which has unquestionably the advantage of higher load factor. When it comes to the power delivered as direct current from the Boston & Worcester sub-stations there is naturally quite another story to be told. The all-day efficiency of the transmission and transformation to d. c. is between 83 and 84 per cent, which brings the coal per d. c. kw-hour up to about 3¼ lbs., costing 0.646 cent. The administration of the sub-stations appears to be thoroughly economical, yet the total cost of power at the d. c. terminals rises to 0.946 cent per kw-hour, compared with 0.764 cent at the a. c. switchboard. The latter figure is nearly as favorable as that reported from the Boston Elevated d. c. auxiliary stations, which are approximately the same capacity. The data thus obtained for the working efficiency of the transmission and transformation in the sub-stations show, we are inclined to think, better results than the average, yet they are considerably below the results which are often claimed.

There is a wide gap between theoretical and practical performance, and the Boston & Worcester has no reason to be ashamed of its figures. It would be interesting to know what effect upon the final cost of d. c. power would be produced by including the up-keep and miscellaneous expense chargeable to the high-tension transmission line, also the effect of the investment and depreciation charges. These are so rarely included in power expenses that they are too often forgotten, although they are of real importance in comparing various systems of distribution. The cost of power per car mile evidently depends on the nature of the rolling stock, and the steady increase in capacity of equipment shows at once. The present cars of the Boston & Worcester take 4 kw-hours per car-mile, which is a tremendous contrast with the old-time figures for street cars, but really represents great economy in total operating expense. Although equipped with multiple unit control, the cars have been, save in rare instances, worked singly. With the completion of the double tracking there will be a good chance for train operation which on a system of this kind should tend to economy. The transmission system proper presents some features of interest. The longest distance is 11.5 miles, which is quite all that could be economically worked at the voltage used. In Framingham two of the high-tension circuits are run as aerial insulated cables for about three-quarters of a mile to avoid trouble from trees. This is a drastic remedy, but it seems to be effective, although the ends of the cable sections have to be guarded by special lightning arrester systems. The trolley wire is No. 0000 round wire, the smaller sizes and the grooved form being now in process of replacement. The tendency toward big trolley wire in such systems is strongly to be commended. It kills two birds with one stone, giving a more ample surface for current collection and simplifying the system of working conductors. The trolley wire is a mighty good place to put copper up to the largest size that can be conveniently suspended.

OPERATING FEATURES OF THE BOSTON & WORCESTER STREET RAILWAY

The Boston & Worcester Street Railway was opened for traffic between Boston and South Framingham, Mass., on May 8, 1903, and the through line to Worcester was placed in service on July 1 of the same year. In these nearly four years of successful operation the road has come to be known as one of the most interesting interurban lines in the East. It connects the two largest cities in Massachusetts in a direct route which has been appropriately designated in all the company's advertisements as the "Trolley Air Line"; serves one of the most attractive sections of the State, and constitutes an important spoke in the radial transportation trunk lines leading into metropolitan Boston. On Sept. 30, 1906, the company operated a total of 74.837 miles of main track, including a double-tracked through route between Boston and Worcester, a branch line to South Framingham, another to Saxonville, and a third to Marlboro and Hudson. The total trackage operated, including sidings, was 77.677 miles

With the exception of about 3.8 miles of the track lying between Framingham Junction and White's Corner, the main line is now all double track. The road actually begins at the end of the Boston Elevated Railway Company's surface lines, at Chestnut Hill, and it extends to the Shrewsbury turnpike near the east bank of Lake Quinsigamond, Worcester, where it connects with the Worcester Consolidated Street Railway Company's system. Through cars are operated by these three connecting companies between Park Square, Boston, and Worcester City Hall, the distance being 40 miles and the running time 2 hours and 20 minutes. In Boston passengers are carried on a single fare from practically any part of the Boston Elevated system to Brookline Village or Chestnut Hill, where they may transfer to the Boston & Worcester cars without extra expense until the Boston & Worcester's own fare collections begin. Passengers arriving in Worcester by the air-line route are given the free transfer privilege to all parts of the city. The reverse privileges are allowed east bound, between Worcester and Boston. The branch lines are practically all single-track mileage.



ROUTE OF MAIN LINE, BRANCHES AND CONNECTIONS OF THE BOSTON & WORCESTER STREET RAILWAY

POWER SUPPLY

The power supply for the road is generated at a single plant owned by the company in South Framingham. The plant is located on the banks of the Sudbury River practically in the center of electrical distribution of the road. Within the last two years the station has been considerably enlarged in capacity and a steam turbine and cooling tower equipment of much interest added. The original station was described in the STREET RAILWAY JOURNAL for Oct. 4, 1902, but as the later improvements have not been taken up to any extent in this paper they will be briefly summed up.

Originally the station contained two Rice & Sargent horizontal cross-compound engines of the condensing type, direct connected respectively to 500-kw and 1000-kw, 13,200-volt, 25-cycle, three-phase General Electric alternators of the revolving field type. These machines remain in service at the present time, but the capacity of the station has been more than doubled by the addition of a 2000-kw, 13,200-volt Curtis turbo-alternator. The standard method of high-tension transmission to rotary converter 600-volt direct-current sub-stations is in use, and current distribution to the cars is effected by a single overhead trolley above each track.

A summary of the principal equipment in the power station follows:

Building, 182 ft. 8 ins. x 105 ft. 4 ins.; three batteries Aultman & Taylor water-tube boilers aggregating 2800 hp, 150-lbs. steam, hand-firing and natural draft; one Green fuel economizer, 9212 sq. ft. heating surface, with direct chimney by-pass; basement, 12 ft. high, containing pumps, Whitlock heaters, condensing apparatus, large piping, ducts; one Rice-Sargent engine, 20 ins. x 40 ins. x 42 ins., 800-1500 hp, 107 r. p. m., direct connected to 500-kw, 13,200-volt alternator; one Rice-Sargent engine, 24 ins. x 48 ins. x 48 ins., 1500-2500 hp, 107 r. p. m., direct connected to 1000-kw, 13,200-volt alternator; one Curtis turbine, 2000 kw, 750 r. p. m., 13,200-volt General Electric alternator; one Deane jet condenser and air pump for 500-kw engine unit; one Blake jet condenser and air pump for 500-kw engine unit; two Deane feed pumps; one Smith-Vaile feed pump, and one Alberger surface condensing and cooling tower equipment for the 2000-kw turbine.

The sub-station equipment consists of the following:

Framingham power station	2—250 kw rotary converters, G. E.,	600 volts,	25 cycles.
	1—500 " " " "	600 "	25 "
Wellesley, sub-station.....	2—400 " " " "	600 "	25 "
	1—500 " " " "	600 "	25 "
Westboro sub station......	2—250 " " " "	600 "	25 "
	1—500 " " " "	600 "	25 "
Marlboro sub-station......	2—250 " " " "	600 "	25 "

Total rotaries, 11; total sub-station rated capacity, 3800 kw.

General Electric step-down transformers and switchboard equipment are used in each sub-station.

The Alberger condensing equipment at the power house is the largest cooling tower installation in New England. The Sudbury River does not permit the use of as much water at all seasons of the year as the station would require if it had been further developed along the lines of the original 1500-kw plant. Something like 6,000,000 gals. of water per day are now required for condensing and boiler feeding, but on account of the low water in the river and the rights of other consumers the plant is limited in times of drought to 25 per cent, or thereabouts, of this amount. The cooling tower installation enables the water at times of low supply in the river to be used repeatedly, the loss by evaporation being made up either from the river or from a well near the station. Three cooling towers are installed, each being 22 ft. in diameter and 33 ft. high.

The normal steam consumption of the Curtis turbine per hour at full load is 40,000 lbs., and any two of the towers are guaranteed to handle the circulating water for the condenser when working under 27 ins. of vacuum. The exhaust from the turbine passes into a counter-current surface condenser containing 12,000 sq. ft. of cooling surface whence the water of condensation is pumped through a 4-in. discharge pipe to a receiving tank in the engine room, after which it is passed into the circulating return pipe leading from the cooling towers to the power house. Any one of the cooling towers is guaranteed to handle the circulating water for the 1000-kw engine unit when condensing from 20,000 to 25,000 lbs. of steam per hour, taking the water at a temperature not lower than 10 degs. below that of the steam, and maintaining from 26 ins. to 27 ins. vacuum. All three towers will handle the circulating water for the turbine when the latter is operating at 50 per cent overload in summer weather at 80 degs. temperature, using 60,000 lbs. of steam per hour and maintaining a 27-in. vacuum with the barometer at 30 ins. The Alberger Company provided the following pumps in connection with this equipment:

EXTERIOR OF FRAMINGHAM POWER STATION, THE COOLING TOWERS ARE SHOWN ON THE RIGHT

One horizontal 8-in. x 18-in. x 24-in. Corliss dry vacuum pump; one Lawrence 50-hp induction motor-driven volute centrifugal pump; and one 5¼-in. x 6¾-in. x 8-in. horizontal duplex hot-well pump.

PARK SQUARE, BOSTON, TERMINUS OF THE BOSTON & WORCESTER STREET RAILWAY

There are also installed two De Laval turbine type centrifugal pumps for use in delivering the circulating water against the head corresponding to the height of the towers. One pump is rated at 55 hp and the other at 110 hp. Two sizes of pumps were selected in order to facilitate operation at times without the cooling towers, and at times with cold water.

The volute centrifugal pump delivers the discharge water from the jet condenser of the engine sets to the cooling towers. All the circulating system is cross-connected with pipe lines from an intake well at the river, so that during part of the year, or when the load on the plant is light, river water can be used, sometimes helping out the condensers by using only one tower together with the river water, and again using river water altogether if the turbine is shut down.

Each of the cooling towers is equipped with two semi-pressure fans 9 ft. in diameter, which run 300 r. p. m. Each

pair of fans is driven on a common shaft by a 40-hp, 350-volt, three-phase General Electric induction motor installed in a special house at the side of the towers. The motors are belted to the fan shafts and are provided with oil switches. Air is supplied through louvres set in the side of the fan house. The cooling towers are guaranteed not to evaporate any more water in the process of heat extraction than the amount of fed water required. The large size of the surface condenser is due to the high temperature attained by the circulating water in hot weather, which often exceeds 80 or 90 degs. The contractors for the power house were J. M. Bishop & Co., of Worcester, Mass., and the power plant was designed and its construction supervised by E. H. Kitfield, consulting engineer, Boston. The chief engineer of the plant is A. F. Lovering.

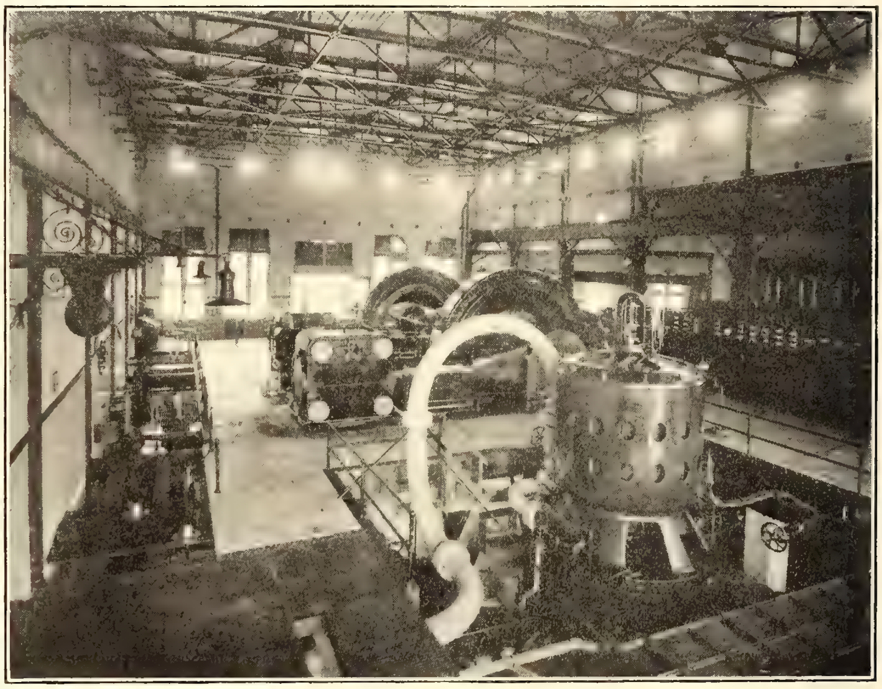
In each of the sub-stations outside that in the main power station the machinery is looked after by the car house employees. Three men are charged with the oversight of the sub-station at Wellesley Hills, where the company's principal repair shops are located. At Westboro and Marlboro two men look after the rotaries. In each of these sub-stations the circuit breakers are wired up to ring a large gong in the car house or shop in case they open. The regular power-house force look after the sub-station at the Framingham plant, as the rotaries and transformers are located in the engine room of the station.

The power-station operating force includes three engineers, working ten hours each; nine firemen, working eight hours per day each; three coal passers, working nine hours; one helper, ten hours, and four oilers, ten hours. Coal is brought to the plant by rail from Newport, R. I., the kind used being a West Virginia coal of about the calorific value of New River. The coal reaches the station on a side track of the New York, New Haven & Hartford Railroad, and it is unloaded by hand, the force being the regular Boston & Worcester track gang.

Careful analyses of the cost of power, both at the generating plant and at the sub-stations, are regularly made by the electrical engineer of the company, Milan V. Ayres. Fuel consumption, wages, supplies, sub-station and power plant repairs are all considered with reference to the car-mile and the kilowatt-hour generated and distributed. The total expenses for power now amount to about $75,000 per year, making a cost of about 3.8 cents per car-mile. The company is constantly doing more business and its rolling stock tends to increase in weight and motive power equipment, so that the total cost of power in the past three years has been greater each year. The table on page 761 is a comparison of the power cost of the road for the three years ending Sept. 30, 1904, 1905 and 1906.

Like many other interurban roads, the Boston & Worcester has not yet adopted a single standard of rolling stock for main line service, but instead has purchased different types of cars from time to time in the effort to serve best the traffic offered. During the past summer the company was obliged to run cars every fifteen minutes between Boston & Worcester and every seven and one-half minutes between Boston and South Framingham. Frequently double or triple-headers were required on some of these trips, and even then the company was unable to accommodate all the people who wished to travel. The result of the company's increasing business has been a progressive growth in the size and weight of its newer cars, and this, with the more frequent stops caused by additional traffic, doubtless explains the increase in power consumption from 3.42 kw-h. per car-mile in 1904 to 3.88 kw-h. in 1905 and 4.05 kw-h. in 1906.

Although the actual kw-h. consumption d. c. per car-mile has increased, it is gratifying to note that the total cost of power production is less than in 1904 per kw-h.; and but one-fiftieth of a cent greater on the direct-current end than in 1905. The erection of additional feeders has been a factor in the economy of distribution and the careful study of power house operating conditions another. The transmission and conversion efficiency of the system as measured by the ratio of d. c. output on the sub-station switchboards to the a. c. output of the generators at the power station


ENGINE AND TURBINE ROOM OF THE BOSTON & WORCESTER STREET RAILWAY

shows a pleasing increase from 78.3 per cent in 1904 to 83.7 per cent in 1906. The coal consumption per kilowatt-hour at the station has held pretty close to constant in the three years shown, being practically 2 lbs. per horse-power-hour each year. The delivery of power at the sub-station d. c. bus-bars at slightly under 1 per cent per kilowatt-hour shows the possibilities of the alternating generating plant, high-tension transmission and rotary converter sub-station scheme to be pretty favorable to economical results if carefully operated.

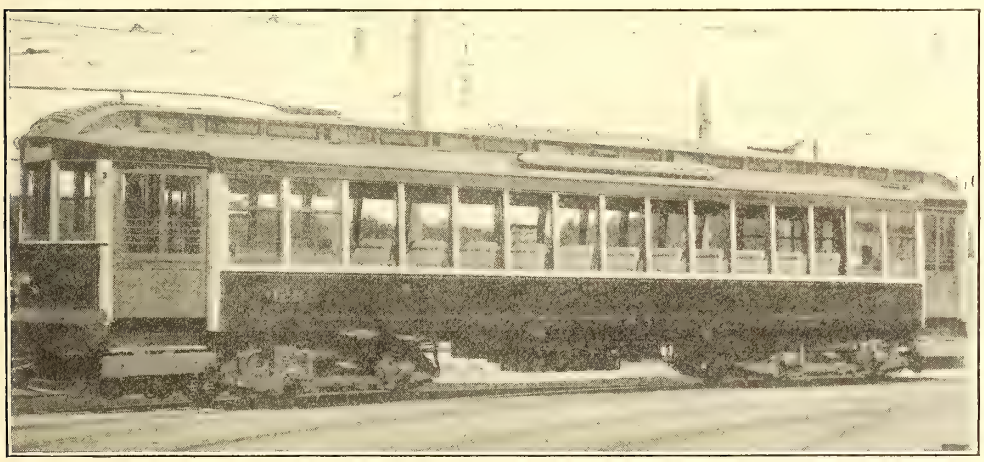
Last year the cost of coal amounted to 71 per cent of the total cost of power at the generating plant, wages to about 20 per cent, supplies 4.4 per cent, and repairs 4.6 per cent. It is interesting to note that steam plant repairs were nearly ten times those of the electrical equipment, showing the relative perfection in design of the two, in a measure. The coal consumption is now about 1000 tons per month—a yearly total which warrants every effort to economize in the consumption of the power plant and in the use of power itself. Of the total operating expenses of the road for the year ending Sept. 30 last, the cost of power figures 26.6 per cent.

BOSTON & WORCESTER STREET RAILWAY COMPANY
POWER REPORT.

YEAR ENDING SEPT. 30.	1906.	1905.	1904.
Total kw-hours generated (alternating)	9,396,335	8,567,403	7,220,238
Kw-hours Framingham sub-station (direct)	2,792,600	2,309,300	1,908,600
Kw-hours Wellesley sub-station (direct)	2,915,000	2,744,080	2,229,720
Kw-hours Westboro sub-station (direct)	1,233,200	1,296,740	1,520,300
Kw-hours Marlboro sub-station (direct)	921,700	796,360	......
Total (direct)	7,862,500	7,146,480	5,658,620
Ratio, direct to alternating	83.7%	83.4%	78.3%
Coal burned, lbs.	25,306,409	22,792,589	19,145,081
Lbs. per kw-hour, alternating	2.69	2.66	2.65
Lbs. per kw-hour, direct	3.22	3.19	3.38
EXPENSES, POWER STATION.			
Coal	$50,803.87	$43,353.30	$39,398.31
Wages	14,458.87	13,338.93	11,907.87
Supplies	3,153.43	3,846.51	5,659.69
Repairs steam plant	2,930.39	3,033.32	1,858.42
Repairs electric plant	349.45	243.77	......
Total power station expense	71,693.51	63,815.83	56,724.79
EXPENSES, SUB-STATION.			
Wages	$1,646.88	$1,652.77	$1,446.77
Supplies and repairs	997.50	220.33	16.64
Total sub-station expenses	2,644.38	1,873.10	1,563.41
Total expense for power	74,340.39	65,688.93	58,188.20
POWER COST PER KW-HOUR (ALTERNATING)			
Coal	0.541 cts.	0.506 cts.	0.544 cts.
Wages	0.154 cts.	0.155 cts.	0.165 cts.
Supplies	0.034 cts.	0.045 cts.	0.050 cts.
Repairs	0.035 cts.	0.038 cts.	0.025 cts.
Total	0.764 cts.	0.744 cts.	0.784 cts.
POWER COST PER KW-HOUR (DIRECT)			
Coal	0.646 cts.	0.607 cts.	0.694 cts.
Wages	0.205 cts.	0.209 cts.	0.236 cts.
Supplies	0.041 cts.	0.057 cts.	0.065 cts.
Repairs	0.054 cts.	0.046 cts.	0.032 cts.
Total	0.946 cts.	0.919 cts.	1.027 cts.
CAR MILEAGE.			
Revenue, double truck	1,859,697	1,648,789	......
Revenue, single truck	......	119,746	......
Dead, double truck	13,240	12,255	......
Dead, single truck	288	2,679	......
Snow plow	1,424	......	......
Total	1,874,649	1,783,469	1,655,028
Kw-hours, direct current per car mile	4.05	3.88	3.42
Cost per car mile	$.038	$.035	$.035

SUB-STATIONS

The effect of the company's policy regarding the care of sub-stations by car house and shop employees is shown in the exceedingly low total sub-station expenses each year. The cost of supplies and repairs has increased sufficiently to compensate for the enlargement of the original sub-station



STANDARD SEMI-CONVERTIBLE CAR IN SERVICE

equipment, and it is something of a question if at some future time it may not be well to arrange for some of the sub-station attendance to be on an all-day and specialized basis. The small percentage of dead mileage is also significant of careful control of car movement.

The Wellesley sub-station is 10 miles from the Framingham power station, the Marlboro sub-station 8 miles, and the Westboro sub-station 11.5 miles. The high-tension supply is carried out by three transmission lines, all being three-phase circuits. One circuit extends from the power house to Wellesley sub-station, being No. 0 copper; another of No. 2 copper runs from the power house to Westboro; and the third, equivalent to No. 2 copper, runs from the generating station to Marlboro. In the town of Framingham, where the foliage is thick, the two latter circuits are run in aerial cables for 3750 ft. At the beginning and end of this cable run, lightning arresters and switch houses have been installed on poles so that the cable sections can be quickly isolated if necessary. The houses are covered with

VIEW OF THE BOSTON & WORCESTER LINE EAST OF THE WELLESLEY CAR HOUSE

galvanized iron and are well out of the way of persons on the street. They are large enough to enable an employee to stand upright inside and walk back and forth without coming into too close quarters with the arresters and switches. Between White's Corner and the Marlboro sub-station the transmission line is of aluminum wire, with the exception of 3000 ft. between the Marlboro city line and the sub-station, which is of stranded, lead-covered copper cable. The three lines are independent, so if trouble occurs on any one the others need not necessarily be shut down.

OVERHEAD CONSTRUCTION

The trolley wire on the main line is of No. 000 grooved wire. On the branch lines No. 00 round wire is used. The grooved wire is being replaced gradually with No. 0000 round wire on account of the greater freedom of the latter from breakages. The feeder system consists mainly of No. 0000 and 500,000-circ. mil sizes. Section insulators are installed near the Framingham power station at White's Corner and opposite each sub-station.

ROLLING STOCK

The company's rolling stock equipment consists of about seventy-five cars. There are five Newburyport box cars, 37 ft. over all, seating 36 passengers each and equipped with Peckham 14-B-3x double trucks, four G. E.-57 motors, single trolley, type-M control and Christensen air brakes. There are also five Newburyport open cars seating 60 passengers each. These are 37 ft. over all and are carried on the same type of trucks as the foregoing. Four G. E.-57 motors are used under these cars. The company has besides fourteen

Newburyport box cars, 42 ft. 6 ins. long, seating 44, with two trolleys, mahogany finish, four G. E.-57 motors and type-M control, and ten fourteen-bench Newburyport open cars with glass wind breaks in front of the motorman. These cars have four G. E.-57 motors. There are also in use on the main line ten Brill semi-convertible cars, 42 ft.

INTERIOR VIEW OF STANDARD SEMI-CONVERTIBLE CAR

6 ins. long over all, with a seating capacity of 44. Five of these are equipped with Brill trucks and five with Peckham trucks; all have four G. E.-57 motors, double trolley poles and type-M control. The company has a variety of cars in use on its branch service. The double-trucked cars are mainly equipped with four GE-67 motors and the single trucks with two GE 1000 or 800 motors. All the cars in use on the main line are double-trucked four-motor equipments, while the branch line cars are single and double-trucked outfits, operating at lower speeds and taking considerably less power. The main line cars are all geared for a maximum speed of about 40 m. p. h. on the level, the line voltage being figured at 600.

The company has just put in service six new Brill semi-

MOTORMAN'S COMPARTMENT IN VESTIBULE OF LARGEST CAR

convertible cars 53 ft. 5¼ ins. long over all and seating 60 passengers each. These cars are among the handsomest in New England, and they are mounted on Brill 27-E-1½

THE WESTBORO CAR HOUSE AND ONE OF THE ROTARY SNOW-PLOWS

trucks and equipped with type-M control and four G. E.-73 motors. The vestibules are equipped with pneumatically-operated sliding doors and folding steps. The air brake equipment is of the General Electric emergency straight-air type. Seven Brill fourteen-bench open cars of the Narragansett type with complete vestibule ends and no front seats have recently been ordered. These are to be 45 ft. long and

equipped with four G. E.-57 motors and multiple-unit control.

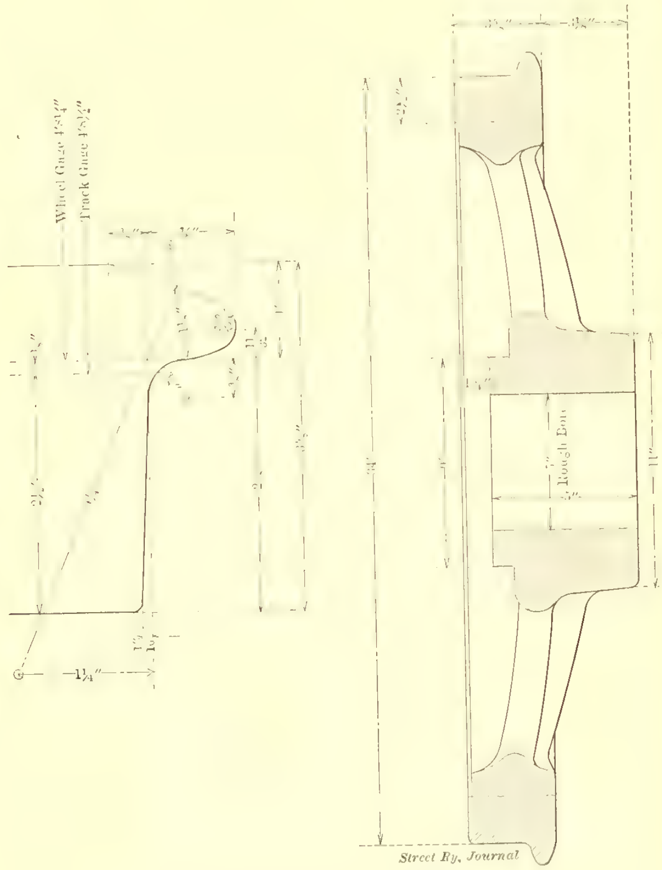
The new Brill semi-convertible cars referred to in the foregoing paragraph are built 41 ft. long over the car body from end panel to end panel. There are fifteen windows on each side of the car. The trolley board is 11 ft. 11 ins. high above the rail, and the roof is of the monitor deck pattern with sixteen ventilator sashes on each side. The outsides of the cars are fitted with solid bronze metal trimmings. The side sills are of yellow pine, 4 ins. x 8¾ ins., plated with ⅜-in. x 15-in. steel plates. The end sills are of white oak, 5¼ ins. x 6⅞ ins., and the center cross joists 4½ ins. x 5½ ins. The cross timbers in these cars are strengthened by iron plates to prevent sagging. The corner posts are 3¾ ins. thick and the side posts 3¼ ins. The cars are equipped with No. 11½ Van Dorn draw-bars, and with two De France air sanders. The wiring is all run in pipe conduit, and all except the light wiring was done by the Boston & Worcester Company.

The vestibule outside doors are four in number, 5 ft. 9 ins. high and 5 ft 4 ins. wide, with an iron bar in the middle. Each car has 22 seats 37½ ins. x 17 ins. and four longi-

VIEW OF COUPLED CARS, SHOWING TYPE OF VESTIBULE

tudinal seats 59 ins. x 17 ins. The total width of the car at the sills is 8 ft. 6 ins., and the sides slope to a width of 8 ft. 2 ins. at the eaves to allow easier passage on sharp curves. The inside finish is of quartered oak with a five-layer poplar veneer ceiling painted green, and wire-glass ventilators. Pfingst fenders, push-button signals for the motorman, Streeter pattern brake-shoes with separate head and slipper, Consolidated heaters and International registers complete the principal equipment, with the exception of the lighting scheme. On each side of the car above the seats and just under the sides of the monitor are mounted thirteen 16-cp incandescent lamps of the frosted bulb type with reflectors. The lamps are attached with rigid polished brass fixtures to a horizontal brass conduit which runs through the car and the lighting effect is admirable. The accompanying photograph of the interior of one of the new cars shows the arrangement of the lamps. The total weight of each car equipped is 72,800 lbs.; the body weighs 27,850 lbs. and the trucks 20,600 lbs.

These cars are equipped with both inside and outside-hung brakes, the inside brakes being operated by air with separate rigging from the outside brakes, which are hand-operated. The wheel base of the trucks is 6 ft. and the wheels are 34 ins. in diameter with 2½-in. treads. Steel tires 2½ ins. thick and ⅞-in. flanges. A drawing of the standard wheel section of the Boston & Worcester is reproduced herewith. The hubs are 11 ins. in diameter outside, with 5-in. rough bore and 5 ins. long. The axles used on these cars are 5¼ ins. in diameter. The flanges of the wheels are of special section to accommodate the special track work on the Boston Elevated surface lines. The outer curve of the flange section has a radius of 4¼ ins., and it swings in toward the center so that the flange will not grind against the head of the girder rail in the streets. The depth of ⅞ ins. provides for high-speed operation on the interurban line. The new axles are not provided with key-ways on account of the tendency of axles to break at these points, but the wheels are pressed on with about 40 tons of hydraulic pressure at the company's shops. The gears are solid and are pressed on, without keys. The journals are 4¼-in. x 8-in. M. C. B. button-head type, and the truck



STANDARD STEEL WHEEL

base from center to center is 29 ft. 4 ins. The side of the car is protected by an outside plate 5¼ ins. wide and ¼ in. thick laid flush with the bottom of the sill.

In addition to the passenger equipment the company has eight nose and shear plows and two rotary plows. These are all double-truck plows operated by four G. E.-57 motors The two rotary plows are equipped with two G. E.-57 motors on the fans in addition to the truck motors. All the wiring of the snow plow equipments is run inside the cabs along the walls, the object being to prevent damage to the insulation by salt and water. There is also a service car equipped with four G. E.-67 motors.

FREIGHT AND EXPRESS SERVICE

The necessary permits to handle a freight and express business have been granted to the company by all the cities

and towns in which it operates, and the commencement of the service only awaits satisfactory agreements with the Boston Elevated and the Worcester Consolidated Companies. A careful canvass among the various shippers located on the line has assured the Boston & Worcester that the freight and express business when in operation will be highly acceptable to the public.

TRACK AND ROADWAY

Between Chestnut Hill and Framingham the company's trackage is nearly all laid in a boulevard or semi-private right of way in the streets. The line between Framingham and White's Corner runs for the most part in the highway but between White's Corner and the Worcester Consolidated line the tracks are laid in a private right of way. There are a large number of grades and curves in the line between Boston and Worcester, and west-bound cars rise about 480 ft. above the sea level in the 40-mile run. There are five stretches of level track, about 1000 ft. long each, on the road; seventeen grades of 5 per cent, seventeen of 6 per cent, eight of 4 per cent and three of 8½ per cent. Between White's Corner and Framingham there are two curves of 90 ft. minimum radius, but when the double tracking is completed the curves will in general be not less than 800 ft. radius. At present the least radius curve, generally speaking, is 500 ft. Very little slacking of speed is necessary on the majority of the curves, but the line is carefully marked at all special points where slow running or extra care are necessary on the part of the motorman. This is done by painting three white stripes, for example, on the third pole from the crossing or sharp curve which must be carefully approached; two stripes on the second pole, and one on the pole next to the caution point. The rails are A. S. C. E. 75-lb. T section on the main line, with Weber joints. Two 8-in. No. 0000 Fig. 8 crown bonds are installed under each joint. The branch lines are using a good deal of 60-lb. rail as yet. The company lights the streets through which it passes in Newton, Wellesley, Natick, Framingham, Southboro, Westboro and to some extent in Northboro and Shrewsbury. The height from the rail to the trolley wire under the lowest bridge is 12 ft. 8 ins. This bridge is in Worcester; the lowest bridge on the Boston & Worcester line gives 17 ft. clearance. The street lighting is done by using six 24-cp, 100-volt lamps in series, but in the car lighting circuits five 16-cp, 120-volt lamps are used. Power is kept on the lines all night.

OPERATING DETAILS

Thus far the company has not operated its cars in multiple-unit trains to any extent, nor has limited service been attempted. When the line is entirely double-tracked it is likely that something of this sort may be tried. The company runs large numbers of special excursions from Worcester and other inland points on its route to the various beaches near Boston each summer. For its prompt and efficient assistance the company's general superintendent, E. P. Shaw, Jr., received a warm letter of executive appreciation from the Governor's chief military representative, Adjutant General Frye.

The general officers at Framingham Junction occupy a special building of attractive design which also contains the dispatcher's room and a waiting room for passengers transferring at that point. An advantageous feature of the station design is the provision of wide, comfortable seats in the open beneath the broad, sloping roof, as well as inside the waiting room—a pleasing contrast to many steam railroad stations in the East. All car movements, whether on

WORCESTER TERMINUS OF THE BOSTON & WORCESTER STREET RAILWAY. THE CITY HALL IS ON THE RIGHT

the single or the double-track sections, are under the control of the dispatcher at Framingham Junction, who is on duty whenever cars are in operation. Records of the car movements based on telephone reports from the crews are kept on a printed train sheet for each day in the same general way that steam railroad trains are registered.

Fixed telephones are located at all turnouts, cross-overs, junctions, important buildings and other places along the line, most of the instruments being protected by sheet-iron booths. The others are located in pole boxes. Every foot of track is covered by the telephone circuits, and private telephones are installed in the houses of many of the foremen and officials. The company has made special provision for the comfort of its passengers, not only at its Chestnut Hill, Framingham Junction and White's Corner stations, but also at many other points along the route. A typical waiting station of the way type is that at Newton Highlands. The station is a neat wooden structure lighted on all sides with ample windows and provided with excellent seats, electric heater, U. S. mail box, a telephone pay station, time-

tables of the Boston & Worcester cars, and lighted at night by 16-cp incandescents. The road is equipped with the Blake semi-automatic signal system, whereby the dispatcher can set any one of the numerous semaphore signals along the line to call any particular conductor to the telephone. These signals are not used to control car movements on the plan of the block system, but simply for calling car crews to the telephone.

On pleasant Saturday afternoons, Sundays and holidays during the winter season cars leave Chestnut Hill every fifteen minutes for Worcester and South Framingham, and during heavy traffic extra cars are run from Chestnut Hill to all points. The first through car for Boston leaves Worcester on weekdays at 6:25 a. m., and thence at half-hourly intervals until 9:25 p. m. From Boston through cars to Worcester are started at 6:15 a. m. and continued every thirty minutes until 9:45 p. m. The branch line connections to Marlboro and Hudson are exceptionally good. The following table gives the distances between the various points on the main line, reckoned from Park Square, Boston.

MAIN LINE MILEAGE, BOSTON TO WORCESTER

PARK SQUARE TO	
Brookline Village	3.19
Chestnut Hill	5.50
Woodward Street	7.84
Wellesley Car House	9.73
Wellesley Hills Square	11.04
North Natick	15.63
Framingham Junction	18.11
Framingham Center	19.40
Hesselt	21.91
Fayville, Southboro	23.45
White's Corner	24.25
Washington Street, Westboro	26.83
Lyman Street, Westboro	29.10
Milk Street, Westboro	30.42
Westboro Car House	31.42
South Street, Shrewsbury	33.93
Shrewsbury Turnpike	35.42
Lake Quinsigamond	37.10
Worcester City Hall	40.15

REPAIR AND MAINTENANCE

All important car repairs are made at the shops connected with the Wellesley Hills car house. This work, including inspection, comes under the authority of the master mechanic, W. H. Wadsworth. Daily inspection and small re-

OFFICE BUILDING, STATION AND OPERATING QUARTERS AT FRAMINGHAM JUNCTION

pairs are made at the car houses. The general repair shop is located at the south end of the Wellesley Hills car house and it is served by two tracks which extend into it from the car house proper for about 20 ft. Below the tracks is a space for the storage of pipe fittings, normally covered by a trap door. This storage space is lighted by 16-cp incandescents mounted in asbestos-lined boxes, and the lamp wiring is run in iron conduit. The shop is rather crowded, on account of the rapid increase of business which the road has lately enjoyed. The machinery is all group-driven by a 10-hp, 360-volt General Electric induction motor, and it includes one Chandler & Farquhar 40-in. engine lathe, one Franklin portable crane for armature handling, one 150-ton Schaffer hydraulic wheel press, an 11-in. lathe, a Hendry 6-in. speed lathe, a Hill, Clarke & Company double emery grinder, one Wells screw-cutting machine, one Barnes ver-

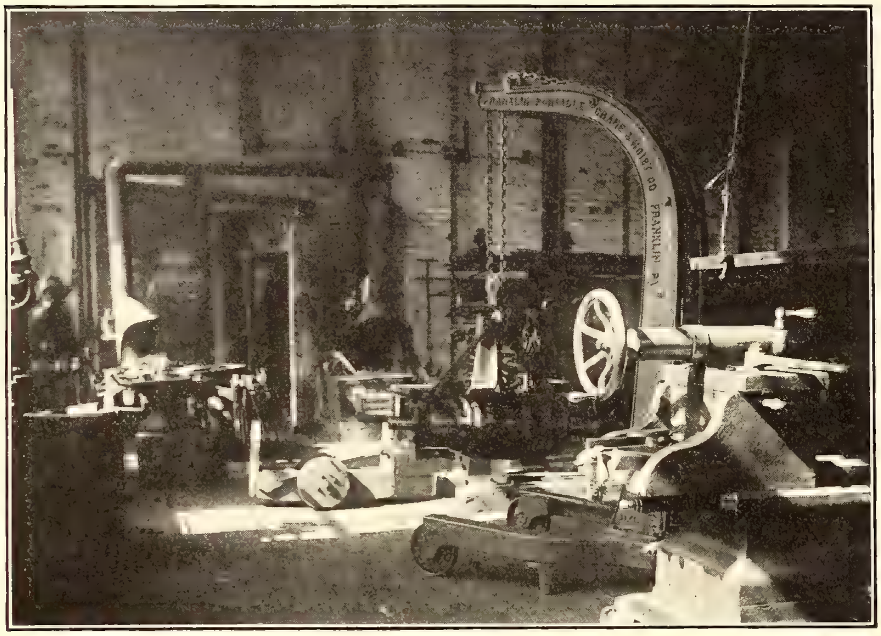
SNOW-PLOWS AND EXPRESS CAR IN FRONT OF THE WELLESLEY CAR HOUSE AND SHOPS

Unlimited round-trip tickets costing 70 cents are sold between Chestnut Hill and the Worcester-Shrewsbury line at Park Square, Boston, Village Square, Brookline, Chestnut Hill, Washington Square, Worcester, and Harrington Corner, Worcester. Single fares are 40 cents each; in either case 10 cents is added in each direction for passengers traveling via the Boston Elevated and Worcester Consolidated systems. The fare from Boston to the Wellesley and Natick line is 10 cents; to the Framingham Centre station or to South Framingham, 20 cents; to White's Corner, 25 cents; and to Marlboro, 30 cents.

tical drill, one Athol grindstone, one American twist drill grinder, one Auburn grinder, one band saw, one 2-ton Harrington hoist, one wheel-grinding machine, one Greenard arbor press and a home-made circular saw.

The work done at the shops includes the operation of a small brass foundry located in the basement of the armature winding room. The furnace is operated by kerosene oil and compressed air, and pouring off occurs about three times a week, the number of castings made averaging from 30 to 40. The company makes its own trolley wheels, window catches, window tighteners, axle brasses for motor

bearings, journal brasses, brass frames for conductors' bells, hinges for oil cups, handles for reversers, split brass oil rings for rotary converters, and any other special brass parts which it may need in a hurry or find cheaper to make than to purchase. The kerosene oil for the furnace is supplied by a 4-hp Christensen pneumatically-driven pump at 25 lbs. pressure per square inch, the storage tank being



VIEW OF THE MACHINE SHOP OF THE BOSTON & WORCESTER STREET RAILWAY COMPANY

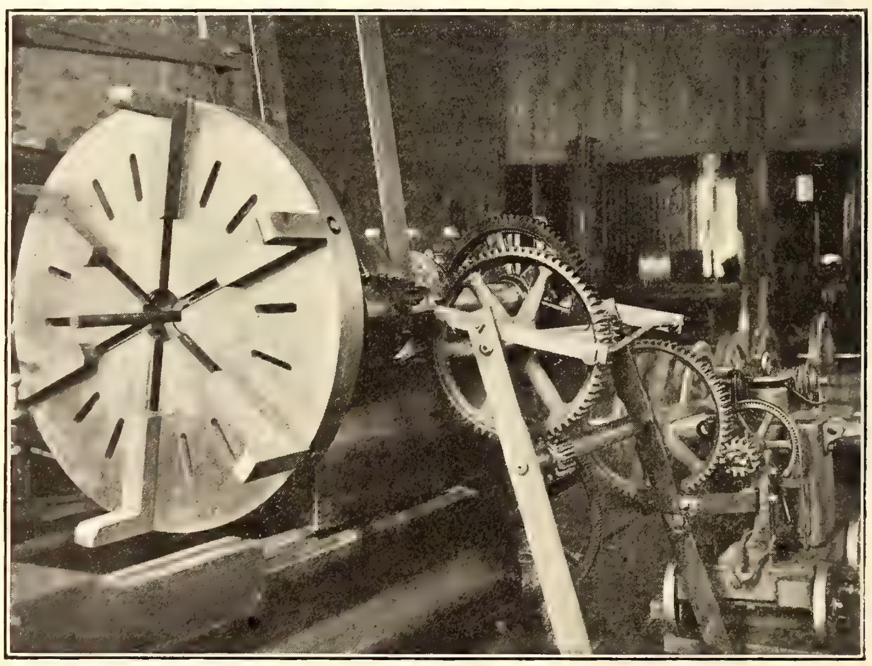
located outside the building. The air blast in the brass furnace is supplied by a fan driven by a 2.5-hp, 600-volt motor. The company makes its own patterns and trolley wheel cores. In mixing the cores the following ingredients are used: Two shovelfuls of special core sand, two double handfuls of flour, about one pint of molasses, and a pint of oil. Care has to be taken in getting just the proper mixture for the work, or a slight explosion and collapse of the cores takes place.

The trolley wheels made by the company are 6 ins. in diameter, 1¼ ins. wide and ⅞-in. core, using a ½-in. bushing. This hub is 3 ins. long. The wheels are composed of about 80 per cent copper and 20 per cent bronze, and their average life is about 800 miles each. The company estimates a saving of about 75 cents per wheel by making its own product. After the wheels are worn down they are remelted and cast over again, and a large quantity of scrap wire from the car equipments is used in the same way. A steam heater is installed in one corner of the brass foundry, and the covering of cast-off wire is first burned off in the furnace of this apparatus. Special jigs are used to facilitate boring out the brass axle linings and the trolley wheels, and the permanent patterns are of aluminum. The brass axle linings are bored out with an adjustable cutter having four knives, and the process is practically automatic. The rotary rings are split so that they can be put on the shafts without dismantling the machine, and the halves are fastened together by screws. The brass foundry is operated by one man, who has the assistance of one of the regular shop employees when pouring off.

The machine shop contains an electric oven for drying armature and field coils, an electric sand drier arranged to feed dry sand automatically to the storage pile from the damp sand compartment, a chemical extinguisher outfit for fire protection, a blacksmith shop equipped with a forced draft coal forge, and a coal-burning furnace for melting babbitt metal, also equipped with forced draft. A belt-driven fan supplies these furnaces in common. On the side of the shop nearest the sub-station door is a bench for the repair of circuit breakers, headlights, control mechanism, fuses, etc. The employee in charge of the sub-station ordinarily works at this bench, and close by is a large gong, which rings if a circuit breaker goes on the switchboard. The man who operates the brass foundry devotes part of his time to the babbitting furnace. The company presses on and off all its wheels and gears. Steel tires are used on the branch line cars, as well as those of the main line.

TURNING STEEL WHEELS

An important piece of auxiliary equipment in the shop is a 1-hp, 600-volt d. c. portable variable-speed motor used to operate the 40-in. lathe slowly enough to enable steel tires to be turned down. This motor is mounted on an adjustabe carriage, and is connected with the back gearing of the lathe. Before this was installed it was extremely unsatisfactory work trying to turn tires. An arrangement also exists whereby tires can be ground down for the removel of flat spots, the drive being mechanical from the overhead shafting. Painting is done at the Westboro car house.



METHOD OF DRIVING LATHES FOR TURNING TIRES, SHOWING GEARING

EDUCATING THE MOTORMAN

One of the duties of the master mechanic is the instruction and examination of motormen qualifying for positions in the car service. When a motorman has had time to study the company's rule book and the car equipment, he is subjected to a severe cross-examination upon his duties, and he is obliged to remedy defects in an actual car in the car house which has been crippled in various ways to test his knowledge. A blank is filled out for each motorman who qualifies, and this is sent to the office.

The company's "Book of Rules" is based largely upon the operating recommendations of the American Street and Interurban Railway Association, modified to suit the special needs of the road. Motormen are held responsible for the safe running of their cars, proper operation of machinery and running according to schedule. No persons except officials, foremen of car houses, trackmen and linemen, and these only when on duty, are allowed to ride in the front vestibule. Employees of foreign roads are not allowed to ride free. On the company's private right of way between White's Corner and Shrewsbury a white stripe on a pole between two red stripes indicates the beginning and a red stripe between two white ones the end of 25-m.-p.-h. limit of speed between such points as indicated by these marks.

A special and somewhat unusual feature of the "Rule Book" is the inclusion of instructions bearing upon the use of the multiple-unit control equipment. These have been worked out very carefully, and contain so many practical points that they have been included in this article.

RULE 300.—LOCATION OF FUSES

On the roof of every car and snow plow is a main fuse block; the fuse is a large copper strip.

The main control switch and fuse is in the vestibule beside the circuit breaker, on one end of car only. Some control fuses are in the control switch. On open cars they are beside the circuit breaker. The reverser and contact fuses are, on box cars under outside sill, in the center of contactors; on open cars under the inside end seat. The air fuses on small box cars are alongside of "air automatic" under the long seat. On large box cars they are in a wooden box with the air automatic. On open cars they are under inside end seat with the air automatic.

RULE 301.—LOCATION OF CONTACTORS

The contactors are in groups of two fives and one three. On large box and open cars they number from left to right, 1 to 13, all on one side of car. On small box cars and open cars, on one side there are two groups, numbering from 1 to 10; on the other side one group, numbering 11 to 13, and the reverser. On large box and open cars, the reverser is on the same side with the contactors.

Contactors that operate on different points on controller:

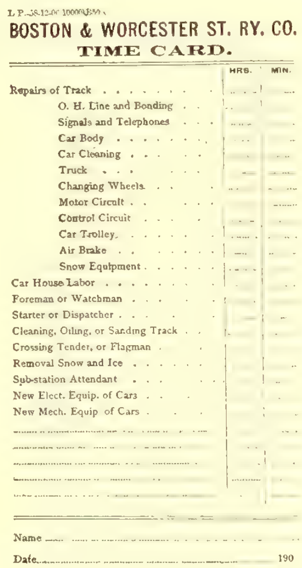
	Contactors
No. 1—Point	1–2–3–11
" 2— "	1–2–3– 5–11
" 3— "	1–2–3– 5– 6–11
" 4— "	1–2–3– 5– 6– 7–11
" 5— "	1–2–3– 5– 6– 7– 8– 9–10–11
" 6— "	1–2–4–12–13
" 7— "	1–2–4– 5– 6–12–13
" 8— "	1–2–4– 5– 6– 7–12–13
" 9— "	1–2–4– 5– 6– 7– 8–12–13
" 10— "	1–2–4– 5– 6– 7– 8– 9–10–12–13

If 1-2-3-11 contactors do not come up on first point, change contactor fuses. If then they fail to come up, look under contactor 12 to see if the small contact fingers are not broken. If not broken, look under 12 contactor and see if it is not stuck up. With the above trouble, contactors 5-6-7-8-9-10 will come up on the second, third, fourth and fifth points on controller, but will not start the car. If the motors on the sixth point fail to get power, and contactors 1-2-4-12-13 do not come up, renew the contactor fuses; if they then fail to come up, look under 11 contactor. With the above troubles, contactors 5-6-7-8-9-10 will come up on 7-8-9-10 points on controller, but will not give motor power.

If the car at any time does not increase speed, point for point on controller, faster than the first point until you use the sixth point, when the car will give quite a jump and not increase for the last four points, change the reverser fuses. If changing fuses does not fix the trouble, put the car on slow speed. Do not at any time run the car after you have found that it does not increase speed, until you change fuses, as by so doing you will get the resistance boxes red hot, and cripple the car.

If the car starts with a jump on the first points or blows circuit breaker, look under contactors 5-6-7-8-9-10-12-13 to see if any are stuck together. If you do not find any contractors stuck together, and the circuit breaker blows, cut out motors. If, on the sixth point the car slows down and takes power, look at contactor 11 to see if it is stuck up.

If contactors do not operate after changing main control fuse, try another controller; if then they operate, shut off main controller switch, open cover on controller to see if the two movable fingers are making good contacts, and if not, bend them so as to make contact, but be careful not to bend them too much. It is not necessary to pull down the trolley to put in any fuses except main fuses on the roof. In changing main control fuses, shut off main control switch; to change contactor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BOSTON & WORCESTER ST. RY. CO.

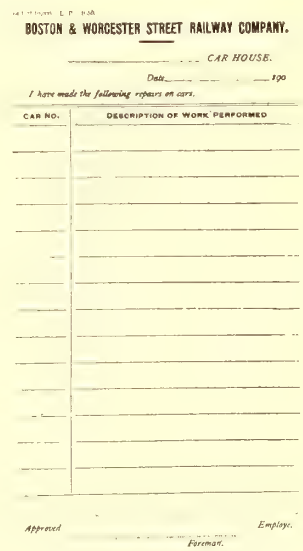
TIME CARD.

	HRS.	MIN.
Repairs of Track		
O. H. Line and Bonding		
Signals and Telephones		
Car Body		
Car Cleaning		
Truck		
Changing Wheels		
Motor Circuit		
Control Circuit		
Car Trolley		
Air Brake		
Snow Equipment		
Car House Labor		
Foreman or Watchman		
Starter or Dispatcher		
Cleaning, Oiling, or Sanding Track		
Crossing Tender, or Flagman		
Removal Snow and Ice		
Sub-station Attendant		
New Elect. Equip. of Cars		
New Mech. Equip of Cars		

Name ....

Date 190

TIME CARD


BOSTON & WORCESTER STREET RAILWAY COMPANY.

.... CAR HOUSE.

Date........................190

I have made the following repairs on cars.

CAR NO.	DESCRIPTION OF WORK PERFORMED

Approved .... Employe.

.... Foreman.

SHOP REPORT COVERING REPAIRS

and reverser fuses, to cut out motor or throw reverser by hand it is not necessary to shut off any switch, but take reverse handle with you, to prevent operation of controller. Before opening covers on contactors to see if contact fingers are broken or stuck, pull out circuit breaker and take reverse handle with you.

RULE 302.—TO CUT OUT MOTORS

The motor leads on the side of reverser go to the two motors facing that side. When you cut out motors, you cut out two. Cut out the side nearest the motors you wish to cut out. If you have trouble with the motors and you do not know which motor it is, cut one pair, try them, and if the trouble remains, cut them in and cut out the other pair. In cutting out motors, the third and sixth large fingers on the side you cut out should lift up from the arm. If they do not, pull them up or the motors will not cut out. If for any reason the large fingers on one side of reverser get burned or bent, and prevent the reverser from operating, or the arm is burned so that it will form a ground or a short circuit, pull the fingers clear of the arm.

RULE 303.—INSTRUCTIONS ON OPERATING

Do not let go of the controller handle with the power on; shut off the power before you let the plunger up. Do not keep the power on going down grade where the car will run faster than the power will drive it, as it will cause a short-circuit. When cars are turned in for blowing circuit breaker, the trouble is often caused by the above. Do not pull circuit breaker in with the controller handle on the "On Position." Holding circuit breaker in is a bad practice. There are 10 points on controllers, make a short pause between each point. Feeding cars

above five points on a heavy grade from a stop is bad practice, as it uses an excessive amount of power and overloads the motors, and is liable to blow circuit breaker. When the car is moving, it is all right to put controller handle on quickly to half or full power according to speed of car. If the circuit breaker keeps coming out the trouble is in the motor or motor circuit. If the motors do not operate, cutting out motors will not make them. Motor circuit and contactor circuit are independent, but if the control circuit does not operate, the motors will not get power. When running cars on slow speed and you cut out two motors, put switch on fast speed. Cars will not start with two motors cut out on slow speed. Snow plows will run on slow speed with two motors cut out. Never take brushes out of one motor thinking you will have three working, as third will not get power.

If you reverse the car while it is in motion let it stay on the reverse till the car comes to a stop. By throwing the reverse to a forward position going above 2 miles per hour, you are liable to cause a short-circuit on the reverse and cripple the car. Do not pull circuit breaker in till you throw reverser, when reverse has been made with circuit breaker out. When running on slow speed or with two motors cut out, never pull circuit breaker to reverse, as motors being all in series will not generate. If a car is crippled and you couple a car in the rear, couple cars according to instructions in Rule Book. To cut out a disabled car in train, use train cut-out switch on disabled car, which is, on box cars, behind one of the long seats (on open cars, under the inside seat).

Put disabled car in slow speed as otherwise, under conditions, motors will generate and act as brakes. If trouble is not in the main control fuses or controller on the disabled car, you can run train from the disabled car with trolley on and the main control switch and fuse in circuit.

If the motor resistance boxes become open-circuited by the grids or a section breaking, it will affect the operation of a car as follows: Will not start; on the first or second, or not till the third point on the controller; or run all right on the first three and jump on the fifth; or on the sixth will not get power; or jump on the seventh or on the ninth point, or will not start or get power on any point. Control circuit coils being open-circuited, will cause car to jump on different points, or blow main control fuse.

If at any point the contactors will not pick up on the first point, after changing fuses and the small fingers under No. 12 contactor are O. K., look at the small fingers on the reverser. There are three on each side, two on each side making connection. Press on them with your finger; if they move inwards, set reverser half way and drive the finger inwards. Be careful not to bend them too much. If the car will not run on slow speed, there is an open circuit in the four motors. Put car on fast speed and cut out the two motors that do not work. The trouble can be in the reverser, commutating switch, motors or motor leads. Pull circuit breaker out and try contactors. If the contactors do not operate on one controller, do not forget to try the other. Pay particular attention to the first point; do not throw reverser every time you try the contactors. Putting the fuses in look to see if they are making good connections; if not press the spring together on the fuse block.

RULE 304.—HOW TO COUPLE CARS IN TRAINS

After coupling the draw-bars together, couple the air pipes, right-hand ones as the motorman stands, together and the left-hand ones together. The pipes should be crossed when coupled. Open stop cocks on both cars by turning handles crossways of car. There are two on each car. Put control jumper in the plug sockets, drive the plug into the socket until the cover of socket will drop back over plug. The air and buzzer circuits, jumper sockets, are on box car, on upper sill on the outside of vestibule windows; on open cars on the front beneath the bonnet. The plug has two fingers of two different sizes which will only fit the corresponding size hole in the plug socket. Turn on switches on inside of cars to put buzzers in circuit. Reverse handles must be off, controllers and engineer's valve handles off of any valves except the ones operating train. An engineer's valve handle on the off position would make the air brakes useless. Trolleys must be on, and circuit breakers in on all cars, for all to work in train.

When the air pump on one car does not work, couple in trains same as instructions. One air pump will do the work of two. If there is a leak in the pressure pipe, leave the right-hand uncoupled. If the brake cylinder pipe or left-hand pipe leaks, do not couple up pipes, as it will not help on a disabled car. After coupling up, try the air to see if it sets brakes on both cars. If it does not, see if the pipes are crossed, stop cocks open, or engineer's valve handle left on some valve, on the off position. If both cars move as one, the motors are all working. If there is a jerk, the control jumper may not be in far enough.

QUESTIONS.

RULE 305.—TROUBLE WITH AIR PUMPS

If the air pumps do not work with both switches on the On Position, what would you do? (Answer). I would lift up the long arm on the automatic governor with a piece of wood, start or stop pump with switch, according to pressure. If pump should fail to work, by lifting the arm, I would change the air fuse. If then the pump fails to work, I would run the car with the hand brake.

RULE 306.—TROUBLE WITH REVERSER

If the reverser fails to work, what would you do? (Answer). I would change the two fuses on the fuse block and have the two ends connected together. If that did not make it work, I would look at small fingers on reverser to see if same are making good connections; if not, I would bend the fingers inward. If then the reverser would not throw, I would throw it by hand.

RULE 307.—TROUBLE WITH CONTACTORS

If the contactors fail to work on the first five points, what would you do? (Answer). If the reverser worked all right, I would change the two fuses known as the contactor fuses. If they then failed to work I would look under contactor No. 12 to see if the small contact fingers under the same were not broken, stuck up or making bad connections. If one was broken I would connect the two with a piece of fuse wire. Explanation: On the 2-3-4-5 points contactors 5-6-7-8-9-10 would come up in the above case. If the car did not increase speed after the first point, and on the sixth point gave quite a jump, what would you do? (Answer). I would change the two reverser fuses. If that did not fix the trouble, I would put switch on slow speed.

If your car started with a jump on the first point, or blew the circuit breaker, what would you do? (Answer). First I would look at contactors 5-6-7-8-9-10-12-13 to see if any were stuck together. If so, I would pry them apart with a screw-driver. If none were struck I would cut out first one pair of motors, then the other, until I stopped the breaker from coming out.

If the main fuse is all right, how can you tell without going onto the roof? (Answer). By the lights burning. How can you tell that the main control fuse is out of circuit. (Answer). By the lights burning and the reverser and contactors not working.

BLANK FORMS

Register records, statements affirming the understanding of bulletin boards, trouble reports, telephone calls and meals taken at the company's expense, power house records of labor, fuel, oil and repairs, arrival of coal, inspection,

40-L. P.-500—B-25-12-04

BOSTON & WORCESTER STREET RAILWAY CO.

LUNCH SLIP.

To Mr.

Please furnish Mr. *with lunch*
and charge the same to the Boston & Worcester St. Ry. Co.

Issued by
Amount charged $ | *c.* *Correct.*

Employee.

Victualler.

Hour Minute
At | *M.* *day* *190*

Keep this slip and send in with your bill each month to Auditor, South Framingham, Mass.

EMPLOYEE'S LUNCH SLIP, USED IN EMERGENCY WORK, AS FOR SNOW-SWEEPER CREWS

mileage blanks, tickets, employees' applications, articles loaned, and ticket classifications are among the blank forms used by the Boston & Worcester Street Railway Company. The accident reports, preliminary and final, provide for the clear statement of essentials, and the final report is distin-

guished by a seat drawing of open and closed cars in addition to the usual diagram of street intersections. Numbers and blank spaces provided for witnesses enable the conductor to place easily the positions of all interested parties in or out of the car at the time of the trouble.

Another interesting form used by the Boston & Worcester Street Railway Company is that relating to fire protection. There are many companies which do not follow up this feature as much is it should be, even where periodical inspections are ordered it may be that no means are provided for having written proof that the work has been done and the necessary changes pointed out. The form reproduced which provides for weekly inspection is very comprehensive, including not only the building, fire pails, chemical extinguishers, hydrants, hose, spanners, valves, automatic sprinklers, etc., but in addition questions relative to the location of the fire alarm key, condition of the watchman's clock and the general cleanliness of the different parts of the building, and where the fire protection apparatus is installed. This applies particularly to the sprinklers, as they are easily covered with dirt or grease or obstructed by clothing, partitions and other things which hinder their proper working.

In some quarters the use of a large number of special blanks is looked upon as needless red tape, but the elasticity of a well-designed system discredits any such view. Without blanks which are complete in their make-up some of the information needed in regard to operating crises is sure to be missing. Busy operating men do not like to write long-winded reports, and the well-designed blank serves an incalculable amount of mental energy for the actual responsible work of each position.

FIRE PROTECTION
Inspection Report
All Property to be Inspected Weekly and Report Sent to General Superintendent

1. BUILDING ....

2. FIRE PAILS. State number in blank spaces.

Basement	In place.	Full?	In condition to use?
First floor	In place.	Full?	In condition to use?
Second floor	In place.	Full?	In condition to use?
Third floor	In place.	Full?	In condition to use?

Sand Pails for fire use.

3. CHEMICAL EXTINGUISHERS. These should be used and recharged at least once a year.

Basement	In place	Date tested or charged
First floor	In place	Date tested or charged
Second floor	In place	Date tested or charged
Third floor	In place	Date tested or charged

4. HYDRANTS.

Note.—Each hydrant should be given a thorough test by flushing at least once a year, spring and fall. One turn to open should be sufficient for other inspections.

Hydrants open easily? Free from snow and ice and easily accessible?

5. HOSE, PLAY PIPES AND SPANNERS IN HYDRANT HOUSES. Each house to be numbered and reported on separately.

No. 1.	In proper place and ready for use?	Condition?
No. 2.	In proper place and ready for use?	Condition?
No. 3.	In proper place and ready for use?	Condition?
No. 4.	In proper place and ready for use?	Condition?
No. 5.	In proper place and ready for use?	Condition?

6. HOSE, PLAY PIPES AND SPANNERS IN BUILDINGS:

Basement.	In proper place and ready for use?	Condition?
First floor.	In proper place and ready for use?	Condition?
Second floor.	In proper place and ready for use?	Condition?
Third floor.	In proper place and ready for use?	Condition?
Fourth floor.	In proper place and ready for use?	Condition?

7. CLEANLINESS.

Oily waste well cared for? Basements clean? Yards kept clean from combustible material? Clothes closets clean? Water closets clean? Clean under benches? Loft clean and free from combustible material?

8. FIRE ALARM KEY.

For box No. In proper place?

9. WATCHMAN'S CLOCK.

In good order? Stations for same in good order?

10. VALVES (Inside gates).

Note.—All gate valves to be secured open with leather straps fastened with padlocks having common keys held by responsible parties. Each valve to be inspected by turning valve one-half turn to insure its being wide open and in good working order. Drip valves to be strapped closed in similar manner.

List of Valves

No.	Location	Open	Strapped

11. VALVES (Outside post indicator gates).

Note.—All post indicator gate valves to be fitted with hand wheel or socket wrench permanently secured to spindle. To be secured and inspected in the same way as inside valves.

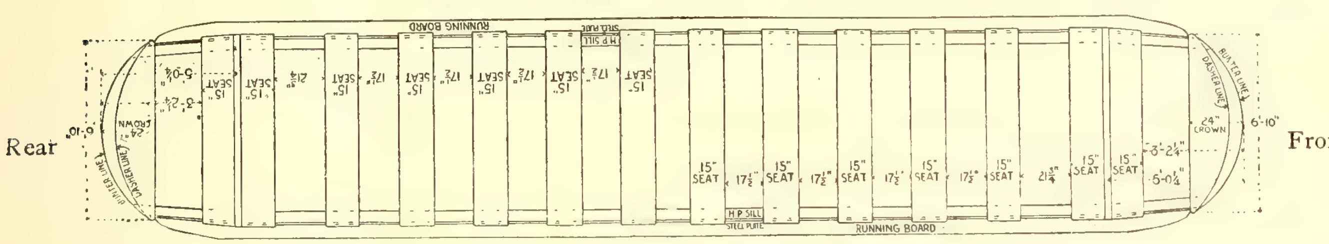
List of Valves

No.	Location	Open	Strapped

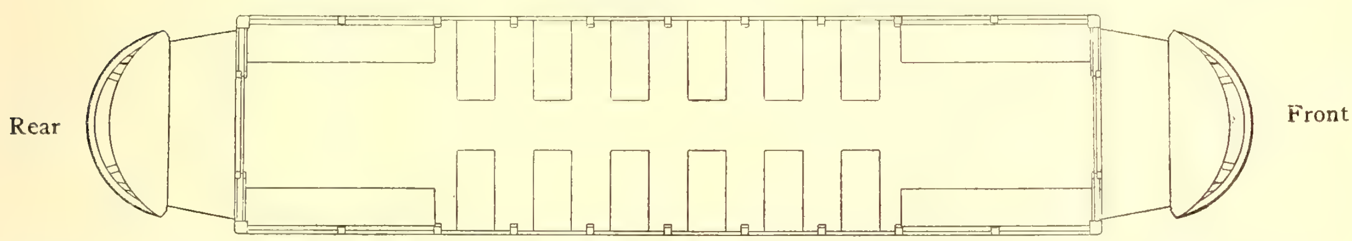
12. Give numbers of any valves found closed, part closed, not strapped, closed temporarily at any time since last inspection. Explanation

Indicate on appropriate plan by a mark (x) exact location of injured persons on car at time of accident; also by means of numbers where witnesses sat on car; also positions of moterman (m) and conductor (c).

OPEN CAR.



CLOSED CAR.



PLANS OF CARS PRINTED IN ACCIDENT REPORT TO SHOW LOCATION OF INJURED AND WITNESSING PASSENGERS, CONDUCTOR AND MOTORMAN.

13. DRY SYSTEMS (Air Valves).

Note.—Dry valve should be tested for water column or condition of spring at least every three months.

List of Air Valves

No. Location Air Pressage

14. Give number of any air system into which water has entered during week. Explanation.

15. ALARM CONNECTIONS.

Note.—All controlling valves or cocks for alarm devices to be strapped in the same way as inside valves. Special instructions to be given regarding testing of alarm valves.

(Alarm controlling Valve.)

No. Location Open Strapped Tested In order

No. 1 Dry Valve Electric.

No. 2 Alarm Valve Electric.

16. AUTOMATIC SPRINKLERS.

Any corroded, bent, whitewashed, gilded or painted, covered with dirt or grease, obstructed by clothing, partitions, shaft hangers?

17. Is there a clear space of at least 2 ft. below level of sprinklers free from storage or other obstruction? Note any exceptions.

Inspection made personally by me, this............day of........190....

GENERAL

The headquarters of the road department are at a car house owned by the company in South Framingham. Inspection of the track proceeds largely on the basis of trips by employees over the line on the cars, particular attention being given on foot to the vicinity of places where repairs or adjustments are made.

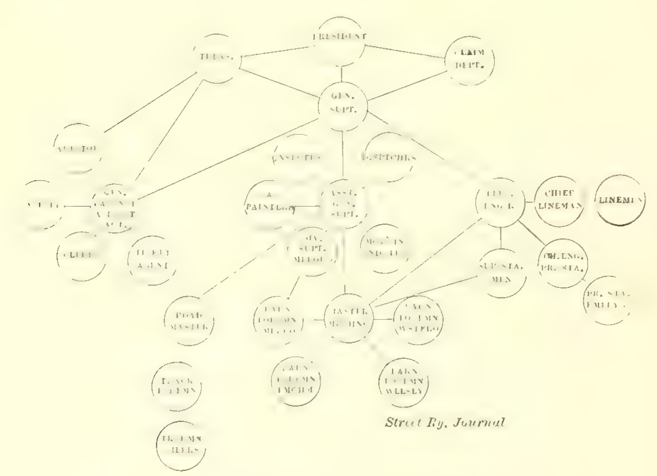
The operating organization of the company is shown in a diagram herewith, the responsibility of the various officials being clearly indicated.

The earnings of the Boston & Worcester road for the year ending Sept. 30, 1906, showed a gain of 13 per cent in gross over the previous year. The gross earnings, operating expenses and net earnings, together with the miles of main track operated since the road began business, are shown in the following table:

YEAR ENDING SEPT. 30.	1903.	1904.	1905.	1906.
Gross earnings..	$103,726.24*	$370,883.51	$448,365.70	$514,464.70
Operating expenses..	41,656.55	195,003.37	229,655.68	269,391.29
Net earnings....	62,069.69	170,880.14	218,710.02	245,073.41
Miles, main track	51.338	73.62	73.62	77.153
Dividends......	......	$46,944.00	$103,494.00	$103,500.00

* Operation began May, 1903.

The receipts from passengers last year were $501,719.22; from the carriage of mails, $250; express and merchandise,



ORGANIZATION CHART

$200; tolls for the use of tracks by other companies, $628.97; rentals, $2,982.46; advertising in cars, $1,481.10. The operating expenses for 1906 were:

Repairs of roadbed and track	$10,793.23
Repairs of overhead lines	4,507.08
Repairs of buildings	528.96
Transportation labor	73,517.78
Power plant repairs	4,422.99
Power station labor	15,963.05
Salaries	23,948.04
Fuel for power station	50,803.87
Fuel for car houses and office building	591.58
Power station expense	3,165.93
General expense	5,267.56
Printing, tickets and stationery	2,811.52
Removal of snow and ice	590.55
Repairs of cars	26,941.45
Repairs of electrical equipment of cars	22,740.92
Track rental	504.24
Power rental	630.59
Other transportation expenses	7,315.00
Damages	3,826.76
Insurance	8,400.00
Advertising	2,120.19

The total cost of the road to Sept. 30, 1906, was:

Track, roadway, line construction, etc.	$2,568,826.17
Land and buildings	206,788.02
Power station plant, including sub-stations	632,083.44
Rolling stock and miscellaneous equipment	612,092.15
Total	$4,019,789.78

Last year the cars of the company carried 10,279,303 fare passengers, as compared with about 9,000,000 in the preceding year. The average earnings per car-hour were $6.56 on the main line (in summer this frequently rises to $10), and $2.32 on the slow-speed branch lines. The main line cars increased their earnings 54 cents per car-hour, and the branch lines increased their earnings 13 cents per car-hour over last year. The earnings per car-mile on the main line were over 31.5 cents, and on the branch lines 23 cents. Of the total receipts from carrying passengers in 1906, about 60 per cent were derived from the traffic between Boston and Worcester, 19.5 per cent from the Boston-South Framingham route, and 20.5 per cent from the local routes.

The officers of the company are: President, James F. Shaw; vice-president, H. Fisher Eldredge; treasurer, George A. Butman; general superintendent, E. P. Shaw, Jr.; assistant general superintendent, M. E. Nash; auditor, general passenger and ticket agent, A. E. Stone; electrical engineer, Milan V. Ayres. The master mechanic is W. H. Wadsworth; roadmaster, Joseph Johnson; chief dispatcher, G. H. McFee; assistant dispatcher, M. L. Goodwin; division superintendent, H. W. McKay, and chief engineer of power plant, A. F. Lovering. Acknowledgements are due to these officials for numerous courtesies extended to this paper in preparing this article.

FREIGHT BUSINESS ON INDIANAPOLIS LINES

The electric railway lines entering Indianapolis are now averaging 200 tons of freight per day, according to figures given out by D. G. Edwards, general traffic manager of the merger lines. To this amount, Mr. Edwards said, might be added at least 25 tons handled by the independent lines. Mr. Edwards is greatly pleased with the development of freight traffic over the lines under his control, and says the express companies feel keenly the competition of the electric railways for light freight.

The Auntamiento, by a vote of 11 to 5, has decided to recommend a rival plan for a system of street cars in Havana, Cuba, as opposed to the proposition of the Havana Electric Company, which is applying for the right to extend its present system.

THE CONSTRUCTION OF EMPLOYEES' HOMES BY GERMAN ELECTRIC RAILWAYS

BY A GERMAN RAILWAY OFFICIAL

The activities of a large electric railway system in the regular work of transportation are so manifold and complex that any proposal to add to them should be subjected to searching analysis as to its value; but much as a corporation may desire to confine itself to its primary object, it cannot afford to neglect doing its share toward settling those social problems which directly affect the welfare of the company. Of these, the labor problem is one of the most acute, for while other employers can increase the selling prices of their goods to counterbalance the higher costs of wages and material, the railway company is restricted to a fixed maximum for its particular commodity, irrespective of higher production expenses. Hence the question arises: To what extent can a large city railway company, for example, escape labor troubles without impairing the value of its services and property to the public and its stockholders?

It is true that considerable attention is being given by American street railways to employees' welfare work, but they have considered the problem chiefly from the moral and not the economic aspect. The best club house facilities will not keep the worker satisfied if his wages do not increase with the higher cost of living. While a railway company cannot exercise any appreciable control over the cost of food and clothing, it can, and should, control the housing problem wherever the cost of rent is a large factor in the cost of living.

In Germany, the advisability of building houses for employees was not a live question until the growth of manufacturing industries required a large number of people from the country districts. This condition brought to light the extraordinary tenacity of the country workman to stick to his homestead rather than accept better wages under poorer housing conditions. Hence resulted the extensive development of whole towns built by large manufacturing corporations in Germany and elsewhere. Judging from the experiences of the pioneers in this work, it may be safely asserted that the proper settlement of the housing question will do far more to avoid friction than any increases in wages or legal enactments. In fact, wherever fair compensation has gone hand-in-hand with the endeavor to provide comfortable dwellings at low cost, strikes have become very exceptional.

The street railway companies of Germany have not been behind the other large employers of labor in that country in looking after the interests of their employees, particularly in the direction of pensions and sick benefit funds. The methods of raising money for these purposes are such as to avoid any feeling on the part of the men that they are receiving charity. The German street railway companies also deserve the credit of being among the first to erect homes for their employees, and it may be of interest to describe how this work is carried out and what the relations of landlord and tenant are under these conditions.

A GROUP OF STREET RAILWAY EMPLOYEES' HOMES IN FREIBERG, GERMANY, ILLUSTRATING THE DIVERSITY IN ARCHITECTURAL TREATMENT WITH THE SAME MATERIALS

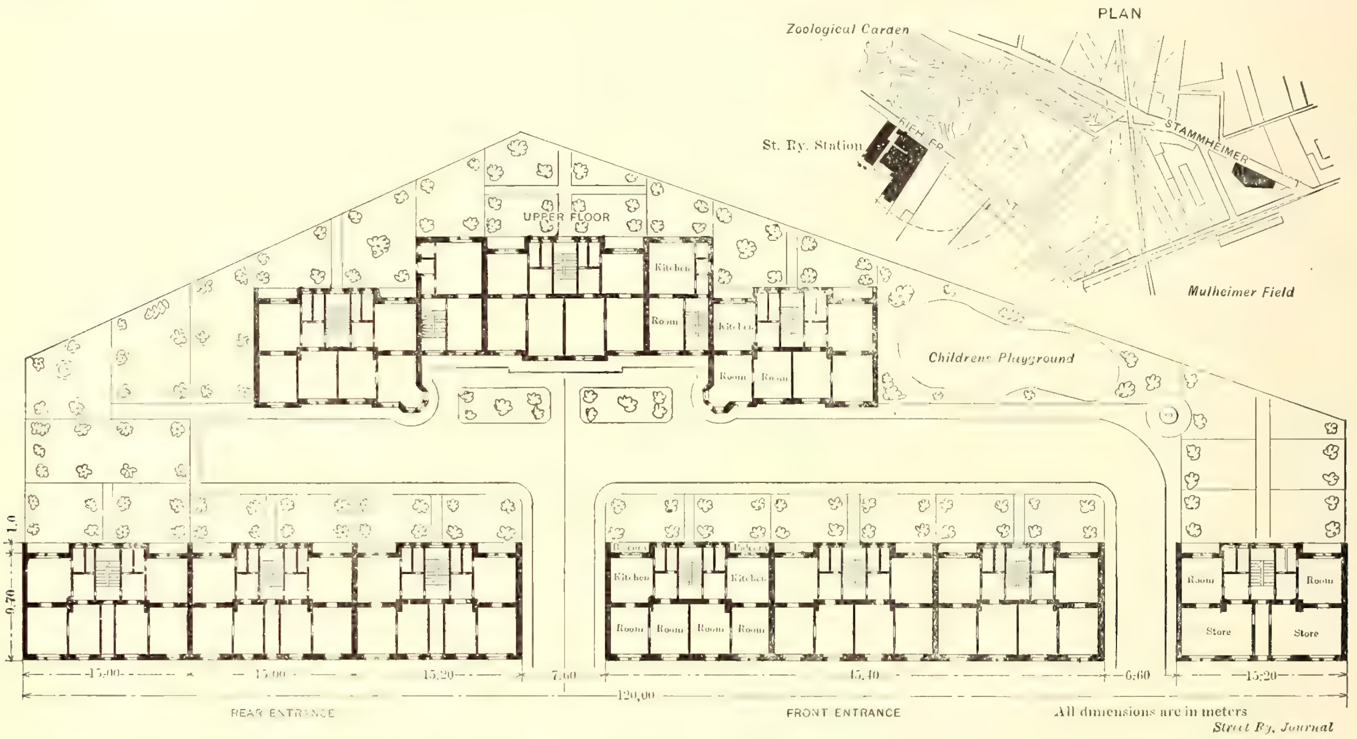
The management of the Prussian State Railways, which is one of the largest employers of labor in the world, was among the foremost to take up this subject. In fact, for several decades the administration has erected homes for its employees practically everywhere. It is noteworthy that this pioneer work was due in large measure to changes in the schedule which required the removal of large numbers of men to other points along the system than those at which they previously had been stationed. The absence of suitable accommodations on a number of occasions led the officials to see what they could do for the men to make them independent of local conditions. At first every department erected buildings according to its own ideas. This method had the advantage of giving a free hand to the

architect and permitting the trial of numerous varieties of single, double and multiple family dwellings, with and without gardens. The disadvantage, however, was the planning of the work by men who were not experienced in architecture, and naturally made many errors and wasted considerable money. When this condition was fully realized, provision was made for the organization of a department especially devoted to this work. This department has made a careful study of all that has been done along these lines, and has now published a great variety of designs in an elaborately illustrated book issued by the Prussian Minister of Public Works. The book contains also the following valuable suggestions which are applicable almost anywhere, and, if carried out, should save much labor and

There should be a yard for each house, and where houses are built in groups separate yards should be provided. The out-buildings should be placed far enough from the main building, or buildings, that they will not cut off any light. As a rule, all dwellings should have cellars under the entire floor area. The windows of houses should face east and west, or as near to those directions as possible.

According to local conditions, every family is to have two, three, four or five living rooms, counting the kitchen as a living room. In addition, each family has a separate toilet, a division of the cellar and a part of the roof and the common use of a laundry with drying apartment. A laundry is to be installed for every six to ten families, either in a separate building or in the cellar.

The living rooms of subordinate officers should have a total area of 45 sq. m. (67.5 sq. yds), and that of a higher officer 68 sq. m. (81.6 sq. yds.). The minimum area of the living apart-



PLANS SHOWING THE GENERAL LOCATION AND THE ARRANGEMENT OF HOMES BUILT FOR ITS EMPLOYEES BY THE COLOGNE MUNICIPAL TRAMWAYS

expense. Some of these suggestions are subjoined herewith:

FUNDAMENTAL CONSIDERATIONS FOR PLANNING AND ERECTING HOMES FOR WORKMEN AND SUBORDINATE OFFICIALS

The land upon which the houses are to be erected should be located so as to combine as well as possible proximity to the place of employment, to stores, schools and churches.

In the country or other places where land is cheap the houses should be built for either one or two families. In other cases it may be necessary to build them for more than two families, the idea being to secure a rental that will not exceed 4 per cent on the investment. Experience shows that where land is high this return cannot usually be secured with less than a six-family house.

In the country, there should be only one basement and a floor above; in cities, the practice of the particular district should be preferred. Where 4 per cent is required on the investment, build a house with a basement and two floors above. The stairway may be common for several families, but, in general, there should not be more than two family apartments for one stairway, except in special cases, such as corner houses.

Where it is necessary to build a number of houses, study the relative advantages of building them separately or adjoining in sets of two or three. The latter plan is usually preferable, as it lowers the cost of construction and keeps the apartments warmer. It is understood, however, that where houses are built in groups they are not to be placed in a solid block, except on city streets.

ments should be 28.5 sq. m. (34.2 sq. yds.). The areas mentioned permit the building of apartments with two, three or four rooms. With 68 sq. m. from four to five rooms are possible. The personal desires of the tenants should be consulted as far as possible before the division of the space into rooms. A considerable number of railway men work at night, and their bedrooms should be isolated from disturbance. Arrange the space so that a large room can, if desired, be divided in two by erecting a partition. Houses with an area of 45 sq. m. to 68 sq. m. should be furnished with attics for about two-thirds of the floor area.

Windows on both the street and yard side should be installed in every room to secure the maximum light, heat and ventilation. The rooms for the workmen and subordinate officials should be at least 2.8 m. (9 ft. 2 ins.), and those for the higher officials 3 m. (9 ft. 10 ins.) in height. All rooms should be at least 4.1 m. (13.5 ft.) wide, so two beds can be placed in one room. All rooms, including the attics, should be arranged for heating.

Houses for several families should have a stairway not less than 2.3 m. (7.5 ft.) wide. Apartments with more than two rooms should have communicating passageways. Design the hallways and passageways to allow the easy moving of large pieces of furniture. Kitchen pantries are provided only in the buildings occupied by the higher officials; in the smaller buildings a ventilated dresser is sufficient. Verandas or covered balconies should be erected if enough money is appropriated.

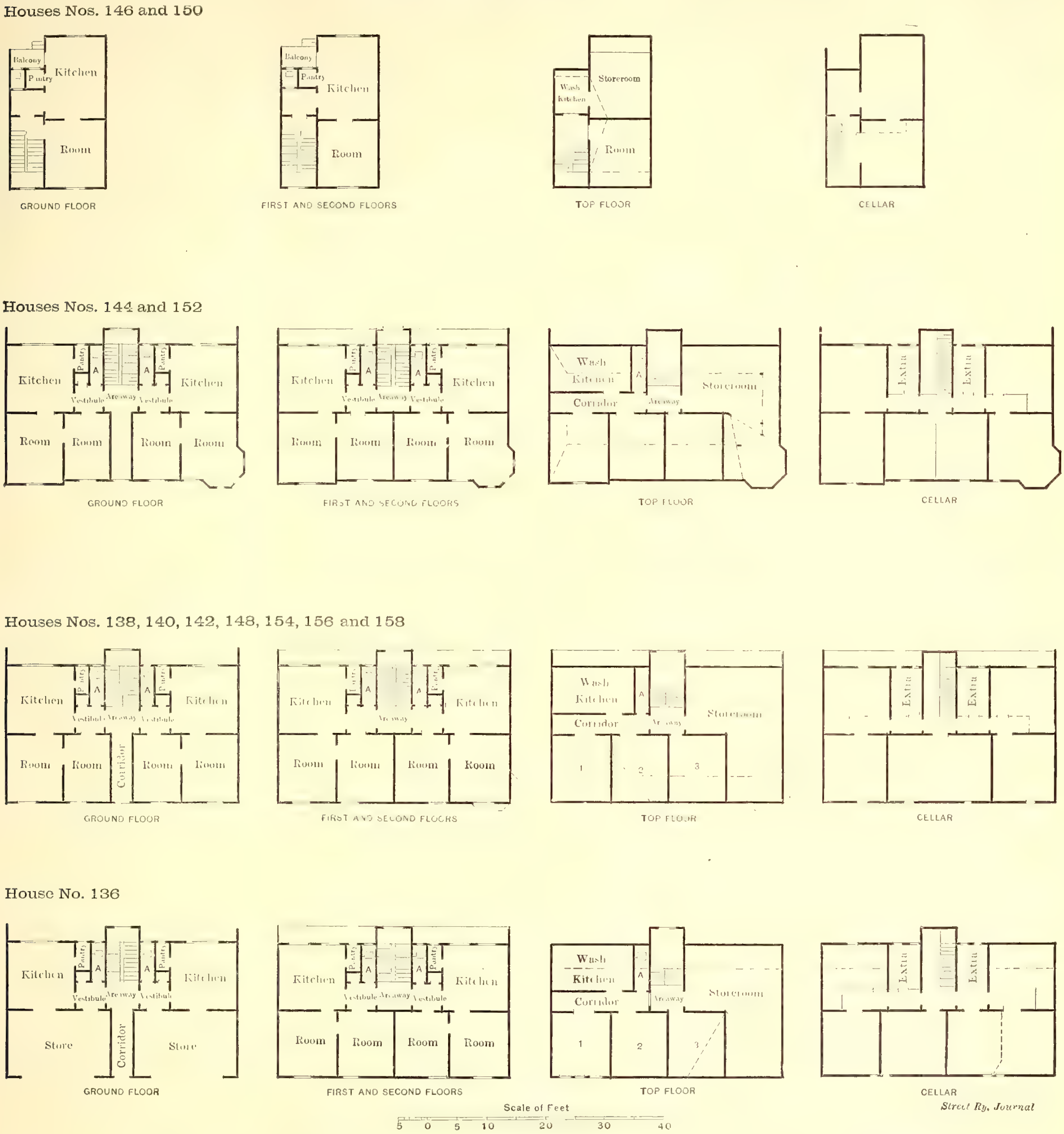
If the buildings are erected in the country where sewer systems are not laid out, the toilets should be located in a yard

building where plenty of water is available. Where they are built as a part of the house they can be placed on a kind of balcony or in some other easily ventilated position.

As a rule, the outside walls of the building should be massively constructed. Interior decorations are permissible only where their cost is low. The kitchen chimneys should be so arranged that heat from the kitchen range may be utilized for heating the other rooms. The roofs should be of the overhanging type, except in cities, and covered with either brick or slate. If attics are not built originally the roof should be designed to permit their easy construction later.

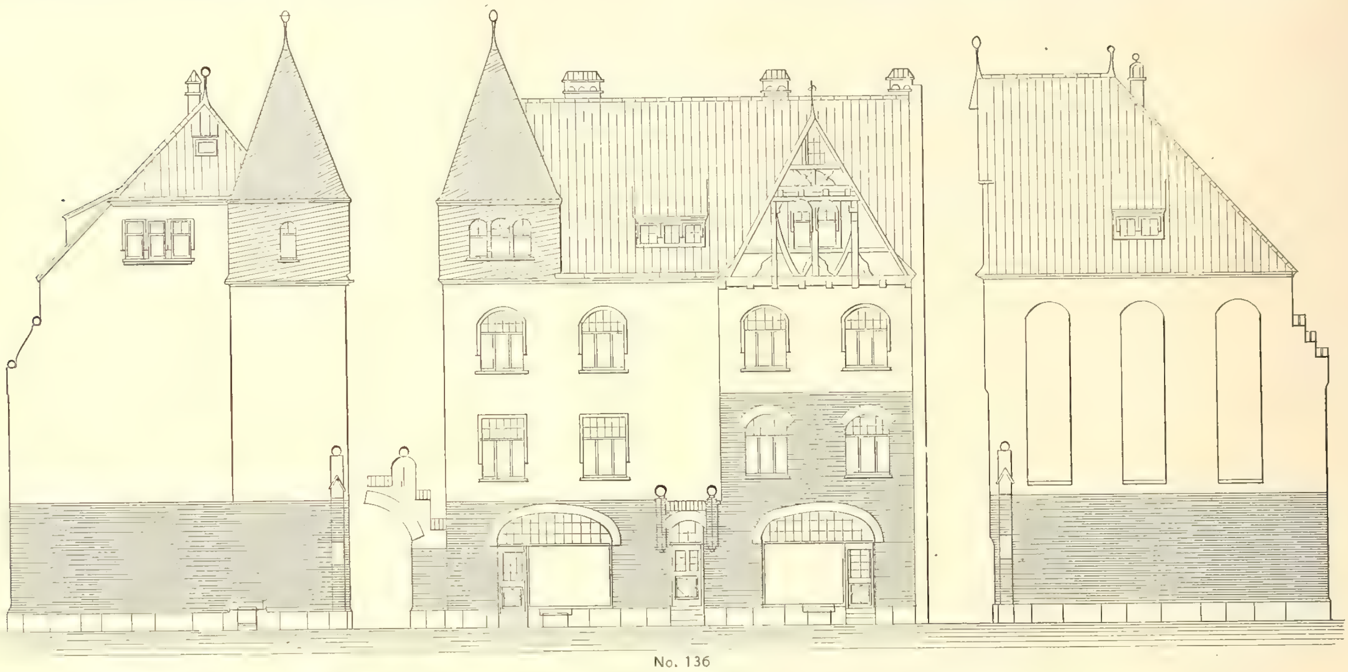
The exterior of the buildings should present a modest, but pleasing appearance; this can be secured without any extra cost for material or design by a wise use of the local building materials, alternation of plain and polished bricks or broken stone work, appropriate painting, etc. Where many buildings are to be erected near each other, avoid uniformity by changing the outlines, the arrangement of windows, using different styles of gables and other means. In general, due attention should be paid to the local styles of architecture.

Special attention should be given to the building of kitchens for the workmen and petty officers, for the kitchen often serves as the main living room for the greater part of the day, and should be laid out with that fact in mind. In view of its importance, it is also advisable to make it the largest room in the apartment. If the kitchen is large enough to be used as a living room, the water piping and sinks should be so arranged that dishes may be washed and other kitchen work done in a well-lighted butler's pantry, with ventilation openings in the door. This closet may be built next to the outer wall, in which case ventilation could be secured by installing a small window. The pantry should be divided in two parts, the upper one for storing kitchen utensils and the lower arranged for the washing outfit and the storage of the cleaning materials



FLOOR PLANS OF HOUSES FOR TRAMWAY EMPLOYEES BUILT AT COLOGNE—RIEHL, GERMANY

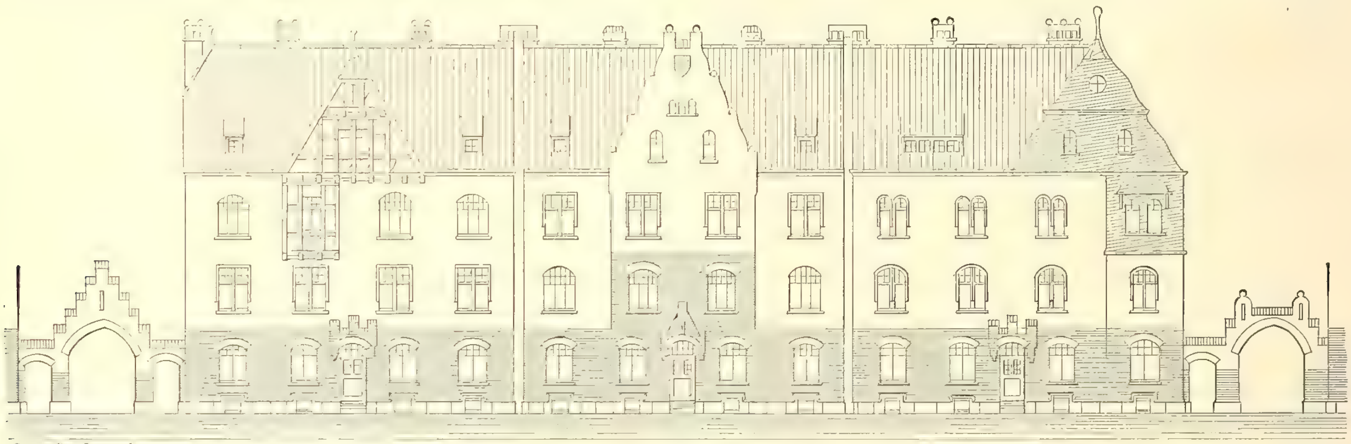
after the work. The pantry may be closed by a door or curtain. The floor should be covered with linoleum. Where the kitchen is the largest living room, it is best to furnish the butler's pantry with a water-tight floor, window and door opening toward the large room. The pantry need not be of the full height of the living room, and the space abve it can be used for other purposes. It is not necessary to construct pantry closets, but enclosed shelves should be provided, and niches should be left in the walls for wardrobes.



No. 136

FRONT AND SIDE ELEVATIONS OF A TYPICAL DWELLING FOR STREET RAILWAY EMPLOYEES AT COLOGNE

Among the street railway companies which have taken up this subject are the Grosse Berliner Strassenbahn and the systems in Cologne and Freiburg. The character of the buildings erected by them is well shown by the accompanying drawings. The plans in particular illustrate how much stress is laid on the arrangement of the kitchen.



No.142 No.140 No.138

FRONT ELEVATION OF A GROUP OF HOMES FOR STREET RAILWAY EMPLOYEES AT COLOGNE

MANAGEMENT OF EMPLOYEES' HOUSES

The question of employees' quarters naturally embraces their management, as well as construction, as it would not do for the owner to relinquish all supervision. In Germany, the relations of landlord and tenant in cases of this kind follow two plans. The first is the organization under the railway's auspices of a "Baugenossenschaft," or co-operative building society, the members of which pay in a certain sum, ranging from $2.50 to $75, which gives them the right to compete for the next vacant house. The second method is to have the railway company build the houses and then rent them to the employees who apply.

The first method, as applied in Berlin, is intended to secure for the members light, healthful buildings with practically continuous leases pending the fulfilment of certain obligations. All privileges extend to the widows of members during their widowhood, and also to retired employees of the company. Members have the privilege of transferring their property rights to other members.

Should an applicant for membership be refused, he may appeal to an advisory council, whose decision is final.

The executive committee has the right to expel any member who has forfeited his civic rights (as for conviction of crime) or if he refuses to fulfil his duties after a second warning. An appeal may be taken before the advisory council within fourteen days, and should this council decide adversely a final appeal may be taken before the next general meeting.

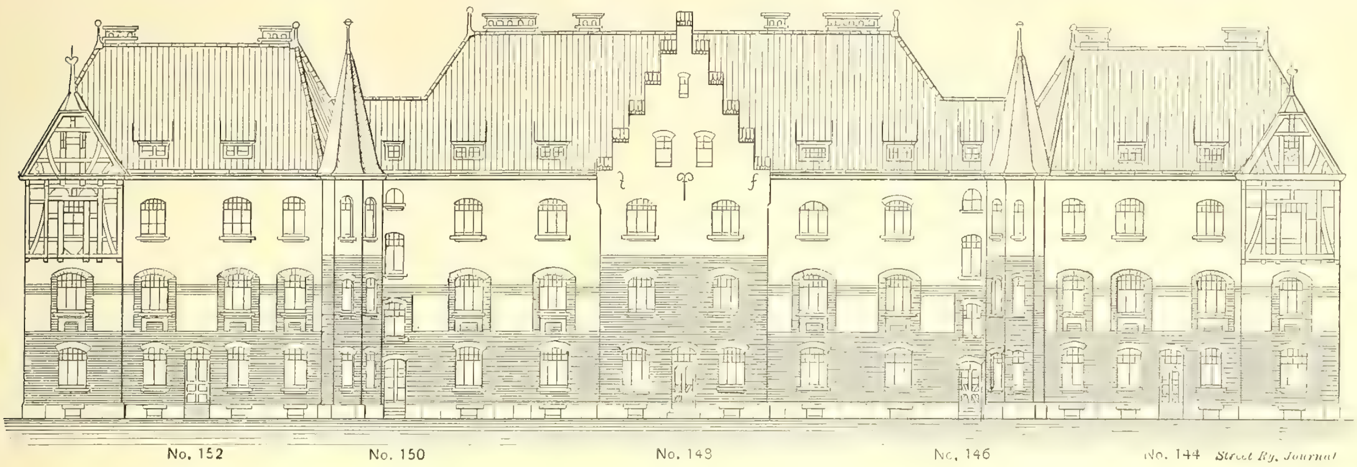
All members are entitled to share the general profits, to receive equal consideration in the allotment of vacant

dwellings, and to enjoy a continuous lease while meeting all contract regulations. The entrance fee is 1.5 m. (37.5 cents) and the minimum monthly dues are only 1 m. (25 cents). A member is held responsible up to 300 m. ($125) per share for any indebtedness not covered by the funds of the society.

The organization is made up of the following kinds of members with their number: Executive committee, three; clerical force, thirty-four; advisory council, nine, and the general assembly. It may be added that the personnel of the committees includes all grades of employees, from manager to platform men. The by-laws of the organization also provide that the clerical force must contain at least one member from the operating department, from the shop force, the auditing department, the construction department and the main office, in addition to the principal and assistant cashier of the company. The chief duty of this clerical committee is to keep the widely scattered members in touch with each other.

The executive committee issues at frequent intervals a list of apartments as they become vacant, and these are then assigned to the applicants in the order of their application. Where several persons desire the same place, a decision is reached by drawing lots. Members already in quarters, but desiring to change, may apply for new apartments under the same conditions as the others. The executive committee has the right to rent apartments to outsiders during periods when members do not apply for them. No tenant may keep visitors for any considerable time without written permission from the executive committee.

Within six months after its establishment the Berlin society had over 600 members and a capital liability of $100,000, of which only a small portion was paid in. The society, therefore, was unable to build any houses until the Grosse Berliner Strassenbahn loaned it, at three per cent interest, different sums, amounting in all to $375,000.

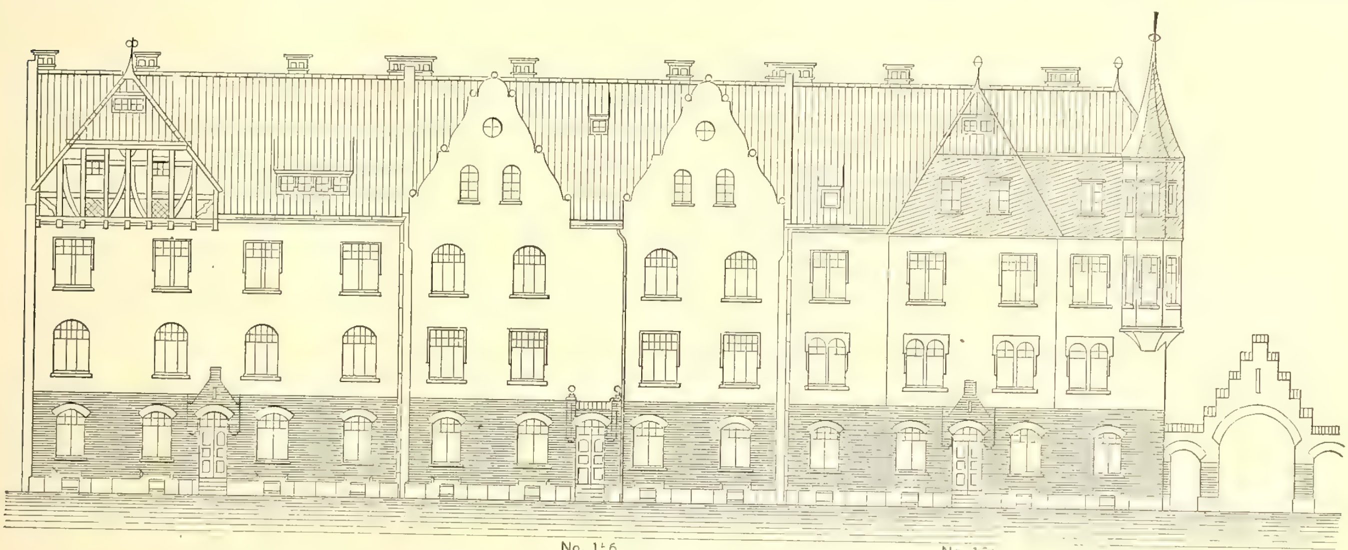


CONTINUATION OF HOUSES ON STAMMHEIMER STREET, COLOGNE-RIEHL, SHOWING VARIATIONS IN ARCHITECTURAL TREATMENT

The rents per month are as follows:

FRONT APARTMENTS

One room and accessories, fourth floor	$5.00
One room and accessories, third floor	5.25
One room and accessories, second floor	5.50
Two rooms and accessories, fourth floor	8.25
Two rooms and accessories, third floor	8.50
Three rooms and accessories, second floor	8.75
Three rooms and accessories, first floor	13.00



ANOTHER GROUP OF HOMES ON STAMMHEIMER STREET, COLOGNE—RIEHL, GERMANY

The last rental applies to left-hand apartments, the right-hand apartments being $1.25 less per month.

SIDE AND END APARTMENTS

One room and accessories, fourth floor	$4.50
One room and accessories, third floor	4.75
One room and accessories, second and first floors	5.00
One room and accessories, basement floor	3.75
Two rooms and accessories, fourth floor	6.25
Two rooms and accessories, third floor	6.50
Two rooms and accessories, second and first floors	6.75
Two rooms and accessories, basement floor	6.50

An annual fee of $5.25 is charged for the baths and water.

At the end of the first fiscal year, Dec. 31, 1903, it was found possible to pay a 3 per cent dividend. At the end of the second year there was a dividend of 4 per cent. The cost for one structure was $118,882, of which $33,785 was required for the lot. As the annual rental amounts to only 5.35 per cent on the investment, it is plain that the buildings are not intended to return high profits. In fact, while the rents mentioned are certainly high, they are undoubtedly less than for similar houses in Berlin.

A second structure erected by the Grosse Berliner Strassenbahn consisted of a front house, two wings and a cross-building. The lot on which it was built cost $46,767, and had a frontage of 36 m. (about 111 ft.) and a depth of 49.4 m. about 162 ft.). This tenement is made up of two stories with living apartments; twenty-three family apartments, consisting of two living rooms, kitchen and accessories, and forty-three family apartments, consisting of one room. The two-window rooms are usually about 13 ft. x 19 ft. 6 ins., and those with single windows approximate 12 ft. x 18 ft. The kitchens do not differ considerably in width from the other rooms, but are 3 ft. to 4 ft. shorter. The apartment accessories consist of a pantry measuring about 4 ft. x 4 ft. 6 ins., and a closet, which includes the bath room, 4 ft. wide x 13 ft. long. The halls are from 5 ft. wide to 12 ft. wide and 13 ft. to 26 ft. long. Both the front and yard sides of the building are furnished with balconies, porticos, ornamental windows, and the like. Every tenant is apportioned a section of the cellar and shares the laundry facilities. All of the rooms are well lighted, as the sodded yards are usually over 65 ft. long.

With regard to the social relations of the tenants, it is worth noting that in the conclusion of the last Berlin report the committee said that the fears that dissensions might break out if so many people in the employ of one company lived together had proved baseless; on the contrary, the relations of the tenants were of a most cordial nature.

As previously mentioned, other street railway systems have built the houses at their own expense and have then rented them to employees. The municipal railway of Cologne, for example, has built a number of buildings of the types shown in the accompanying drawings. Inspection of the plans will show the large space allowed for the kitchen, which serves also as a living room in the smaller houses. The monthly rents for the Cologne three-room apartments are as follows: Basement, $4.75; first floor, $5.25; second floor, $5, and for an attic room, only 37½ cents.

These rates allow 3.6 per cent on the investment after deducting 1½ per cent for maintenance and sinking fund. The usual monthly rentals in Cologne average about 25 cents more per room. Tenants must give up their rooms on a month's notice after quitting the service.

The following table of costs was prepared at the time the Cologne houses were planned. These consist of ten buildings with six three-room apartments and two with three two-room apartments.

ESTIMATED COST

5160 sq. yds of land	$10,750
Sidewalks (one-half)	1,800
Ten six-family buildings	57,500
Two three-family buildings	4,750
Gardens, fences, etc	7,700
Total	82,500

ESTIMATED INCOME

Average three-room monthly rental	$5.00
Average two-room monthly rental	3.75
Average attic room	.375
Total annual income	$4,167.00
Less 1½ per cent for depreciation and maintenance of buildings	1,012.50
	$3,154.50

The last figure is equal to 3.8 per cent of the invested capital.

The municipal railway of Freiburg has also erected some dwellings of the type illustrated. The annual rentals vary from $65 to $106 for a four-room apartment and $40 to $57.50 for three rooms. These figures are about one-half the local rates. At present there are four four-room apartments and forty-four three-room apartments.

NEW SOUTH WALES TRAMWAY OFFICERS' ASSOCIATION

The street railways in the State of New South Wales are owned by the Government and are operated by a board of three commissioners appointed every seven years to manage all the trunk-line railways and the tramways. The largest tramway system, of course, is in Sydney, where there is a single-track electric mileage of 137 and a steam mileage of 18. The officers of the company about two years ago established an association known as the New South Wales Tramway Officers' Association, for the discussion of problems affecting the operation of the tramways, and this association has proved of great value not only to the officers but to the management. A number of papers has been presented. All of them have been keenly discussed, and valuable suggestions for the improvement of existing practice have been made. In this way the junior officers especially have received an insight into the principles which govern their daily routine which must make for improved results. The members number 114.

The second annual meeting was held Feb. 15, with the president, John Kneeshaw, in the chair. In his address Mr. Kneeshaw commended the association upon the work done during the past year. He said that the department was fully alive to the advancement in regard to tramway traction in other parts of the world. As an instance, an equipment had been imported by the Railway Commissioners in connection with the system of regenerative control, and experiments were being now conducted with it. If they proved successful considerable economy in the consumption of electrical current would be effected. The tourist cars continued to be well patronized, and the new type of car introduced was very popular. The tramway traffic was already very congested, and the time was fast approaching when it would be necessary to very seriously consider the manner in which it was to be brought into the city.

A feature of the organization is a magazine, issued monthly, discussing various topics connected with the management. Owing to the small number printed the copies are typewritten. The February articles were the following:

	Page
Editorial	1
Additional Tracks for City Traffic (H. A. Brown)	2
The Necessity of an Effectual Clerical Training (Mr. McSweeney)	3
Tramway Xmas Cards	4
Conundrum	4
Regenerative Control of Cars (Mr. N. J. Munro)	5
The Collecting of Unpaid Fares (Mr. H. R. Heydon)	6
Cancellation of Days off (Mr. B. Hade)	6
Tramways and Tramways	7
From a Witness's Point of View (Mr. Munro)	10
Retirement of Mr. Inspector W. Lambert	11
Newcastle and Broken Hill	11
High Car Floors (Mr. Tankard)	12

The articles form the basis for discussion at the different meetings, which have proved very desirable in cultivating the qualities of observation on the part of all.

TRAMWAY SYSTEM OF MONTEVIDEO

On Nov. 19, amid a scene of great enthusiasm, the first electrically operated lines in Montevideo were inaugurated. Montevideo, the capital of Uruguay—or, to give the latter its better known local title, the "Banda Oriental"—is situated on the northern shores of the River La Plata near its mouth.

At the present moment the population of Montevideo exceeds 300,000. The streets, for the most part, are wide and fairly well paved, and as the city is situated on a tongue of land between the bay and the River La Plata, it is pleasantly cool. The water supplied by an English company is copious in quantity and excellent in quality. The port works, long delayed, are now approaching a state in which they will be of immense benefit to Montevideo in particular and the trade of the country in general. Altogether, if granted a succession of years of peace, Montevideo bids fair to become one of the most important cities of the Western Hemisphere.

The first mule tramways in Montevideo were opened in the year 1868, just thirty-nine years ago. This was a short line which has grown with the city until there are now 150 miles of line, either electrified or in course of electrification. Ten years ago the Commercial Company applied to the powers that were for authorization to reconstruct its lines on more modern principles, but the veto of the president, or rather the opposition of the municipality, frustrated every attempt. With the election in 1903 of President Señor Battle y Ordonez, a change came over things, and the long wished for concession was granted. In it the government stipulated that all the lines should be extended into more distant suburbs in order to facilitate the solution of the housing question, which in Montevideo, as in Buenos-Aires, had become serious.

VIEW OF STREET IN THE OUTSKIRTS OF MONTEVIDEO

In the afternoon of Nov. 19 last, some 400 guests were assembled at the electric power house of the company when Dr. Williman, Minister of Government, switched the current on to the lines. Twelve cars then conveyed the party down through the crowded streets and out to the Pocitos Hotel, where a banquet prepared by the Commercial Company was awaiting them. Among the guests were the Minister of Government, Dr. Claudio Williman; Juan Cat, the general manager of the Commercial Company; General Vazquez, the Minister of War; Señor Vidiella, the President of the Junta; the British Minister; the American Minister; A. N. Connett, chief engineer of J. G. White & Company, Ltd.; C. C. Lewis, superintendent of construction of the same firm, and Harrison Jones, the engineer of the Commercial Company. On the same evening Mr. Cat, the manager of the Sociedad Commercial, gave a reception at the Pocitos Hotel. On Wednesday evening a banquet was given by the contractors at the Uruguay Club to the leading men of Montevideo.

CALLE SORIANO FROM RIO NEGRO

CONTRACT

In December, 1904, an agreement was made between the United Electric Tramways of Montevideo, Ltd., of Basildon House, Moorgate Street, London, E. C., and J. G. White & Company, Ltd., contractors, of 9 Cloak Lane, Cannon Street, London, E. C., for the complete reconstruction of the existing horse tramways to electric traction, and the erection of a power house to supply the required power. The work has been carried out under the general supervision of a committee of the Board of the United States Electric Tramways of Montevideo, Ltd. Frank Bourne, of 62 London Wall, E. C., acted as engineer to the committee.

The constructional works were started in March, 1905, and the opening ceremony took place on the date stated above. The electrification of these lines (practically 51 miles single track) and the erection of the power station

has, therefore, taken some twenty months; which, considering the many attendant difficulties, was exceptionally quick work.

TRACK WORK

All the lines are laid to a gage of 4 ft. 8½ ins., and the rails manufactured by the Lorain Steel Company are 45 ft. in length and weigh 87 lbs. per yard on the straight and 100 lbs. per yard on curves. They have the following specified chemical composition:

Carbon	0.55	per cent
Manganese	1.00	do
Silicon	0.10	do
Phosphorous	0.10	do
Sulphur	0.10	do

A test piece taken from the rails withstood the following tests: A test piece was prepared having a sectional area equal approximately to ½ sq. in. and with a length

TRACK WORK AT REDUCTO STATION

of 2 ins. between test gage points. When tested it withstood the specified tensile strength of 40 tons per sq. in. with an elongation of 12 per cent. The section is the Lorain No. 87-381. The rails are laid on concrete stringers with the rods spaced 3 ft. 9 ins. apart. The depth of the stringer is 6 ins. and the width 15¼ ins.

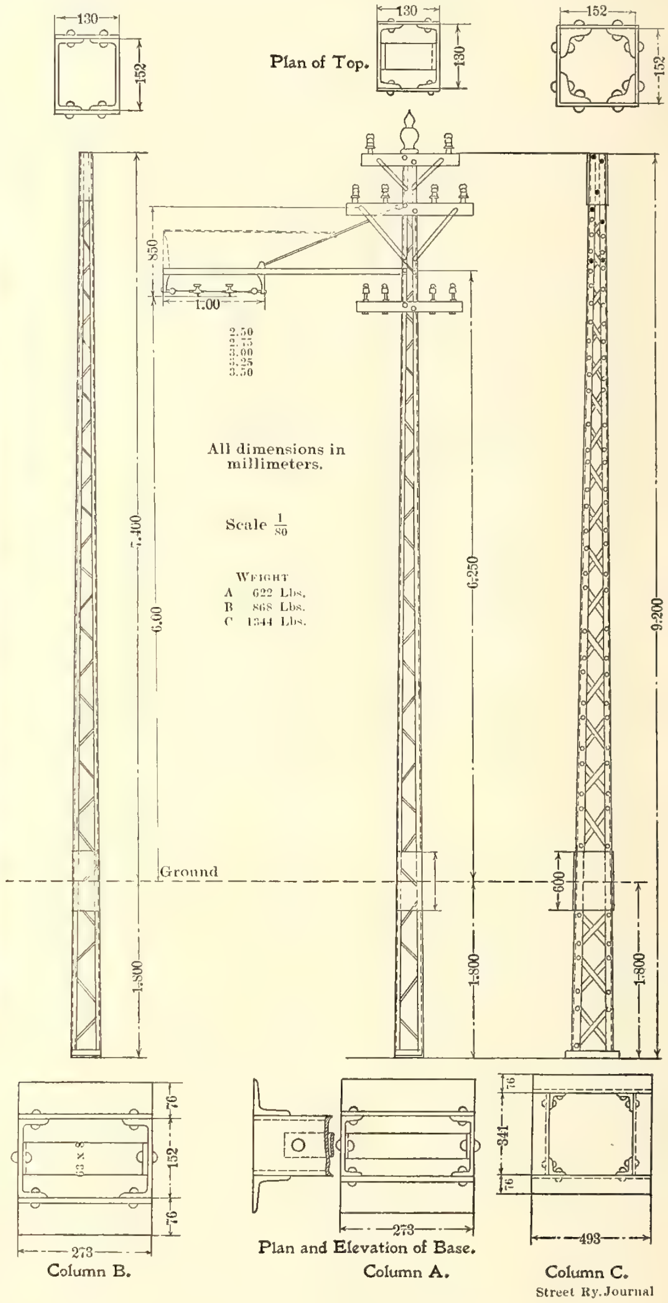
The distance between centers of tracks is 9 ft. 10 ins. The minimum distance of outside running rail from pavement is 3¼ ft. Three kinds of paving are used: Belgian block, cobbles and macadam. The Continuous Rail Joint Company's rail joints were used. They are 24 ins. long, a pair weighing 88 lbs. Two No. 0000 bonds are used at each joint. A view of partly completed track is shown on this page.

All special work except the switches was manufactured by the Lorain Steel Company. The switches are automatic, made of best toughened cast-steel with solid Era manganese steel open mates manufactured by Messrs. Hadfields, of Sheffield.

OVERHEAD EQUIPMENT

The poles supporting the overhead trolley wires are of two designs—tubular and lattice. The former, of which there are 457, are used only in the Plazas and on a few of the main streets. The lattice poles number 2765. All the poles are planted 6 ft. deep in concrete and also have 6 ins. of concrete beneath their bases.

A No. 00 groved trolley wire is used. Its total length is 70 miles, and it is divided into half-mile sections. The



DETAILS OF LATTICE POLES

wire was supplied by Edward Le Bas & Company and the National Conduit & Cable Company.

The section insulators of special make were manufactured by the Electric Tramway Equipment Company of Birmingham. This insulator consists of an ordinary double-break section insulator with the addition of a knife switch. The switch is closed by means of a long bamboo pole, which is usually hung on a pole and secured by a padlock. A hook on the end of the pole fits into a hole in the blade of the switch, at the back of which is a spring. This

spring, pressing down the blade, assists in making a quick contact.

CABLES

The total cable laid was approximately 28 miles, 15 miles aerial and 13 miles underground, as follows:

Diameter and description of cable	Yards
61/.101 ins. insulated, steel taped armored	13,400
61/.101 ins. insulated, steel taped armored	250
61/.092 ins. insulated, steel taped armored	2,230
500,000-circ.-mil. aerial cable	9,650
600,000-circ.-mil. aerial cable	17,300
5-core test and telephone cable, armored, approximately	7,200

The insulated cables are of the single conductor type, armoured and laid directly on the ground. The lead covering is 1-10 in. thick. The cable was tested at the makers' works with a flash test of 2500 volts alternating for 15 minutes. The total weight of copper used was approximately 150 tons.

The conductors in the case of the aerial cables are of hard-drawn copper, having a conductivity of 98 per cent of Matthiessen's standard. The cable is twice braided, each braiding being separately served with weather-resisting preservative compound.

CAR SHEDS AND DEPOTS

There are three depots for the cars which have been provisionally reconstructed, viz., Pocitos, Reducto and Del Este. The Del Este car house is the largest and has accommodation for forty cars. Each has repair shop adjoining. The power in these shops is supplied by Lancashire motors.

THE CARS

The cars were built by the United Electric Car Company, Preston, England, and include seventy semi-convertibles, twenty open cars (all single-deckers) and one flat car. The car bodies are mounted on 21-E Brill trucks having 6 ft. 6 ins. wheel base. Steel-tired wheels 34 ins. in diameter are used. The cars are fitted with Providence fenders.

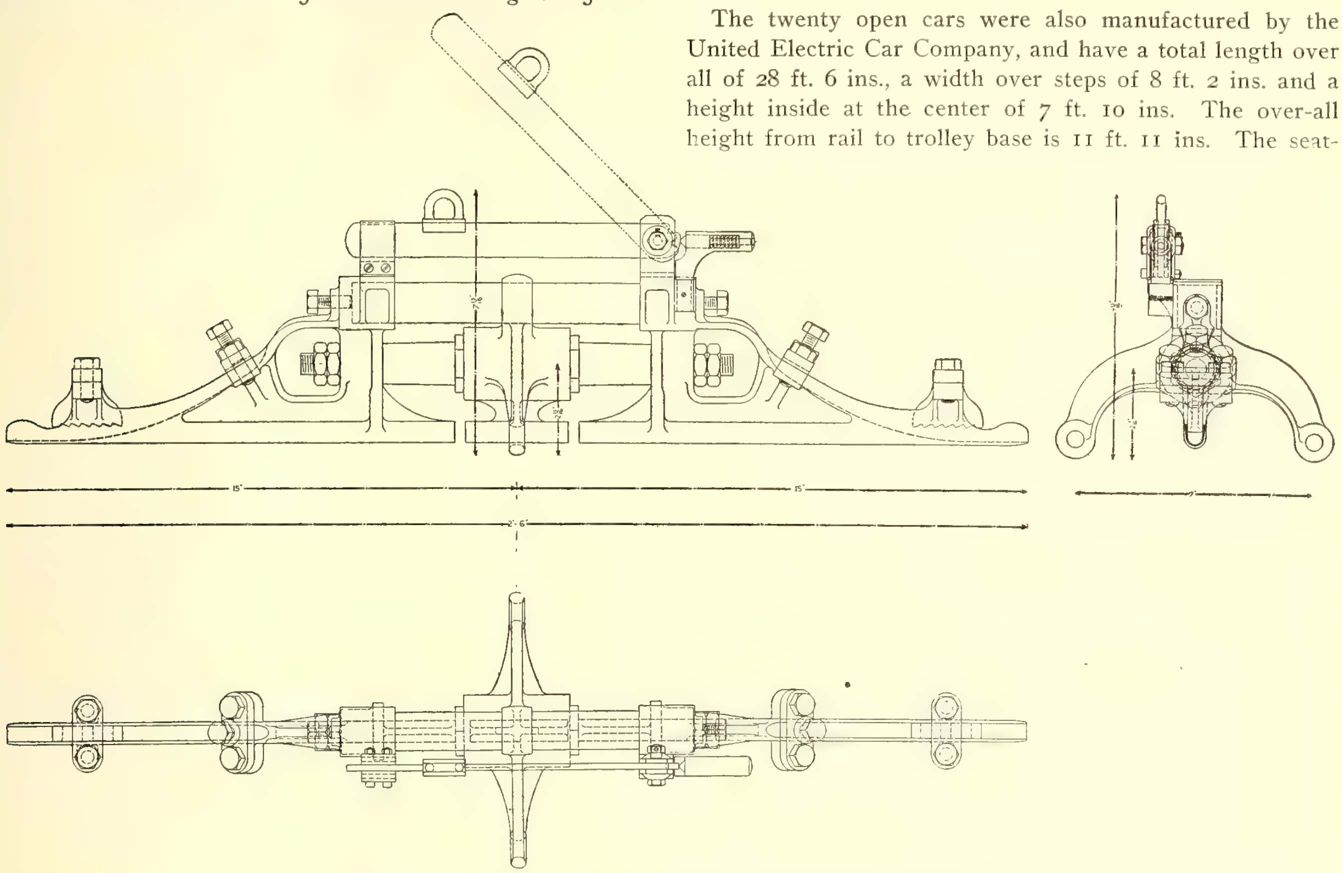
The general dimensions of the semi-convertible car, which seats thirty-two passengers, are as follows:

	Ft.	Ins.
Length over end panels at sill	20	8
Length over bumpers	30	3
Width at sill, including panels	7	9½
Width at belt rail	8	½
Extreme width over mouldings	8	4
Height inside, center	7	10
Height of draw bar-center above rail	1	4
Gage of track	4	8½

The ventilation has received special attention and there are special outlets for the foul air. They are located in the roof.

The twenty open cars were also manufactured by the United Electric Car Company, and have a total length over all of 28 ft. 6 ins., a width over steps of 8 ft. 2 ins. and a height inside at the center of 7 ft. 10 ins. The over-all height from rail to trolley base is 11 ft. 11 ins. The seating capacity is forty passengers. Each car is equipped with a Peacock brake, manufactured by the National Brake Company of Buffalo.

The electrical equipments of the cars furnished by Dick, Kerr & Company of London consist of two motors, type No. 3, form A4, and two series parallel controllers, type D.B.1, form E, and trolley with straight under-running head.



SWITCH BREAKER USED ON THE MONTEVIDEO TRAMWAYS

POWER STATION

The power house is situated in the Calle Cebollati, close to the water edge. The main dimensions of the station are 114 ft x 52 ft.

The boiler installation comprises four boilers of the Babcock & Wilcox design. Each boiler is capable of evaporating 11,300 lbs. of water per hour at natural draught, and at a working pressure of 180 lbs. per sq. in. used in conjunction with a Green economizer. They are erected in batteries of two. Each boiler has a B. & W. superheater fixed with it, with 572 sq. ft. of heating surface, and capa-

ble of superheating 150 degs. F. Each boiler has a heating surface of 3240 sq. ft. and a grate area of 58 sq. ft.

The Green's economizer used in connection with these boilers has 400 tubes, each 9 ft. long and 4 9/16 ins. diameter, with top and bottom headers forced together in sections by hydraulic presses with metal to metal joints. The scrapers of the economizer are driven by a 3-hp inclosed dust-proof shunt wound motor working on a 500-volt direct-current circuit with starting switch with overload and no-load release.

There are two horizontal steam-driven direct-acting feed pumps manufactured by the Worthington Pumping Engine Company, size 9 ins. x 5¼ ins. x 10 ins. duplex, each capable of delivering 4500 gals. of water per hour against a boiler pressure of 160 lbs. per sq. in. when using saturated steam at a pressure of 160 lbs. per sq. in., the pump running at normal speed. The feed water is drawn from a hot well at a temperature of 80 degs. F., the water level being not more than 8 ft. below the suction inlet of the pump.

ESTE STATION AND CAR HOUSE OF THE MONTEVIDEO TRAMWAYS

CONDENSING PLANT

The condensing plant consists of two complete surface condensers manufactured by Cole, Marchant & Morley, of Bradford. Each plant is a duplicate of the other, and consists of a surface condenser, a pair of steam-driven Edwards' air pumps, and electrically driven centrifugal circulating pump.

Each plant will condense 24,400 lbs. of exhaust steam per hour, and give a vacuum of 26 ins. with the barometer at 30 ins. when supplied with condensing water at an initial temperature not exceeding 70 degs. F. All the condensing water is drawn from the sea. The surface condenser is of the horizontal counter-current design with cast iron cylindrical shell and waterheads, the covers of which are removable without breaking any pipe joints, and are fitted with hand holes for inspection and cleaning. Solid drawn brass tubes, ¾ in. external diameter, 18 S. W. G. thick, are secured into brass tube plates by screwed ferrules and cotton-tape packing. Suitable baffle plates and diaphragms are provided for distribution of steam and water.

Each of the pair of air pumps is of the Edwards' fly-wheel single-acting type, having a positive length of stroke. The delivery valves are placed at the top of the barrel and are readily accessible. The pair of air pumps is driven by compound steam cylinders mounted on cast-iron frames standing on the pump bodies, the crossheads working in bored guides. The crankshafts are coupled together, consequently one pump balances the other. The speed is controlled by a belt-driven adjustable Pickering governor. Each pump is capable of dealing with 17,100 cu. ft. per hour and has a piston speed of 200 ft. per minute average.

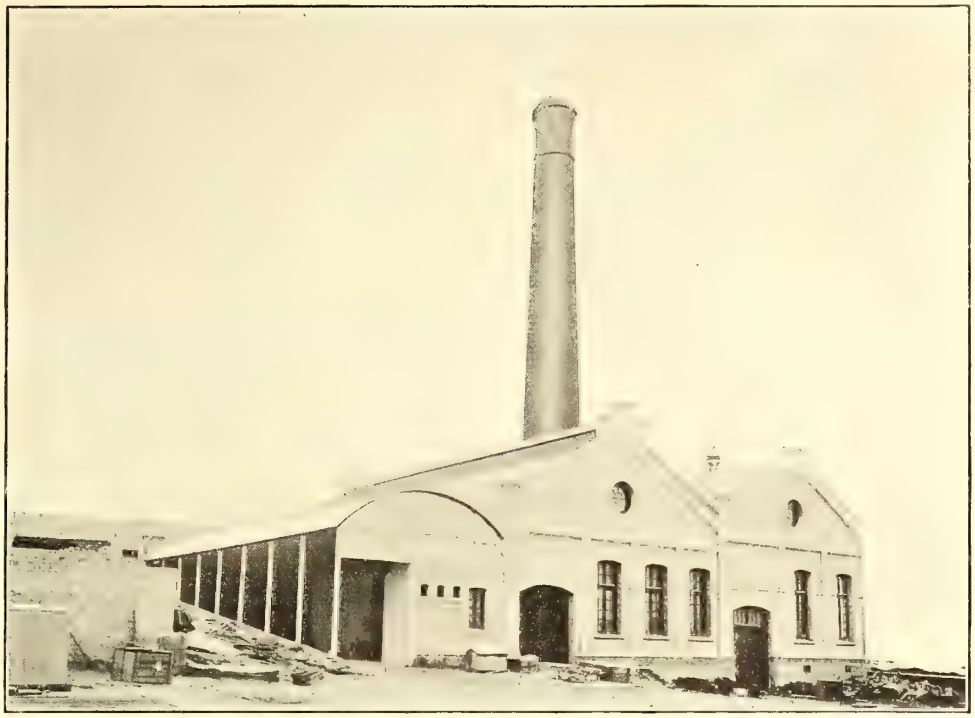
The centrifugal circulating pump is of cast-iron and is mounted on a massive cast-iron baseplate which is extended to take the motor with which it is connected by

a flanged coupling. The motor is shunt-wound and works on a 550-volt d. c. circuit, with starting switch with overload and no-load release, etc.

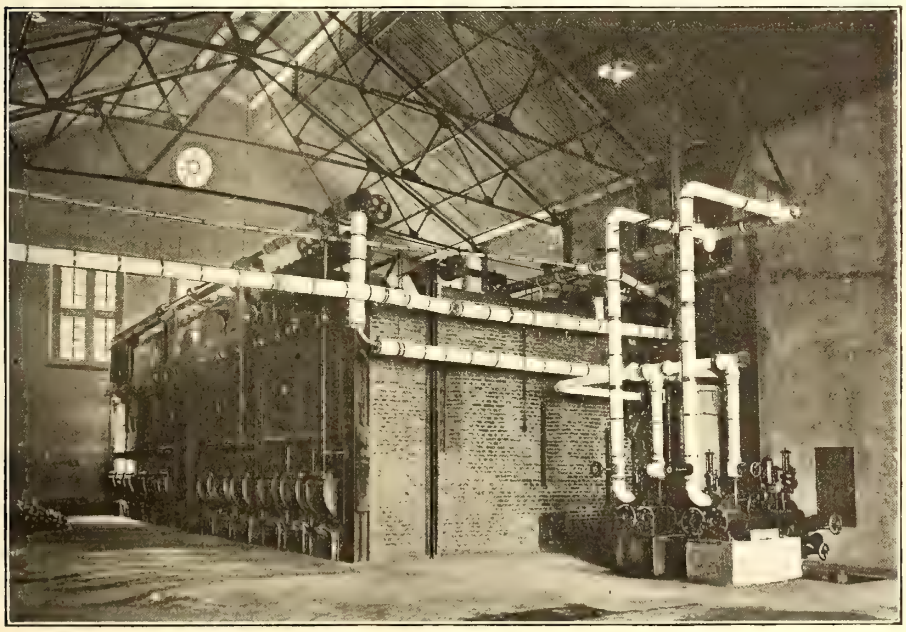
The following are some of the leading features of the condensing plant: Condenser area, 2500 sq. ft.; pair of Edwards' air pumps, 16½ in. diameter x 8 in. stroke; normal speed, 145 r. p. m.; bhp of air pumps, 6 bhp; steam consumption with saturated steam at 160 lbs. pressure does not exceed 300 lbs. per hour; circulating pump bore, 9 ins.; gallons of circulating water per hour, 73,200 gallons; suction "lift," circulating pump, 10 ft.; power and speed of circulating pump motor, about 15 bhp at 650 r. p. m.

The feed-water heater, which was manufactured by Wheeler Condenser Company and has 150 sq. ft. of heating surface, is capable of dealing with 3000 gals. per hour of boiler-feed water at 160 lbs. per square-inch pressure, and about 950 lbs. of exhaust steam per hour at a maximum of 5 lbs. per square-inch pressure. The steam exhausts into the shell of the heater, the tubes being protected from the impact of the entering steam.

A 3-in. heavy pattern cold-water meter, manufactured by the Worthington Pumping Engine Company, has been installed, which is capable of dealing with 4500 gals. of water per hour against a pressure of 160 lbs. per square inch.



MONTEVIDEO TRAMWAYS POWER HOUSE



BOILER ROOM OF MONTEVIDEO POWER STATION

ENGINES

Three Belliss & Morcom's three-crank three-cylinder enclosed triple expansion engines with forced lubrication and automatic cut-off are direct coupled to the generators. The cylinders are 18½ ins., 27 ins. and 40 ins. in diameter x 20 ins. stroke. They run at 250 r. p. m., and are supplied with steam at the engine valve at a pressure of 160 lbs. per square inch superheated 150 degs. F.

The normal full load of each engine is about 1000 bhp, but they are designed for an overload of 23 per cent. and 50 per cent for short periods. As regards regulation: the permanent variation between full and no load is 2 per cent; and momentary variation at variable load is 5 per cent.

The guaranteed steam consumption per brake hp per hour with a steam pressure of 160 lbs. per square inch rating condensing with a vacuum of 26 ins. at the engine is as follows:

	Pounds.
Full load	12.2
Three-quarter load	12.3
Half load	13.1

A patent forced lubricating system is fitted to all working parts, consisting of a valveless pump worked direct for the crankshaft with adjusting valves fitted in the engine bedplate. The fly-wheel, which is of cast iron, has a diameter of 8 ft. 5 ins. and weighs approximately 9 tons. The total weight of the engine, exclusive of fly-wheel, is approximately 50 tons.

GENERATORS

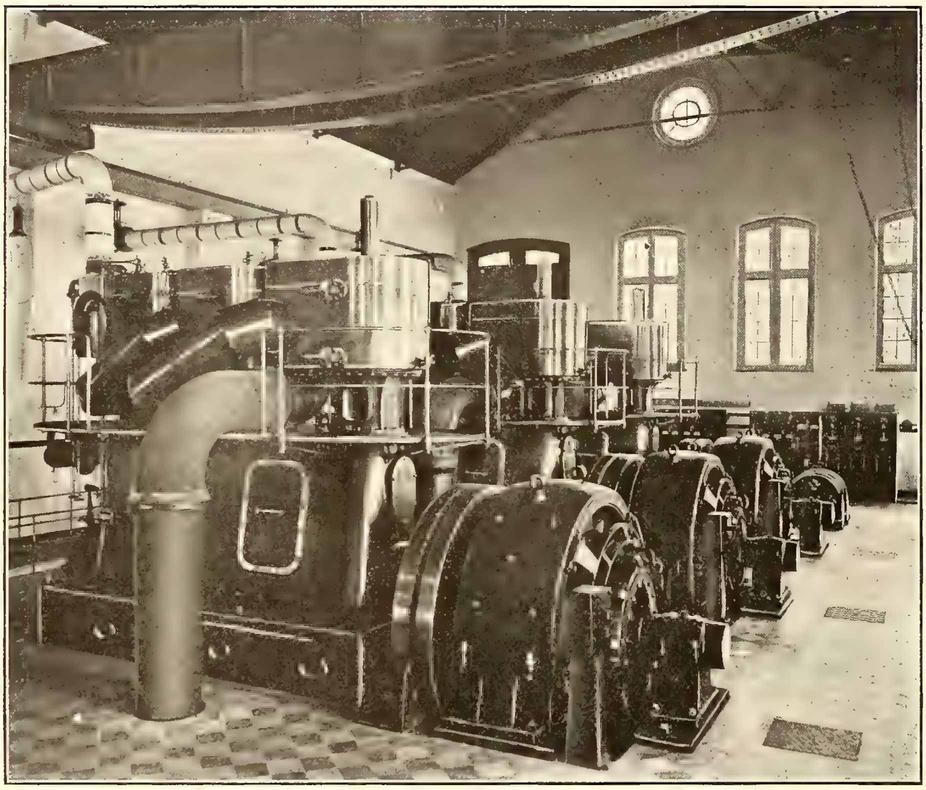
The dynamos built by Bruce, Peebles & Company are of the multipolar slotted armature type, and are direct-coupled to the engines. Each has an output of 650 kw and is wound for 550 volts direct current. They are guaranteed to withstand an overload of 25 per cent for two hours after reaching the maximum temperature due to full load; and 50 per cent overload for 15 minutes under similar conditions. The speed is 250 r. p. m.

The generators are ten polar and fitted with compensating poles, the field poles being of steel, cast solid with the yoke, with a special polar ring secured to the pole face completely surrounding the armature. The efficiencies of the generator are as follows:

	Per Cent.
One-quarter load	85
One-half load	91
Three-quarter load	93
Full load	94.5

BOOSTERS

Two negative booster sets, one of 22 kw the other of 25 kw, were supplied by the Electric Construction Company, Wolverhampton. The combined over-all efficiency of the motor booster at full load is 75 per cent for the 22 kw and 76 per cent for the 25 kw set. Each booster is capable of standing an overload of 25 per cent of the full load output in amperes and volts for half an hour. The maximum speed of either set does not exceed 1000 r. p. m.



ENGINE ROOM OF MONTEVIDEO STATION

SWITCHBOARD

The main switchboard, manufactured by the British Thomson-Houston Company, of Rugby, is made up of slate panels bolted together on iron frames, the slates being 2 ins. thick and of the best quality. The board is so arranged that there is a clear passage 4 ft. wide behind and around it. The arrangement of the instruments and fittings is such that each panel is self-contained for the generator and booster panel; but the feeder panels control two feeders each. The board is made up as follows:

Three 650-kw 550-volt generator panels.

Four feeder panels, each arranged for two 300-amp. feeder circuits.

Two booster panels.

One totalizing, testing and station lighting panel.

One panel for two 18-b. h. p. motors.

The engine-room is spanned by a twenty-ton hand crane, made by Higginbottom & Mannock.

THE STANDARDIZATION COMMITTEE OF THE CENTRAL ELECTRIC RAILWAY ASSOCIATION MEETS

The standardization committee of the Central Electric Railway Association held a three-days' meeting, beginning April 25, at the offices of the Central Electric Railway Association in the Traction & Terminal Building, Indianapolis, Ind., during which every item relating to the standardization of equipment for electric railway cars and other equipment was carefully considered and certain recommendations agreed upon. The committee selected the following subjects to be considered by sub-committees:

1. Standard height of draw-bar for interurban and city cars; also standard form of coupler for interurban and city cars. R. C. Taylor, superintendent motive power Indiana Union Traction Company, Anderson, Ind., chairman.

2. Standard form of trolley base; standard length of trolley pole and standard form of trolley harp and wheel. M. Baxter, master mechanic and electrician Western Ohio Railway Company, Wapakoneta, Ohio, chairman.

3. Standard classification lights and signals and location of same on car. W. A. Gibbs, general manager Indiana, Columbus & Eastern Traction Company, Newark, Ohio, chairman.

4. Standard foundation brake gear; brake jaws; pins; levers; and brake rods. Fred Heckler, superintendent motive power and cars, Lake Shore Electric Railway, Fremont, Ohio, chairman.

5. Committee on Car Painting; Mr. Heckler, chairman.

6. Standardization of electric equipment; motors recommended for ton mile speed car; detail dimension of electric equipment and supplies which enter into the maintenance of electric car service supplies. Mr. Taylor, chairman.

The sitting committee also formulated a report which will be presented at the May meeting of the association, to be held in Indianapolis, on the following subjects:

Brake-shoes; axles, journal and journal boxes, tread and flange of wheels; rails for street and interurban railways.

W. H. Evans, of Indianapolis, chairman of the standardization committee, announced that the committee would have another meeting before the convention of the association in May, and that it is the purpose to hold a two-days' meeting of this committee and the above-named subcommittees the two days previous to the fourth Thursday in May, at which date the association would meet. The chairman of each of the above designated sub-committees is authorized to select at least two other master mechanics or electrical engineers connected with interurban roads to serve on the committee with him in consideration of the subjects assigned and attend the two days' meeting to be held in Indianapolis previous to the May meeting. W. H. Evans, R. C. Taylor and Fred Heckler were present.

NEW POWER EQUIPMENT FOR THE BOSTON ELEVATED

The Boston Elevated Railway Company is enlarging its power plant capacity by 10,800 kw, contracts having been placed for sixteen 600-hp boilers and four 2700-kw engine-driven generating units, with condensing equipment and feed pumps. These additions are to be made at Lincoln, Harvard and Charlestown power stations. They represent an increase of 27 per cent in the company's generating capacity, and when installed will give the road a total power plant normal rating of 50,871 kw.

The additions at Lincoln power station, which is located at the foot of Battery Street on the edge of Boston harbor, will require an extension of the present building 83 ft. 4 ins. by 152 ft. in the mean outside dimensions. A new brick stack, 250 ft. high and 13 ft. inside diameter, will be built to supplement the present chimney. Eight of the 600-hp boilers will be installed at this station. All the boilers in the equipment extension are of the Babcock & Wilcox type, each having 294 4-in. tubes 18 ft. long, the usual heating surface of 10 sq. ft. per horse-power, a working pressure of 200 lbs. per square inch, if desired in operation, wrought steel headers and superheaters capable of raising the normal steam temperature 50 to 75 degs. F., according to the load.

The feed pumps to be installed in the three plants are ten in number, each being a Warren duplex outside packed plunger pump, cylinders 14 ins. by 9 ins. by 18 ins. Four pumps will be placed at Lincoln power station.

Two engines will be installed at Lincoln power station, each being built by William Tod & Company, of Youngstown, Ohio. Each will be direct connected to a 2700-kw Allis-Chalmers d. c. generator wound for 575 volts flat characteristic. Each engine is of the vertical cross compound condensing type with cylinders 42 ins. by 90 ins. by 60 ins., and a normal speed of 75 r. p. m. The maximum rating is 6000 hp. The bearings are 32 ins. in diameter and 58 ins. long.

Each engine has a 37-in. steel shaft with a 14-in. internal hole, the length from center to center of journals being 19 ft. 6 ins. Mounted upon the shaft is a 270,000-lb. fly-wheel, 25 ft. in diameter and 29 ins. face. In regard to regulation, the variation in speed from no load to 50 per cent overload is not to exceed 3 per cent, and the maximum momentary variation in speed for extreme and sudden changes of load is to be 1½ per cent. Each unit is to be run with a temperature of steam equivalent to 75 degs. of superheat; all steam and exhaust valves are double ported; the steam supply pipe is 16 ins. in diameter, and the exhaust pipe 30 ins. The usual intermediate receiver is provided, with a capacity of 440 cu. ft., and there is also with each engine an automatic safety stop valve controlled by an auxiliary centrifugal governor, so that the engine can be shut down at any predetermined increase in speed. The weight of the engine complete is about 1,100,000 lbs.; the weight of the heaviest piece, aside from the shaft, which weighs 130 tons, is 35 tons—the low-pressure cylinder. The outside dimensions of the largest piece are 12 ft. 6 in. by 16 ft. 6 ins. by 6 ft. 6 ins. Each engine is provided with rack inside the fly-wheel rim and a motor driving equipment for turning it over. The condensing apparatus in all three plants is of the Warren twin vertical jet type, with 16-in. by 48-in. by 24-in. air pump cylinders.

The equipment for Harvard and Charlestown power stations is the same, except that the new chimneys vary in dimensions. The Harvard stack is to be 225 ft. high and 11 ft. inside diameter; the corresponding data for Charlestown are 200 ft. and 12 ft. Space is provided at both plants for the installation of an additional generating unit with auxiliaries. The addition at Harvard covers an engine room extension of 104 ft. by 66 ft., and a boiler room extension of 140 ft. 6 ins. by 55 ft. 6 ins., inside diameter. At Charlestown the total exterior dimensions of the extension are 158 ft. 4 ins. by 65 ft.

One 2700-kw General Electric direct-connected unit is to be installed in each of these two plants. The engines are McIntosh & Seymour vertical, cross compound, condensing machines, cylinders 40 ins. by 82 ins. by 60 ins. Each has a nominal rating of 4100 hp at 24 per cent cut-off and 50 per cent sustained overload capacity, at which the drop in speed from normal rating is guaranteed not to exceed 4 per cent. These units are to be capable of working at a steam pressure of 170 lbs., with a superheat of 75 degs. F., and 26 ins. vacuum. Their normal speed is 90 r. p. m.

The economy specifications are:

Steam per ihp-hour at 90 r. p. m. with 160 lbs. pressure and 26 in. vacuum; dry, saturated steam—

Load per cent.	Lbs. Steam.
25	15.25
50	13.35
75	12.7
100	12.7
125	13.3
150	14.45

With steam superheated 50 degs. at the throttle—

Load per cent.	Lbs. Steam.
25	12.75
50	12.05
75	12.05
100	12.05
125	12.65
150	13.85

The maximum power which each engine will deliver continuously is 7080 ihp. Bearings are 30 ins. by 54 ins.; shaft diameter, 33 ins.; fly-wheel weight, 200,000 lbs.; diameter, 21 ft.; face, 21½ ins.; receiver capacity, 480 cu. ft. The steam supply pipe will be 16 ins. in diameter, and the exhaust, 34 ins. Weight of low-pressure cylinder, 60,000 lbs.; shaft, 137,000 lbs., not including the armature. The outside dimensions of the low-pressure cylinder are 8 ft. 6 ins. by 10 ft. 11 ins. by 11 ft. 8 ins. The speed variation from no load to 50 per cent overload is not to exceed 6 per cent, with a maximum momentary variation of 4 per cent. The throttle valves will be of the Schutte & Koerting semi-steel, quick-closing type, and an automatic stop with auxiliary governor is to be provided. Richardson lubricators will be used on the cylinders.

The completion of the foregoing work will give the following capacities in the various power stations of the company:

Station	Capacity Kw.
Central	12,900
Auxiliary	1,600
Lincoln	13,500
Charlestown	7,000
Dorchester	3,750
Harvard	6,300
East Cambridge	2,802
Medford	975
Somerville	700
Allston	744
East Boston	600
Total	50,871

The constructing engineers for this work are the Stone & Webster Engineering Corporation, of Boston.

AVOIDING GROUNDS ON ELECTRIC CAR RESISTANCES

BY A MOTOR INSPECTOR

Figs. 1, 2 and 3 indicate a method of suspending grid rheostats under a car, and with minimum chances of subsequent shocks to passengers or short-circuits from frame to frame in wet weather. Investigation of cars that were giving both of these troubles showed that shocks were, in most cases, due to hanger bolts passing through the car floor and to the hangers and resistance frames, both of which was metallically connected to the same iron channel bars. The resistance metal of a grid rheostat is normally insulated from the containing frame, but the distance from the metal to the frame is short, and it does not take salt

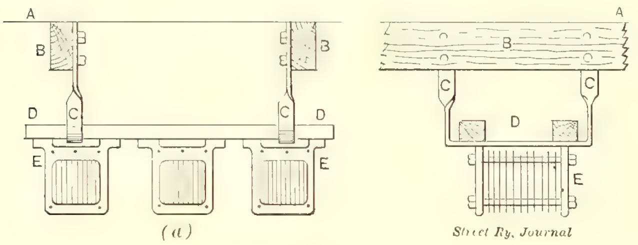
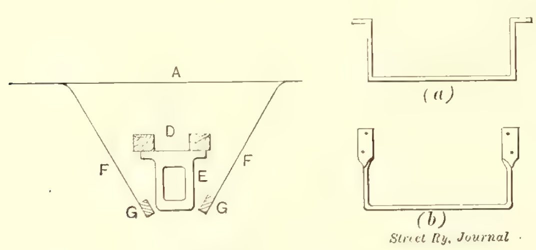


FIG. 1

slush thrown by the car wheels very long to establish an arcing path, which ultimately becomes a short-circuit, especially if the hangers are accessible to any grounded part under the car. Such a grounded part is usually provided by the hanger coming near another hanger or carrier belonging to the hand or air brake rigging.

In the diagrams, *A* is the under side of the car floor; *B*, two of the cross sills; *C*, the iron resistance hangers; *D*, 2 in. x 4 in. sticks of ash soaked in insulating paint, and, in this case, about 5 ft. long; these sticks are provided with two sets of holes, so that the pieces kept in stock can be used whether the resistance frames must be hung to them the long way or side by side, as in the engraving. *E* represents the resistance frames. It will be noted that the hangers are secured by bolts that pass horizontally through the car sills. In case the sills do not come in the right place conveniently to permit this construction, extra timbers equivalent to the car sills can be bolted to the car floor and the hangers can then be bolted to them. The chances of a passenger stepping on a live bolt are minimized, and as adjacent frames are separated by lengths of insulating wood, the chance of trouble involving more than one frame is small.

Fig. 2 shows where a hanger construction, instead of



FIGS. 2 AND 3

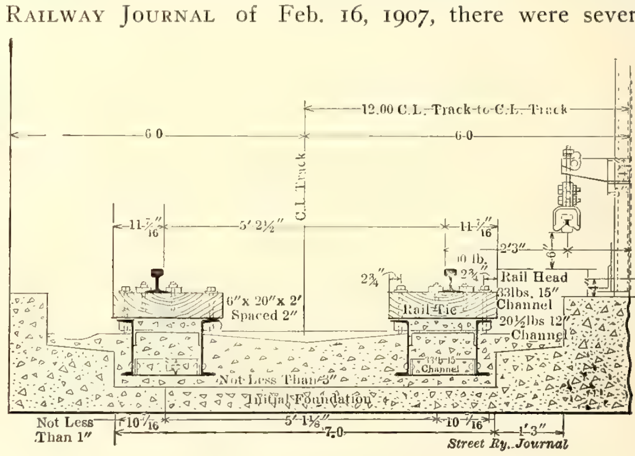
lying along the longitudinal center line of the car, had to be placed along the cross center line, with the result that the two outside resistance frames were brought within the range of slush thrown by the car wheels. Here *F* is a canvas curtain hung in the manner indicated. Ordinarily a curtain is a bad thing, because it deprives the coils of the windage so useful in keeping them cool; but sometimes its use is unavoidable.

Where such a plan is practicable it is well to keep the resistance symmetrical with respect to both center lines of the car and out of the range of the wheel spray. On single-end cars the proposition of installing the resistance may be simplified by hanging them under the rear end, where they will have to be protected possibly on but one side. Fig 3 (a) shows the kind of hanger generally used and which calls for through bolts in the car floor—a bad thing. Fig. 3 (b) shows a hanger of the same general dimensions, but with straight legs, which require horizontal fastening, as in Figs. 1 and 2. This wooden stick-horizontal bolt construction has replaced the iron channel bar, vertical construction on more than 150 cars with which grounded resistance troubles had previously been experienced, and in no case has the change failed to make good in the worst of weather conditions. Originally fifteen different kinds of hangers and almost as many different kinds of channel bar were used, but they have been replaced by three kinds of hanger and one kind of wooden stick with two sets of holes bored in it. This makes it practicable to keep all parts in stock in minimum storehouse space and with minimum chance of running out of what is needed in repair work.

On the old style of resistance frames the possibility of grounds was admitted and the holes in the legs of the resistance frames were made sufficiently large so that an insulating bushing could be used around the bolt that secured the frame to the hanger. In the modern frames, however, the bolt hole is too small to admit of using a bushing, so that other preventive measures must be taken, as described. A wise precaution to prevent the current from finding a leak and finally a jumping path from the resistance metal to the frame, is to use on the ends, instead of the last 16th inch of mica washer, a piece of mica or micanite several inches in diameter, thereby making the trouble path longer.

EXPRESS TRACK CONSTRUCTION IN THE PHILADELPHIA SUBWAY

In the article on "Recent Progress in Heavy Electric Railway Work at Philadelphia," published in the STREET RAILWAY JOURNAL of Feb. 16, 1907, there were several



TYPICAL SECTION FOR EXPRESS TRAINS IN MARKET STREET SUBWAY

illustrations showing the methods for carrying the third rail in the Market Street subway and on its elevated extension. Brief reference was made in that article to the proposed sub-structure for the subway express tracks, but at that time some of the details were still uncertain. The

accompanying cut illustrates the type now approved as standard. It will be seen that the yellow pine blocks to which the rails are secured are bolted to the top members of two 20½-lb., 12-in. channels embedded in concrete. These longitudinal channels are separated by short sections of 33-lb., 15-in. cross channels, which keep them parallel when the concreting is in progress. To provide for the ultimate installation of guard rails the running rails were laid off-center on the blocks.

ELECTRIC CAR LOADS ON HIGHWAY BRIDGES

At a recent meeting of the Boston Society of Civil Engineers a number of points of interest to electric railway engineers were brought forth in the discussion of a paper on "Replacing Bridges," by H. K. Higgins. F. P. McKibben stated that in the design of track stringers of highway bridges carrying electric cars, the stringers directly under the rails should be computed to carry the entire loads from the rails without relying upon the planking to distribute the loads to adjoining stringers. In the study of existing bridges of this kind it is frequently necessary, however, to assume that the planking distributes the track loads over a considerable width of the roadway, and hence over several lines of stringers.

If the planking is in good condition this assumption is allowable, but it is difficult to determine exactly how the loads are proportioned among the various stringers. A very common form of track construction is to have the rails resting directly upon a lower layer of planking which in turn is supported by wooden stringers placed 30 ins. on centers with one stringer directly under each of the rails. In this case the amount of load upon each of the stringers is far from equal. Given an electric car axle load in the center of an ordinary 13-ft. panel with 4-in. x 14-in. stringers spaced as just stated, the rail resting on a layer of continuous 4-in. planking, it can be shown that approximately 30 per cent of the axle load is carried by each of the stringers under the rails, 26 per cent by the stringers under the center of the track, and 7 per cent by each of the two stringers just outside of the rail stringers. These percentages change somewhat with change in the size of stringers, thickness of planking, etc., but are of sufficient accuracy to show that the assumption of equal distribution is incorrect. As the weights of electric cars increase, this becomes a matter of considerable importance.

An examination of existing highway bridges carrying electric cars reveals one form of construction which is so prevalent and so poor that it should be emphasized in order that existing bridges having this defect may be strengthened, and that the evil may be avoided in future construction. The practice to which reference is made is that of supporting wooden stringers upon small steel shelf angles riveted to the webs of floor beams, the shelf angles not being braced by stiffeners fitted under the outstanding legs. It is not at all uncommon to find electric railway tracks on highway bridges carried upon stringers which rest upon shelf angles as small as 3 ins. x 3 ins. x ⅜ in. Such angles are almost invariably over-stressed, and Mr. McKibben stated that he has in his possession broken shelf angles from three different bridges.

L. S. Cowles stated that the most frequent overloading of city bridges appears to come from the ever increasing weight of urban and interurban cars. The main girders and trusses are no doubt less likely to be overstrained than the floor system, and especially the connections of stringers to floor beams. In old city bridges the practice of supporting wooden stringers carrying car tracks on single unsupported shelf angles is to be deplored, and all such defects should be remedied by means of vertical stiffeners under the outstanding leg of angle, or where there is not enough space the angle may be supported by vertical bolts and a yoke over the top chord of floor beams.

The question as to what constitutes a liberal allowance for impact for electric car loading is a much mooted one. C. C. Schneider in his very excellent paper on "Bridges for Electric Railways" in the STREET RAILWAY JOURNAL of Sept. 22, 1906, introduces his impact formula for railroad bridges in a modified form so that the addition for impact due to electric car loads is practically one-half that due to locomotive loads. This seems perfectly safe, as the speed maintained on most electric railways is much lower than on trunk lines, and the rotating effects of the motors is no doubt less disastrous than the reciprocating motion of the steam locomotive parts. Certain defects common in the track system of many electric roads might tend to equal the pounding effect of poorly-balanced locomotive driving wheels, but over such a roadbed high speeds could not with safety be maintained.

The heaviest surface car now being equipped on the Boston Elevated Railway will weigh when loaded about 41 tons, and in case the motors are mounted on one truck only, the load on the motor truck will be about 25 tons, or practically the same as for an elevated car on the same system. Thus, for short spans, such as stringers, this is equivalent to a 50-ton car, and in the light of present facts it would seem advisable to adopt as a standard a 50-ton car about 45 ft. long in designing new work where car tracks are to be supported.

F. H. Fay pointed out that in Boston a number of city bridges originally designed to carry a uniform live load of 100 lbs. per square foot, or a single 20-ton wagon, are now being strengthened by the Boston Elevated Railway Company to take trolley cars weighing 50 tons.

THE DENVER RULE BOOK

The Denver City Tramway Company has revised and reissued its Rule Book, and now presents it to employees in the form of a neat pocket-book of eighty-three pages bound in a black leather cover. Among the features of this book are the inclusion of several city ordinances relating to the operation of cars and a comprehensive alphabetical index giving the rule and page number. A number of notes are scattered through the book and printed in italics, to assist the employees in carrying out the rules. For instance, after the instruction to slow the cars to 2 miles an hour at certain points, the note is added that at this speed the car takes about thirty seconds in passing between consecutive span poles. At 4 miles an hour fifteen seconds is the time occupied in passing from one span pole to the next.

Vice-President Buckland, of the New York, New Haven & Hartford, is quoted as follows, in discussing the handling of freight by the trolley lines at Providence: "We believe that throughout the New York, New Haven & Hartford system, by the adoption of the trolley freight service, we can save $15,000,000 annually to the manufacturers and consumers. This is one of the routes where we can try to save some money that is being unnecessarily spent. By combining our steam and trolley services we are sure that we can save a good deal to the citizens of Providence."

NEW TRAMWAY CONTROLLER FOR UNDERGROUND CONDUIT LINES

A new type of series-parallel controller has recently been adopted by the London County Council through its chief officer for tramways, A. L. C. Fell.

This controller was designed to meet the special conditions on the conduit system of the London tramways, where the return circuit is insulated, and is one of two types lately developed by the British Westinghouse Electric & Manufacturing Company, Ltd. The controller supplied to the London County Council is the British Westinghouse Company's T2 type, shown in Fig. 1, and its co-type, T1, shown in Fig. 2, is designed on much the same principle for all circuits employing a ground return. An exterior view of both types is given in Fig. 3. The claims which are set forth for the new design, and the deviations from present tramway practice embodied therein, are as follows:

The electrical connections of the two controllers are so arranged that they can be used with either rheostatic or magnetic braking and with either motor cut out of service. Each controller has four series, four parallel, and seven brake notches, and is specially adapted for smooth starting and stopping when used in conjunction with magnetic brakes. The shape is elliptical, so that the controller conforms closely to the dash-board of the car, and therefore takes up the least possible amount of useful floor space. Special attention has been paid to the mechanical construction, which is very substantial and well adapted for the most severe service conditions. The number of controller parts is said to be materially less than on any other street railway controller of the series-parallel type, and the design is such that all parts are readily accessible for inspection or renewal.

A novel point in the construction of these controllers is that there is only one shaft, upon which are mounted the drums necessary for making the proper electrical connections. As a result of this arrangement, the mechanism for interlocking the drums so as to prevent the main controller drum being moved except when the reverse drum is in the forward or reverse position, and also to prevent the reverse drum being moved except when the main drum is in the "off" position, is extremely simple. Neither of the handles can be removed unless both are in the respective "off" positions. The reverse handle is depressed so that it is level with the controller top, thus making it impossible for the operator to catch his fingers between the two handles. The "body castings" on the main drum are of cast iron and made in two parts, which are clamped about an insulated shaft, thus making it possible to renew the same in a few moments without disturbing the remainder of the drum.

All the copper segments on the main drum are fitted with arcing tips, which are renewable. The fingers are of simple construction, and are also fitted with renewable copper tips, which are made by cutting from a standard drawn-copper section a length equal to the width of the finger. The finger spring is of phosphor bronze, is very flexible, and allows of a large range of movement without affecting the pressure of the finger on the drum. The fingers are provided with an adjustment to limit their range of movement when making or breaking the contact with the drum, and it is impossible for any "stubbing" or catching action to take place. This adjustment is made entirely without the use of any tools, and is positively locked as well.

The cutting out of either motor, in the event of a fault developing, is effected by raising two fingers which are fitted with catches for holding these fingers out of contact with the drum. The motor which is cut out is entirely disconnected, and does not interfere with the operation of the second motor for running or braking.

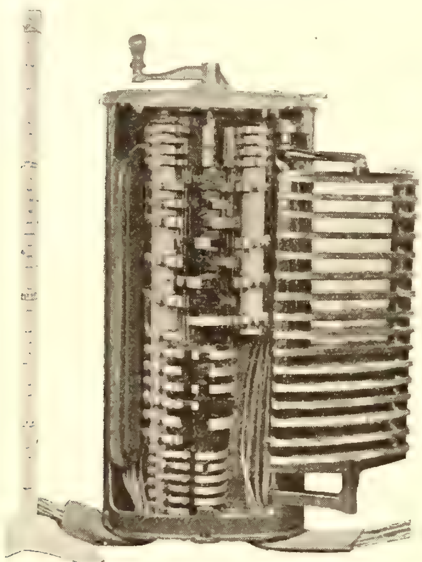


FIG. 1.—T-2 CONTROLLER

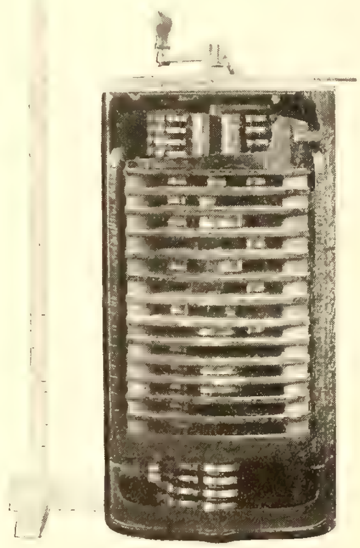


FIG. 2.—T-1 CONTROLLER

FIG. 3—T-1 AND T-2 CONTROLLER

The arc shield is hinged in such a manner that it can readily be swung clear of the controller to allow of access to the interior, or lifted off its hinges if any repairing is required. The deflector or shield plates are easy to renew, and the shield, as a whole, is of a very substantial construction. The arc shield of the T2 controller is fitted on double hinges, as shown in Fig. 1. This arrangement permits greater accessibility when it is necessary to fix the controller in a confined space. Each controller is fitted with a magnetic blowout consisting of two coils, one on either side of the controller (Fig. 2), the magnetic circuit of which is so arranged that the arc is blown in a direction at right angles to the drum, and does not impinge directly on the deflector plates. This considerably increases the life of the plates. The construction of the controller frame and cover is such as to render the whole water-proof. The cables are protected where they enter the controller by means of rubber-lined can-

vas hose, securely fastened to the controller base and long enough to allow of a watertight joint being made.

On the London County Council tramway system 600 of this type of controller have been in constant service for nearly twelve months, with such satisfactory results that Mr. Fell has felt himself justified in adopting them on 300 further cars which are now being built.

SOUTH AUSTRALIAN MUNICIPAL TRAMWAYS TRUST

On Feb. 5 the horse tramways operated by the different companies throughout the city and suburbs of Adelaide became the property of the State Government. They were formally taken over by the Municipal Tramways Trust, a check for £280,372 being paid to the vendors, £280,000 representing the purchase money, and the balance various sums expended by the companies for stock since the agreement was made. The Municipal Tramways Trust is composed of representatives of the State and of the various municipal authorities concerned. The purchased lines are made up of lines in and around Adelaide.

The trust consists of eight members, two being appointed by the Governor, two by the Corporation of the City of Adelaide, two by the Suburban Corporations, and two by the District Councils. Members retire every three years, but are eligible for reappointment. No member of the Legislature may be elected or sit on the trust. The Governor appoints the chairman. Each member other than the chairman is to receive a fee of £1 for each meeting he attends, but not more than £78 in any one year. The chairman is paid £250 per annum. The trust is a body corporate, with perpetual succession and a Common Seal. It has the exclusive right to work horse or electric tramways within a radius of 10 miles from the Adelaide General Post Office.

Within three years from Dec. 31, 1906, the trust is to "form, lay down, make and construct" a system of tramways propelled by electric energy, with or without overhead trolleys. Such tramways are to run from some point or points in Adelaide to terminal points in specified suburbs. So soon as these lines are properly remunerative the trust must complete lines to other suburbs within five years. The financial details show that the Government will issue

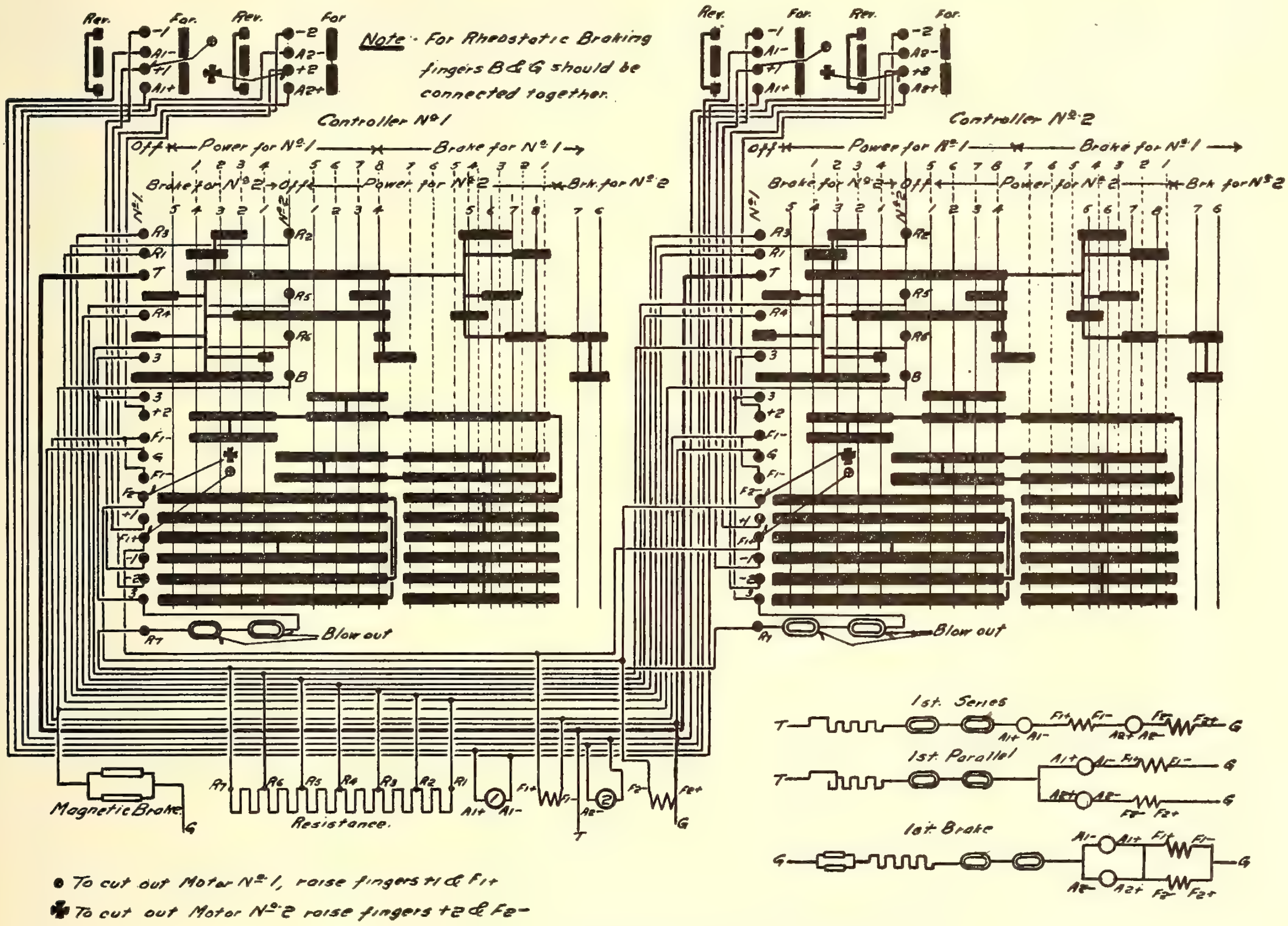


FIG. 4.—WIRING CONNECTIONS OF TYPE T CONTROLLER

Treasury Bills bearing interest at 4 per cent, and the trust is to repay one-sixtieth part of the total sum advanced every half-year. The Treasury will control the finances of the trust. The liabilities of the trust and its assets are divided into three portions, one each for the City of Adelaide, the Suburban Corporations, and the District Councils. The usual general powers to break up roads, etc., are conferred upon the trust, which may purchase and use any sort of vehicle, run an amusement park, or do various other things for the furtherance of its tramway business. Except with the consent of the Governor, the work of construction must be done by contract, and the total cost of the conversion from horse to electric traction, including everything, must not exceed £12,000 per mile, on average. No contract may be made without the consent of the Governor.

THE PEORIA-BLOOMINGTON SINGLE-PHASE LINE

The first single-phase line to be put in operation by the Illinois Traction System is the Bloomington-Peoria section of the Peoria, Bloomington & Champaign Traction Company. The line which is now in operation between Bloomington and Peoria, a distance of 38 miles, will eventually be extended to Champaign, about 50 miles southeast of Bloomington. The road has been built with a view of making the run between Bloomington and Peoria in one hour, and, as a consequence, sharp curves and heavy grades have been avoided even at considerable cost. The line is 3 miles shorter than either the Vandalia or the Lake Erie & Western Railroad between Bloomington and Peoria. The time on these steam lines is at present one and one-half hours. The road is built on a private right of way 80 ft. wide. It passes through a well-populated farming district and reaches several towns of some importance. Among these are Danvers, with about 700 people, and Mackinaw and Morton, each with a population of about 1000. The terminal cities, Bloomington and Peoria, have a population of approximately 25,000 and 60,000, respectively.

VIEW NEAR BLOOMINGTON, SHOWING THE CHARACTER OF THE COUNTRY THROUGH WHICH THE LINE PASSES

A HEAVY CUT ABOUT 5 MILES FROM PEORIA

Near Bloomington the country traversed is comparatively level and no excessive cuts and fills were required. Towards the west terminus, however, the land is exceedingly rough. At one point a 50-ft. cut partly in rock was made, and there are several fills from 40 ft. to 60 ft. high. The largest steel structure on the line is a bascule bridge over the Illinois River at Peoria. The structure consists of three truss spans which form the east approach to the draw and a series of girder spans west of the draw carrying the tracks over several steam railroad switch tracks and through an extension of a new turbine power plant at Peoria which will supply current to operate the line. All of the spans rest on concrete piers. The east approach to the steel structure is over about 600 ft. of trestle, while at the west end the tracks are gradually brought down to the street level by the girder spans. Another steel structure of note is a viaduct over the tracks of the Vandalia Railroad about 1 mile west of Morton. The larger waterways are crossed

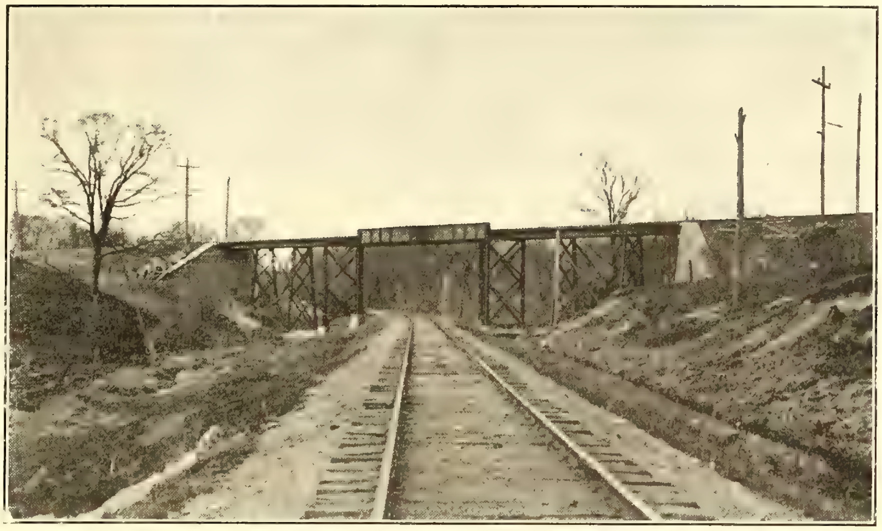
BASCULE BRIDGE OVER THE ILLINOIS RIVER AT PEORIA

by steel spans resting on concrete abutments. The smaller ones are formed of concrete arches.

SUB-STATIONS

Power to operate the line is obtained from two transformer sub-stations, at Danvers and at Morton, approximately 20 miles apart and 10 miles distant from the terminals of the road. Both are housed in similar combination sub-station, freight, and passenger stations of fireproof construction. The floors and roofs are of concrete and the exterior walls dark colonial brick with limestone trimmings. In the front portion of each building is a passenger waiting room; the sub-station occupies the rear portion, and a freight room, with the floor elevated to the height of the car floor, is located in the central portion. A spur from the main track runs alongside a covered loading platform on one side of the freight room, and on the opposite side of the building is a doorway used in loading and unloading wagons.

In each sub-station is installed two 200-kw, 33,000 to 3300-volt, single-phase, oil-insulated, step-down transformers. All three wires of the three-phase, high-tension line enter the building, and the connections are such that the lines may be disconnected at the sub-station by opening a triple-pole oil switch. When this switch is open the sub-station may be operated from either the Bloomington or Peoria side of the switch by throwing a hand-operated double-throw switch. Between this hand-operated switch and the transformers is a double-pole oil switch. Near the transformers is installed a totalizing panel carrying a 150-amp. ammeter, and against one wall is a double panel for the two feeders leaving the station. This latter board is provided with two 100-amp. ammeters. A 30-amp. ammeter is connected through transformers to the high-tension lines. Multiple gap lightning arresters for the high-tension lines are installed on the rear wall of the sub-station room.



VIADUCT OVER THE VANDALIA RAILROAD NEAR MORTON

THE MORTON SUB-STATION, WITH ACCOMMODATIONS FOR PASSENGERS AND FREIGHT

THE TRACK AND ROADWAY

The track is built with a 70-lb. rail laid in 30-ft. lengths. Continuous rail joints and General Electric No. 0000 plug bonds are used. The entire road is ballasted with gravel.

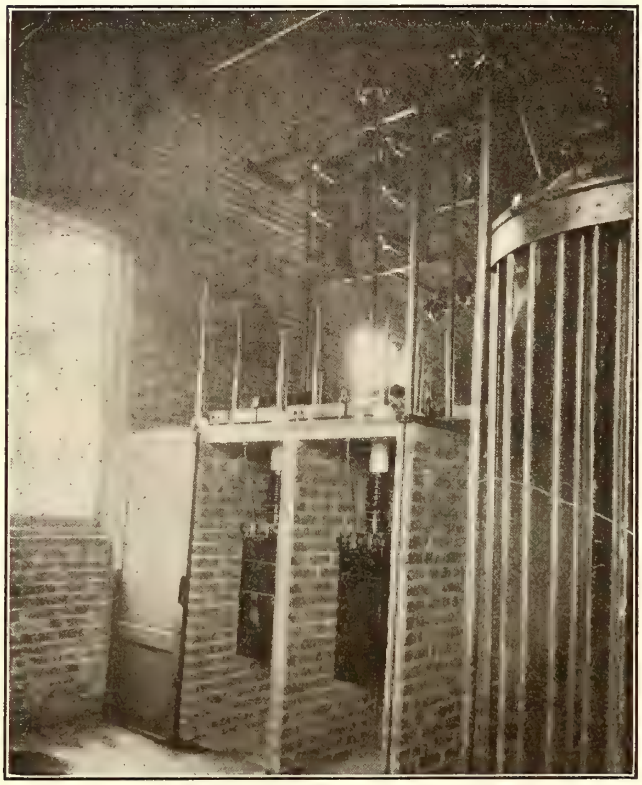
OVERHEAD CONSTRUCTION

The poles, which are spaced 140 ft. apart, are of Idaho cedar, 40 ft. long, and have 7-in. tops. They are set 7 ft. in the ground with 6 ins. of concrete around the butts. A derrick car hauled by a locomotive was used in setting the poles. The same train carried sand, stone and cement, and the concrete for each pole was mixed on the car at the time the pole was set.

At the top of the poles is a single cross-arm measuring 4¾ ins. x 5¾ ins. x 10 ins., which carries the three No. 2 hard-drawn copper wires of the three-phase, high-tension system. A gain is provided for a second shorter cross-arm above the one now in position to carry two of the wires of a second high-tension line to be installed later. The third wire will be carried on the end of the long cross-arm, and, when completed, the two circuits will have a double-delta arrangement. Locke No. 312 triple petticoat insulators are supported on malleable iron pins secured to the cross-arms by wrought-iron bolts passing through them, carrying the high-tension wires. A No. 6 iron ground wire, grounded every sixth pole to an iron bar driven in the ground, is run at the top of the poles. A cross-arm just below the trolley bracket supports a telephone circuit of two No. 10 hard-drawn copper wires. These are carried on No. 7 Locke insulators and are transposed every four poles. Cross-country telephone lines encountered have been placed 2 ft. under the track in iron conduit. Outside of corporation limits the catenary trolley construction is carried on tubular brackets, all of which were set with instruments. On curves a span wire ties the bracket pole to a pole placed on the opposite side of the track, and this

latter pole is braced by a guy anchored in the ground.

The messenger wire of seven-strand, 7-16-in. Siemens-Martin cable is supported by Locke insulators secured to iron pins with Lehigh Portland cement. A two-bolt clamp holds the pins to the bracket arm. Outside of towns and cities the trolley, which is of No. 000 grooved wire, is sus-



APPARATUS AND WIRING IN THE MORTON SUB-STATION

pended to the messenger at three points between poles, and, as the poles are set 140 ft. apart, this makes the distance between supports 46 2-3 ft. Inside of municipal limits the number of suspensions varies up to eleven. The messenger has a deflection of 28 ins., the trolley being 2 ins. below it at the middle suspension. The trolley is staggered 7 ins. by varying the distance from the center line of the track 1 in. at each bracket. At the extreme points a steady brace is employed to hold the trolley the proper distance from the poles. These steady braces, which are also used at curves, consist of a long maple insulator with a trolley clamp at the outer end. They are bolted to the pole with an upward slope towards the pole to avoid possible interference with the top contact of the pantograph trolley.

At each end of all curves and on tangents at ¼-mile intervals the trolley is braced by short connecting guys attached at the points of suspension nearest the pole to both the trolley and the messenger wire. The two guys from each suspension are carried back under the bracket, where they are clamped, and they are then extended to the adjacent poles.

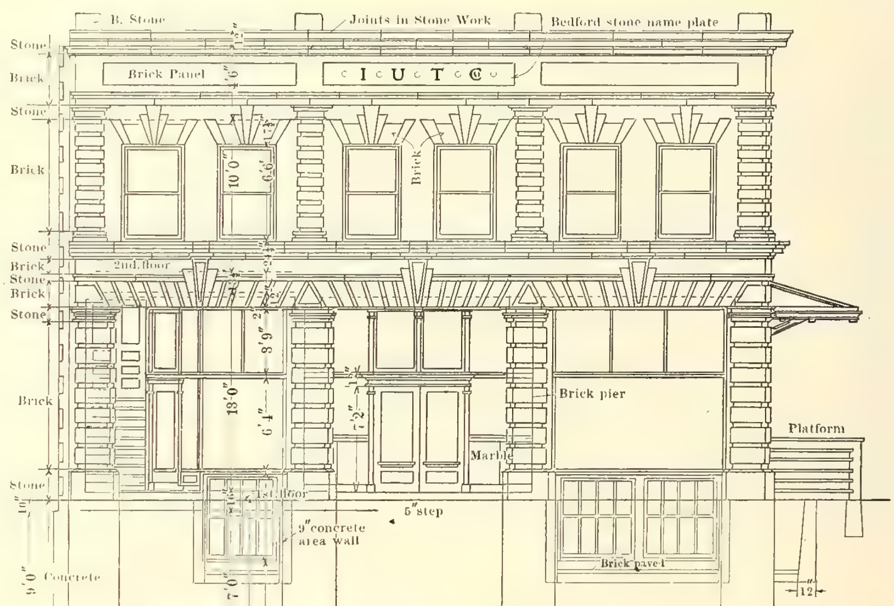
A rather novel method was employed in stringing the wires. The high-tension wires and the ground wire were strung before the brackets were put up. Two flat cars hauled by a locomotive were employed. One car carried the reels of wire, while the other was provided with a gin pole which could be swung out over the cross-arm. A horizontal arm on the end of this pole contained grooves for the three high-tension wires and the ground wire. After the wires had been started through the grooves the construction train moved along and the wires were laid over the cross-arm. The brackets were then put up and the messenger wire and the trolley were strung in a similar manner.

CARS

The cars operated on the line were built by the American Car Company, at St. Louis. They are 51 ft. 6 ins. long over bumpers and weigh about 40 tons completely equipped. They have a seating capacity for fifty-eight people. The interior is divided into a smoker and passenger compartment, both of which are provided with cane seats. The interior finish is dark oak. A heater and toilet room is located in one end, and in the opposite end is a switch cabinet. The cars are built for operation in both directions. In addition to a pantograph trolley over the center of the car wheel trolleys of the usual type are provided over each truck. The cars are equipped with four General Electric 75-hp a. c.-d. c. motors geared for 50 miles per hour. The Illinois Traction System, of which the Peoria-Bloomington line is one division, is operated from offices in Danville, Ill., by L. E. Fischer, general manager.

NEW INDIANA UNION TRACTION COMPANY STATION AT KOKOMO, IND.

In accordance with its policy of erecting suitable stations in the larger cities through which its lines pass, the Indiana



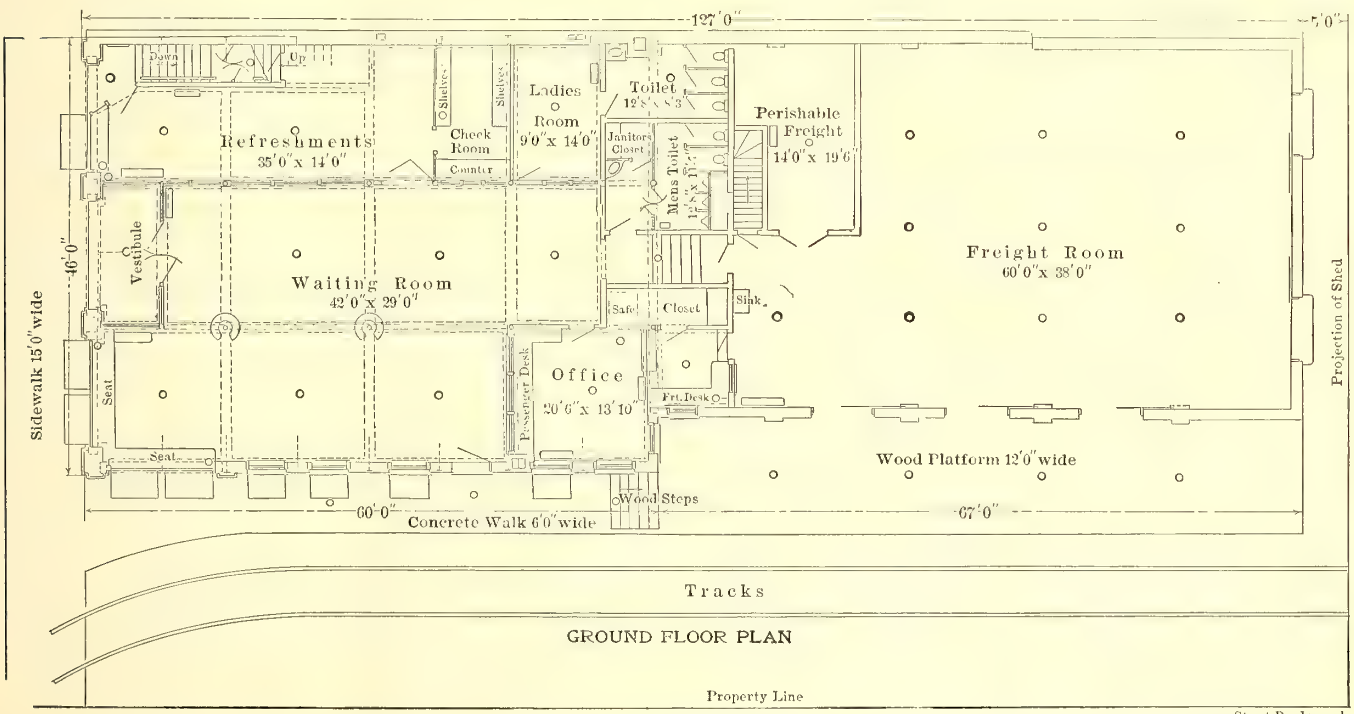
FRONT ELEVATION OF THE INDIANA UNION TRACTION COMPANY'S STATION AT KOKOMO, INDICATING THE TYPE AND MATERIALS OF CONSTRUCTION, SHOWING ALSO THE POSITION OF THE LOADING PLATFORM

Union Traction Company has just completed quite an elaborate passenger and freight station at Kokomo, Ind. The building, which is two stories high, measures 127 ft. deep and 46 ft. wide. The exposed walls are built of hydraulic

pressed brick with trimmings of Bedford stone. The first floor is divided about equally between a passenger station and a freight room. A passenger waiting room entered through a small vestibule with marble wainscoting, measuring approximately 29 ft. x 55 ft., takes up the greater portion of the front portion of the building. The waiting room is provided with a concrete floor and plastered walls above a marble base, and is finished in dark ash. Separated from the room by a glass partition is a refreshment room and a ladies' room. This latter room has a toilet in connection with it.

The office in the rear of the waiting room has a passageway leading to the freight room, and there is also a doorway between the freight and waiting room. A small room partitioned from the large freight room is kept heated and is used for perishable fruit. Three doors, 12 ft. 10 ins. wide, open out on to a 12-ft. platform extending the full length of the freight room on the south side, while wagons are loaded and unloaded through two similar doors in the rear of the building. Passenger cars stop in the street in front of the station and freight and express cars are run on a siding extending along the south side of the building. On the whole, this station should prove a worthy model for other interurbans doing a freight and passenger business, and the Indiana Union Traction Company deserves commendation for its progressiveness in this direction.

COMPLETED KOKOMO STATION OF THE INDIANA UNION TRACTION COMPANY, WITH VIEW OF CAR-LOADING PLATFORM AND CAR



GENERAL PLAN OF KOKOMO STATION, SHOWING THE GENERAL LAY-OUT OF FACILITIES FOR PASSENGER AND FREIGHT SERVICE

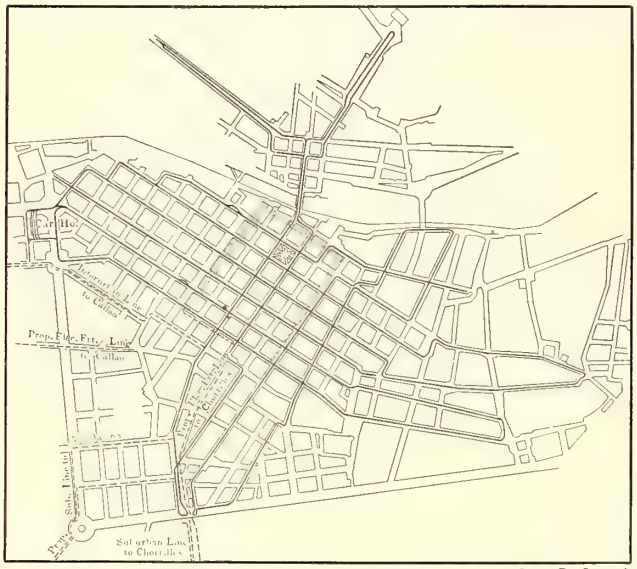
The Portland Railway, Light & Power Company, of Portland, Ore., is rebuilding two of its motor freight cars and changing them into locomotives. They will be used for handling freight trains and will conform in appearance and equipment to two new electric locomotives ordered in the East and due to arrive this summer.

SAN FRANCISCO FINANCES

It is stated that the United Railroads of San Francisco has had to face an expenditure due to the earthquake and strike and for betterments and improvements from March 1, 1906, to March 1, 1907, amounting to $4,294,271. This had all been provided for so that the company on March 1, 1907, had current liabilities amounting to $2,310,209, against which it had current assets of $2,177,410. In addition to this, it has sold securities which were delivered in March that netted it an amount in excess of $900,000, and still left in its treasury over $2,500,000 of its 4 per cent consolidated bonds. It is claimed that by the sale of securities the $4,294,271 above mentioned has been provided at a cost not exceeding 5 per cent interest. Improvements, however, will not be made as rapidly as first contemplated.

THE ELECTRIC TRAMWAY SYSTEM OF LIMA, PERU

That the cities on the western side of South America are not behind the important towns of Argentina and Brazil in the adoption of modern methods is well shown by the fine electric railway system now operated in Lima, a prosperous Peruvian city with a population of 150,000. Unlike their fellow-continentals, the Peruvians placed this work in the



Street Ry. Journal

STREET RAILWAY MAP OF LIMA, SHOWING PRESENT AND PROPOSED LINES

care of United States instead of German capitalists and engineers, so that the installation throughout follows American practice.

Lima is the first of the cities of Peru to employ electric

WAGON FOR SETTING POLES

traction. In addition to the city road there are two interurban lines, one from Lima to Chorillos, a distance of 8 miles, and the other from Lima to Callao, a distance of 7 miles. By a recent combination, all of the electric interests in the vicinity of Lima have come into one company, the Empresas Eléctricas Associadas. This comprises, in addition to the three railways above mentioned, the Empresa Eléctrica de Santa Rosa, which furnishes all the lighting and power for the city and surrounding towns, as well as the power for all of the railways.

The work of converting the old horse-car system of Lima to electricity was started in September, 1905, and on June 1, 1906, the first line went into operation. The other lines have been operated as soon as ready and the change is now complete. The total length of track is about 40 km (25 miles), made up of nine different lines. On the streets

A CHARACTERISTIC SCENE DURING THE TRACK CONSTRUCTION PERIOD, SHOWING THE NARROW AND CURVED STREETS

paved with asphalt or Belgium blocks a Lorain section No. 326 74-lb. grooved rail is used, and on the other streets a Lorain section No. 263 60-lb. T-rail, 6-ins. high. On account of the narrow streets the cars are operated in only

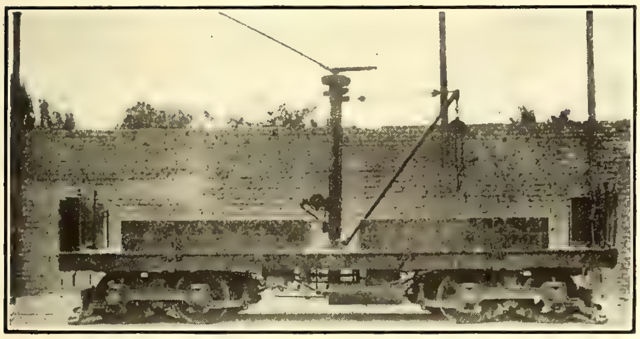
TOWER WAGON IN SERVICE

one direction on a street and the track is laid on one side near the curb.

Many difficulties were encountered in constructing the trolley, as the poles could not be placed on the curb near the track. It was necessary, therefore either to place them against the buildings or on the other side of the street, which would require a very long bracket. As a rule the

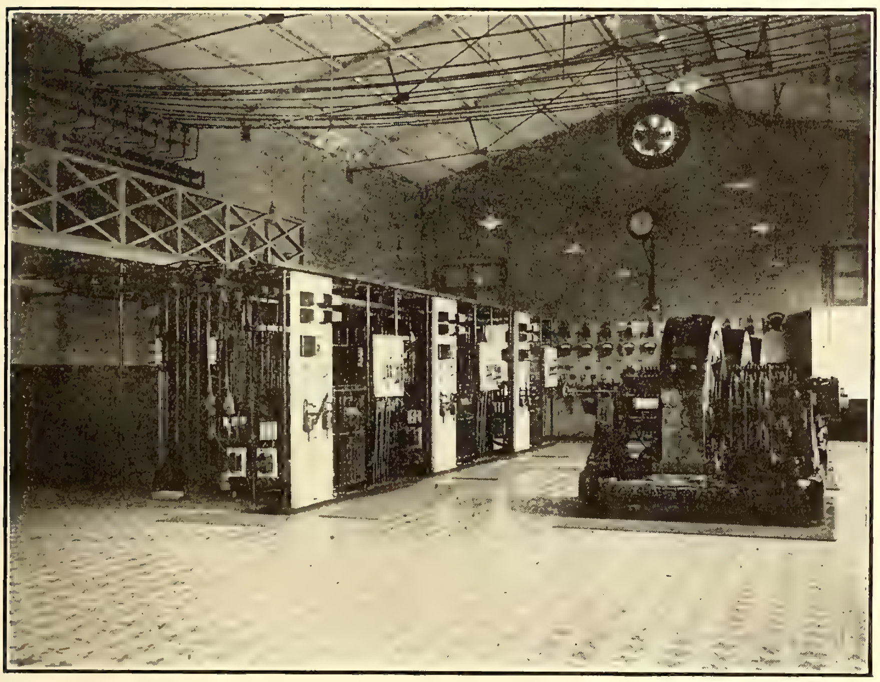
buildings are close together and have overhanging balconies, a condition which has necessitated a great many special arrangements for suspending the trolley. No. 0000 grooved trolley is used, supported on flexible brackets and two-section tubular iron poles. The government regulations require a guard wire over the trolley. The construction devised by the engineer consists of two No. 12 phono electric wires supported on the brackets 2 ft. above the trolley; this is well grounded and clamped at each bracket, so in case the wire breaks only the section affected will fall.

A complete central energy telephone installation has been installed in connection with the tramway system, the central being located in the main office of the company, with private lines communicating with the car house, sub-station, power station, etc. In addition there are twenty-four telephones installed throughout the city at various points, these being of the iron box type attached to the iron poles.



A SPECIALLY DESIGNED WORK AND FREIGHT CAR

EXTERIOR VIEW OF THE SUB-STATION



INTERIOR OF SUB-STATION CONTAINING THREE 300-KW ROTARIES. TWO MORE HAVE BEEN ORDERED

The sub-station is located in the center of the city and is a brick building 80 ft. x 30 ft., of one story with large passages below the floors for cables. The power is supplied by the Empresa Eléctrica de Santa Rosa from the Chosica water power plant, 40 km (25 miles) distant; the power is transformed in the water-power company's Lima station and delivered to the railway at 2300 volts. To guard against shut-downs, a duplicate transmission lines are provided. The present sub-station equipment consists of three 300-kw, six-phase, 60-cycle rotaries and three-phase 330-kw transformers of the oil-cooled type. Provision is made for two additional units to be installed later, thus bringing the ultimate capacity to five units. Adjoining the sub-station a house is provided for the sub-station attendants and the emergency tower men.

The current is distributed by fourteen feeders, as shown on the plan. The feeder cable is of the steel armored type and is laid in the ground without conduit; manholes are placed at each street corner. The feeders are arranged to give the greatest flexibility possible and reduce to a minimum the lines shut down should it be necessary to take the power off any particular section for any reason.

The car house building, which also includes the shops and general offices, is located at one side of the city. The building is of brick, 425 ft. x 200 ft., and contains eight tracks, three of which have pits. The machine shop is 130 ft. x 35 ft. and has a track with pit. The equipment consists of four forges, two upright drills, two lathes, which are arranged in two sets with large benches, so that two gangs of men can work independently. The shop is also provided with a shaper and wheel press.

The carpenter shop is 180 ft. long x 35 ft. wide, and contains one Fay & Egan planer and matcher, one band sawing machine, one No. 1 variety saw. The paint shop is 180 ft. long x 35 ft. wide, and the foundry is 110 ft. long x 40 ft. wide, containing all the necessary machinery appliances for making the castings required in connection with the system. The armature repair room adjoins the machine shop and is equipped with a large oven with electric heaters for drying, and an armature binding machine. A cross pit connects with the pits in the car house, so that the armature lifts may be wheeled directly from the car to the armature room. The stock room is large and conveniently arranged, as it is

necessary to carry a large stock of supplies, due to the distance from the factories.

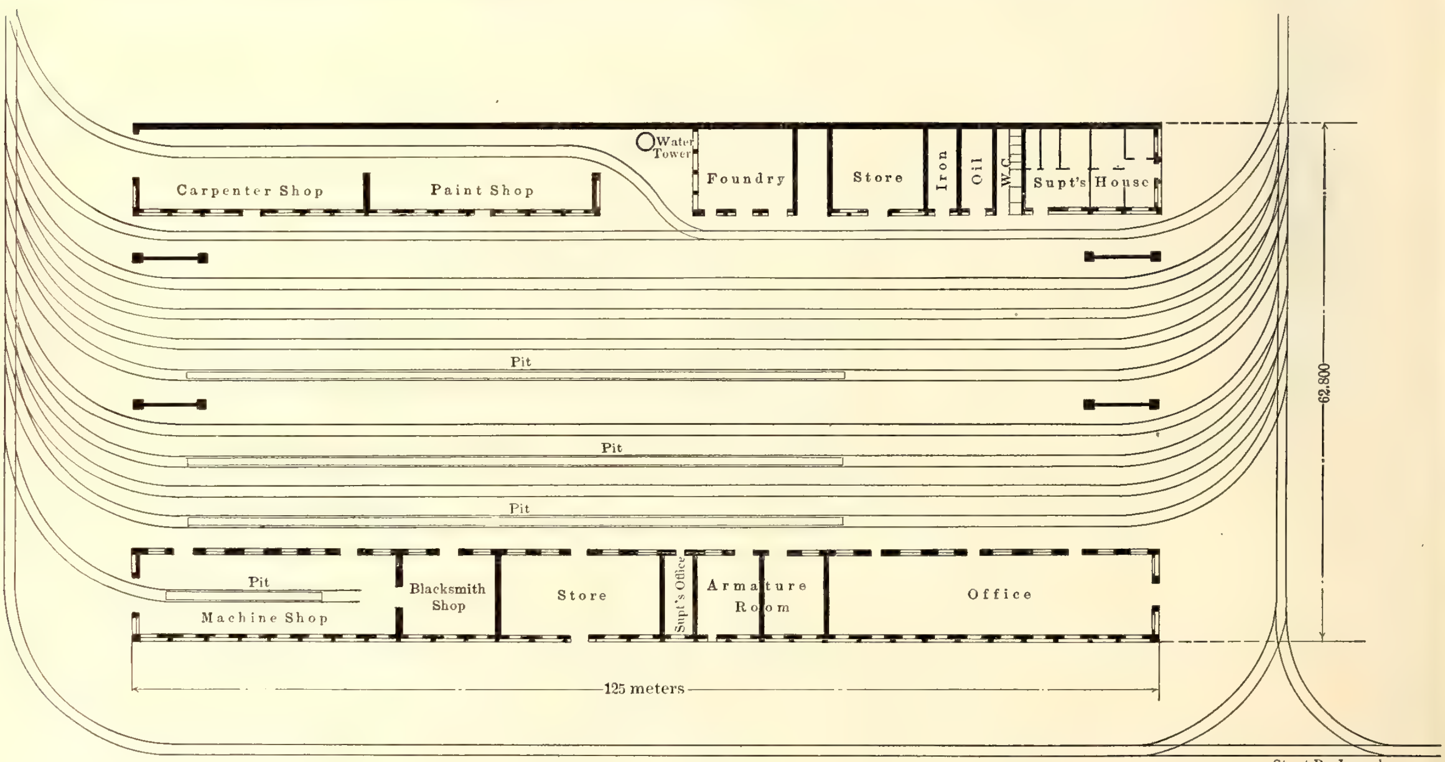
In all of the shops the machines are driven by individual motors, and it will be noticed that there is not a single piece of shafting in the entire building. It is also proposed to install a Murphy car-wheel grinding machine in the car house, and this machine has already been ordered.

The car house superintendent's office contains the transformers and switchboards controlling the light and power circuits of the building. A small pump is also installed here for pumping out water which may accumulate in the pits, as there are no public drains and there is no other way of accomplishing this. A large room is provided for the motormen and conductors, and the office provides ample space for the manager, electrical and civil engineers, traffic manager, accountant, cashier, etc. Adjoining the car house is a house for the car house superintendent.

EIGHT-BENCH OPEN CAR USED IN LIMA

THE LIMA CAR HOUSE, WITH GATES BETWEEN THE TRACKS

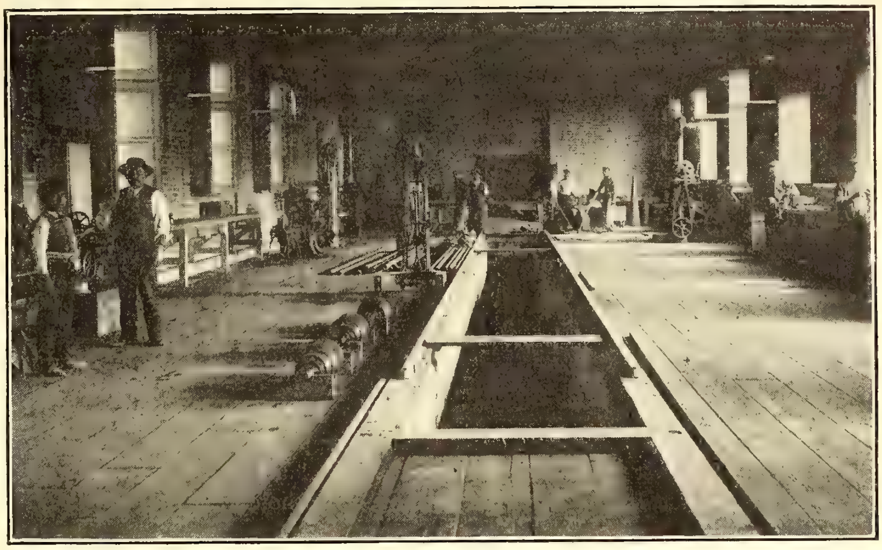
The cars are of the eight-bench open type, fully described in the STREET RAILWAY JOURNAL of April 7, 1906. As the government requires the use of air brakes, it was found necessary to place the compressor under one end of the seats and the tank under the other. The brake cylinder is also placed under one end of the car. The trucks are of the solid steel Columbian type, 6 ft. 6 ins. wheel base. G. E. No. 54 double motor equipments are used on all these cars.



PLAN OF CAR HOUSE, SHOP AND OFFICE BUILDINGS

At present there are forty-eight-bench cars, and in addition two sprinklers, two meat cars and a work car with derrick. The G. E. No. 80 double motor equipment is used on the latter cars. Twenty additional eight-bench open cars have already been ordered and will be required as soon as received.

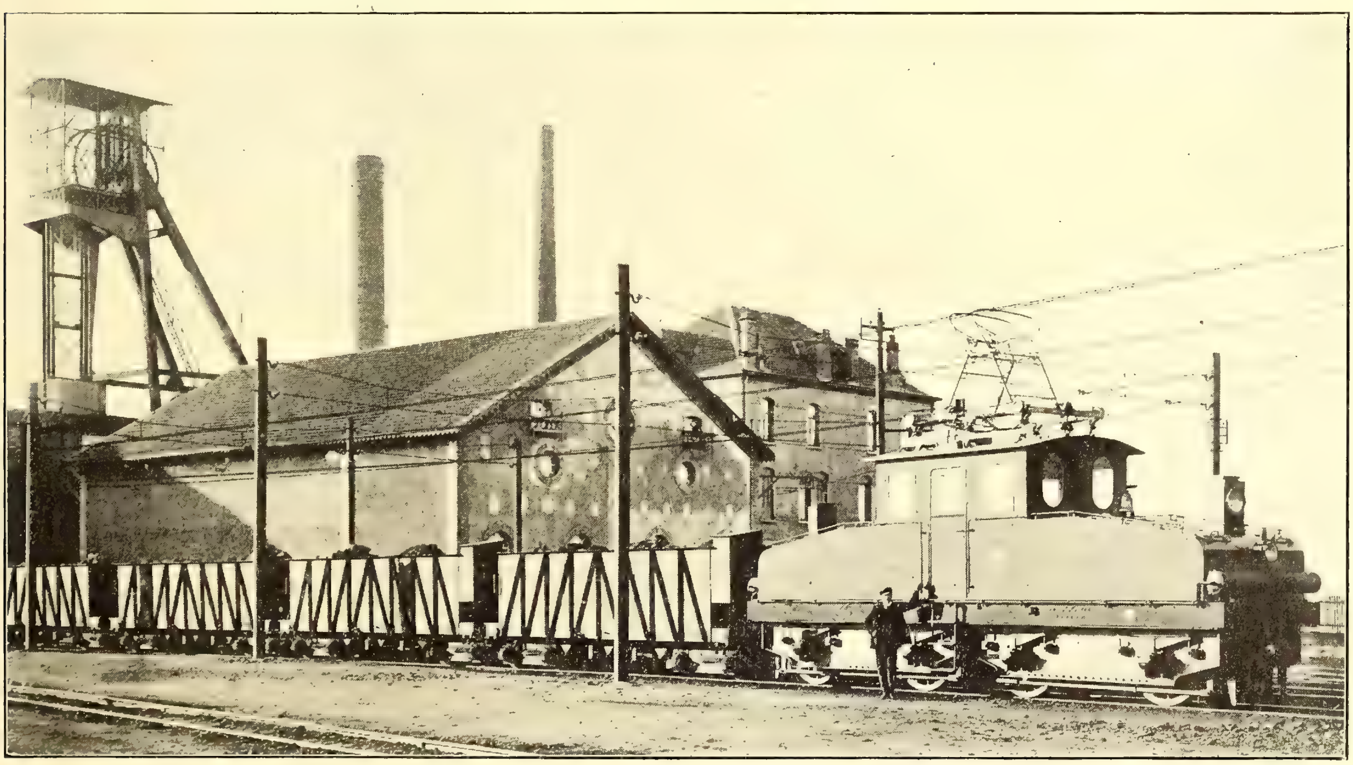
The tramway system was designed by the well-known American engineer, A. W. McLimont, who has also directed the installation. The entire electrical equipment was supplied by the General Electric Company; the open cars by the Stephenson works of the J. G. Brill Company, of Philadelphia; the trucks and special cars by the McGuire-Cummings Company, of Chicago, and the poles, brackets, etc., by the Elmer P. Morris Company, of New York. All of the orders were placed through the firm of W. R. Grace & Company, of New York.



INTERIOR OF THE REPAIR SHOP OF THE LIMA TRAMWAY SYSTEM, SHOWING THE PIT AND GENERAL REPAIR EQUIPMENT

2000-VOLT TROLLEY IN THE MOSELLE DISTRICT

The attention which is being given by electrical engineers in this country to high-voltage direct-current work will give additional interest to a recent installation made by the Siemens-Schuckert Company, of Berlin, at Maizières in the Mozelle district in France, and put in operation late last year. The line is equipped with three electric locomotives, which are used for hauling coal and freight cars. Each locomotive is furnished with four 160-hp Siemens-Schuckert motors and 2000 volts are used on the trolley wire.



ELECTRIC LOCOMOTIVE WITH DOUBLE-JOINTED BOW-TYPE CURRENT COLLECTOR USED FOR HAULING COAL AND FREIGHT CARS IN THE MOSELLE DISTRICT, FRANCE

Especial interest attaches to the method of current collection, as the pantograph trolley has been abandoned in favor of a double-jointed current collector very similar to that used on the same company's Murnau-Oberammergau Electric Railway, described in the Street Railway Journal for April 1, 1905. The accompanying illustration gives a view of this collector. As will be seen, it consists of an insulated structure carried on the cab, supporting a collapsible frame on which are hinged the two light bow collectors characteristic of the Siemens overhead construction. The line is 14 km, or 9 miles, in length and has a gage of 1 meter.

The Toledo Railways & Light Company is having a car built for the Toledo, Ottawa Beach & Northern for the purpose of advertising the attractions of Toledo Beach.

REVERSING THE POLARITY OF ARC HEAD LIGHTS

BY E. C. PARHAM

In ordinary street arc lamps the top and bottom carbons are of the same diameter and the lamp is so connected that the top carbon is positive, the bottom carbon being negative; under this condition the top or feeding carbon is consumed faster than the bottom one, and the crater, or heated concave light-giving surface, will be formed on the top carbon. On such lamps, if the direction of current flow through the lamp be reversed either by reversing the connections of the lamp or by reversal of polarity of the station dynamo, the bottom carbon will burn faster than the top one and formation of the crater on the bottom carbon will throw most of the light upward, where it will be useless. In the first case, only the lamp with reversed connections will be affected, but reversal of the polarity of the station dynamo will affect all lamps on its circuit. As the lower carbon, due to its longer life under normal operating conditions, is made much shorter than the upper carbon, possibly the first positive indication that the lamp is burning "upside down" is that the lower carbon-holder is badly burned as the result of acting as a carbon.

The writer had occasion recently to notice a considerable number of electric car arc headlights turned in for burned carbon-holders and suspected that the condition might be due to some of the headlights being connected to the car wiring in the wrong polarity relation. This suggested the desirability of a test to determine the relative merits and demerits of an upper and lower positive carbon in headlights, in which ordinary street conditions are somewhat modified by the use of reflectors. The test was as follows:

Two arc headlights, newly trimmed and each in series with its own rheostat, were connected in parallel across the 500-volt railway circuit and permitted to burn steadily for three hours. On one of the lamps the top carbon was made positive and on the other the bottom carbon was made positive. At the end of the three-hour test it was easy to see that one lamp tended to throw the light upward and the other downward; but as both lamps had bright reflectors there was no noticeable difference in the amounts of light projected ahead in the direction desired. Furthermore, measurement with the gage showed that on the lamp on which the lower carbon had been made positive the consumption of the carbon was practically the same as that on the lamp on which the lower carbon had been made negative, although the positive upper carbon showed more consumption than the negative upper carbon. On these lamps the lower carbon is of greater diameter than the upper, and this device seems to have accomplished its purpose of keeping the arc at an efficient average elevation, in regard to the center of the reflector, for the maximum length of time without retrimming.

This test and subsequent observation on a car seem to indicate that the matter of polarity of the arc is of little importance so long as the reflector is in a condition to reflect. Of course, a positive connection to the lower carbon will cause it to consume faster than if the connection were negative, but not enough faster to modify materially the frequency of trimming, provided this frequency has been adequate in the first place. One of the advantages claimed for the parabolic reflector is that the light will be properly projected forward even when the arc may have moved to a point higher or lower than the axis through the center of the reflector. Whether this is theoretically so or not it seems to be practically so as long as the reflector is in a reflecting condition. With the treatment ordinarily accorded arc headlight reflectors, the parabolic reflector rapidly becomes a parabolic absorber, and we are not familiar with the theory of this device. We do know, however, that when the reflector becomes poor it does not fulfil its mission, and the commonness of this condition raises the question as to whether it would not be a good thing for a company operating hundreds of headlights to make home provision for renewing the reflecting surfaces. Actually some reflectors get so bad that a coat of white paint helps them considerably. The reflector is not the only abused and neglected part of an arc headlight. In a later article the writer proposes to show how this valuable part of a car equipment may rapidly become worth its weight in "scrap."

SHELTERS AT OKLAHOMA CITY

At several points on suburban lines the Oklahoma City Railway has erected shelters of the type shown in the illustration.

PASSENGER SHELTER BUILT IN OKLAHOMA

These are comparatively inexpensive structures, yet they answer the purpose of a shelter very well and tend to encourage traffic. They are usually built with two slat seats in the center.

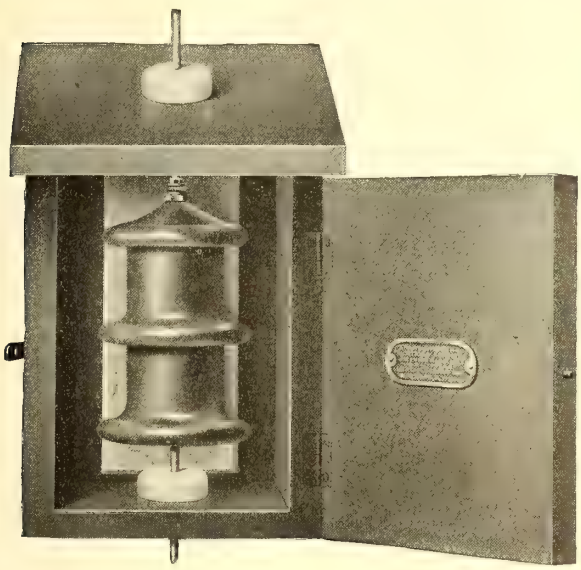
PRELIMINARY INSPECTION OF THE PITTSBURG & BUTLER LINE

The formal opening of the new single-phase line of the Pittsburg & Butler Street Railway Company took place May 1. A party of officials made an inspection of the line from Butler to Pittsburg April 24. On board the car when it left Butler for the Sixth Street and Liberty Avenue terminus in Pittsburg were: George Heard, president of the Pittsburg & Butler Company; William H. Pape, general manager, and C. L. Wilcoxon, superintendent. The car proceeded rather leisurely to Etna, stopping at intervals to permit inspection of the work done on the road. Etna was reached at 10 o'clock, and a short lay-over was taken while P. E. Jones, assistant to the superintendent of the Pittsburg Railways Company's lines; W. F. Fowler, of the Westinghouse Company, and other officials of the companies were gathering, and then the trip to Pittsburg was resumed, the car being manned by an Etna line crew. Frequent stops were made to study the road, so that it was nearly noon when the car reached Pittsburg. The officials say that they expect to be able to cover the distance from Butler to Pittsburg in time that will rival the schedules of the railroad trains.

NON-ARCING LIGHTNING ARRESTER

The manufacturer of the Shaw lightning arrester, the Lord Electric Company, of New York and Boston, in that device has made use of conducting or semi-conducting parts interposed by a series of spark gaps of higher electrical resistivity to offer a path from line to earth of large capacity and relatively low static resistance. The company's patents cover the basic principles of a series of partially conducting discs or rings separated by laminar insulating material in such manner as to give the easiest path for a discharge of a static character and present an impenetrable barrier to the dynamic line current of normal voltage.

The portions of the arrester serving as static low resistance conductors consist of rings resembling carbon,



MODEL A IN WOODEN CASE

which are treated so as to make them conductors in a class by themselves and yet different from what is commonly known as "non-arcing" material. Each ring maintains an equal spacing between its periphery and that of the next succeeding ring in the series. The rings are separated from each other by mica washers, whose superiority over air or other forms of spark gaps lies in its ability to carry static current by reason of electrolytic capacity, large surface area, non-absorptive nature, and its high insulating qualities, which prevent the passage of a dynamic current.

The combination of non-arcing rings and mica discs are mounted on porcelain arbors having strong dielectric properties. The arbors are inserted into the bore of the rings and discs, leaving the peripheries exposed for the easy transmission of static discharges over large surfaces. The arresters are mounted in porcelain in porcelain housings. For voltages of 1000 and under, the porcelain housings are mounted on a supporting base of wood, while arresters intended for higher voltages are mounted on marble bases.

The arresters are constructed so as to be watertight and dustproof, so that no deterioration ensues. For protection from accident or from malicious persons the instruments are furnished with wooden cases. The arresters are designed for voltages as high as 66,000.

NEW CARS FOR THE CAMDEN INTERSTATE COMPANY

The Camden Interstate Railway Company, which operates from Guyandotte, W. Va., to Ironton, Ohio, and is building additional lines in Huntington, Central City and Guyandotte, received last month from the G. C. Kuhlman Car Company five 28-ft., grooveless post, semi-convertible cars built under Brill patents. The cars operated on the

EXTERIOR OF CAMDEN PASSENGER CAR

Ironton division are, like those delivered by the Kuhlman Company, of the semi-convertible type, and were built at the plant of the J. G. Brill Company. The standard interurban cars are 47 ft. 6 in. long, with a seating capacity of fifty-two. The five new semi-convertible cars are of stand-

EXTERIOR OF CAMDEN FREIGHT CAR

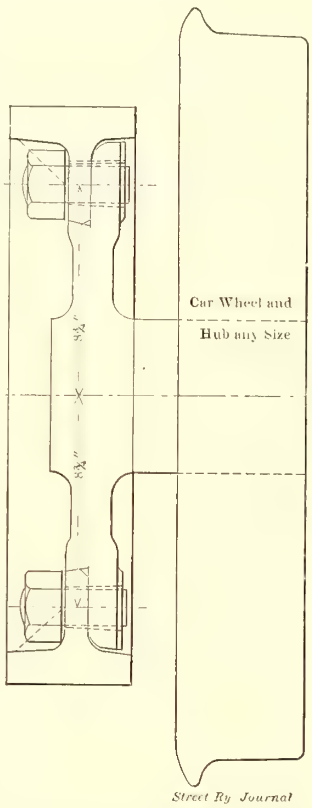
ard length for this type, 28 ft. over the end panels. The trucks are the No. 27-G1 with 4-ft. 6-in. wheel base. The chief dimensions are: Width over sills, including sheathing, 8 ft. 1½ ins.; height from track to under side of sills, 2 ft. 9½ ins.; side sills, 4 ins. x 7¾ ins.; end sills, 5¼ ins. x

INTERIOR OF CAMDEN FREIGHT CAR

6⅞ ins. The interiors, which provide seating room for forty passengers, are of cherry; ceilings of poplar. Another addition to the company's rolling stock is a baggage car for use on high-speed lines; it measures 45 ft. over the ends and is 8 ft. 6 ins. wide over the sheathing; the trucks are the No. 27-E1½ type, with wheel base of 6 ft. and 33-in. wheels.

A MODIFIED SECTIONAL GEAR WHEEL WITH INTERCHANGEABLE RIMS

A number of changes are announced by James F. Fogarty, of New York, as having been made in his sectional gear wheels with interchangeable rims. In the type of wheel brought out by Mr. Fogarty several years ago the hub or permanent part of the gear wheel formed an extension of the hub of the car wheel of any size. In this way the detachable gear could be placed on this extension and removed when worn out without disturbing the car wheel, and it is this process that Mr. Fogarty has succeeded in further simplifying by casting the car wheel and the permanent hub of the gear wheel as one. This removes the necessity of pressing on both the wheel and the hub separately. In addition, it was found to be expensive to mill out the tool casting, because of the rapid using up of the tools, and so a female V has been put in the cast iron at an angle of about 15 deg., which makes it easier to prepare the hub and lessens the cost. In addition to this, Mr. Fogarty has adopted the practice of having the gear on the inside of the hub, as shown in the accompanying illustration. This adds still further to the ease of handling the rims, especially where solid wheels are used, and tends toward reducing the time required for replacing the rims, which is about an hour. As in previous practice, Mr. Fogarty still adheres to the use of four 1⅜-in. drop-forged bolts passing through round holes with some draw for attaching the rim to the hub, but for exceedingly heavy work six bolts can be used. This method insures a perfect fitting rim, as the bolts, drawn tight, force the rim into the V of the cast iron.



SECTIONAL GEAR WHEEL

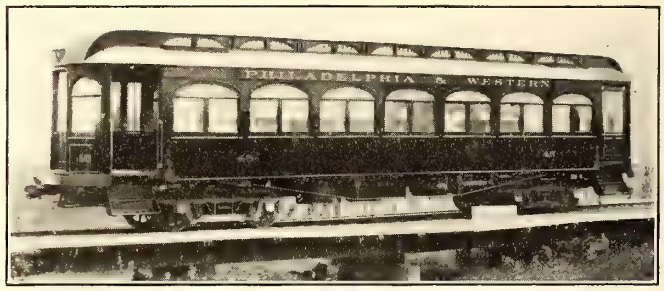
MECHANICAL AND SPLICING EARS

S. Dixon & Son, Ltd., of Leeds, England, have just placed on the market a new mechanical ear for suspending overhead trolley wire. The metal of which the clamps are made is specially hard rolled and has a breaking strain of over 29 tons per sq. in., as against the 19 tons per sq. in. of ordinary cast gun-metal ears made from the British Admiralty mixture. An important feature of this ear is its interchangeability. Every part is made to standard gage and each can be renewed separately at any time, thus obviating the necessity of scrapping the entire ear. The easy and effective way in which a straight line ear can be made into an anchor or a feeder ear are well worth considering. These ears are made in five distinct types, the clip style varying for grooved, round, Fig. 8 and bow trolley wires, and the sweated type for round wire only. The extra attachments are for anchor and feeder ears.

The company also makes an automatic splicing ear which, when desired, can be supplied in the form of an emergency splicing sleeve. The arrangement is such that when the broken ends of trolley wire are inserted in the ends of the sleeve and pushed home the wire is automatically gripped by steel cone grippers and kept in position. As repairs can be instantly executed with this ear, every emergency wagon should have two or more in its equipment.

CARS FOR THE PHILADELPHIA & WESTERN RAILWAY

The Philadelphia & Western Railway Company, now building out of Philadelphia, has received its equipment of cars from the St. Louis Car Company. These cars are of a very neat design and have quite a few new features. The interior finish is mahogany with marquetry inlay designs.


EXTERIOR OF PHILADELPHIA & WESTERN CAR

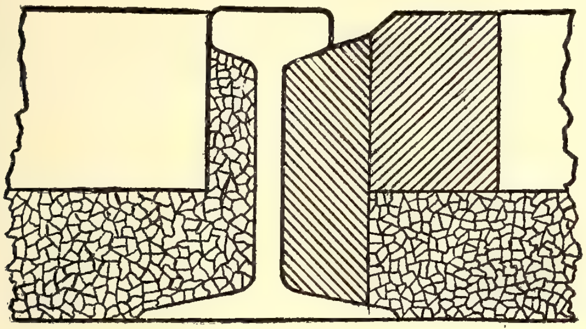
In the interior incandescent lamps are used, and for the exterior, arc lights. The side windows are double, and the lower sash glazed with plate-glass, upper of Gothic and the deck sash glazed with opalescent glass in metal frames. The main and smoking compartments have the St. Louis Company's reversible seats, with high back and head roll, upholstered with green leather. The cars are arranged to be operated in trains, and have automatic couplers, spring buffers and automatic air brakes. The vestibules are arranged with sliding doors on each side, equipped with electro pneumatic operating device, and also have a door in the end to allow passage from car to car. The general dimensions of each car are as follows: Length of car over bumpers, 51 ft. 4 ins.; length of car over corner post, 40 ft.; length of platform, 5 ft.; width of car over sheathing, 9 ft. 3 ins. These cars are mounted on the St. Louis Company's No. 61 truck.


INTERIOR OF PHILADELPHIA & WESTERN CAR

SPECIAL BLOCKS FOR PAVING AGAINST RAILS

Much of the opposition to the use of T-rail in cities is based on the assertion that no suitable paving blocks exist that will permanently retain the groove desired by wagon traffic. Nevertheless, more or less successful results have been obtained with bricks designed to secure such grooves, but the main fault of single-block types is that any settlement in the tracks will loosen and break them or make the free ends of the bricks kick up; the vibration of the rails will often cause the same trouble.

To avoid these difficulties, the Nelsonville Brick Company, of Nelsonville, Ohio, supplies the desired groove by



using two distinct blocks, one called a "filler" and the other a "stretcher." The "filler" brick fill the entire web of the rail and thus avoid the use of any other kind of filler. They are made in 9-in. lengths and are easily handled. The "stretcher" brick, to be used in connection with the "filler" brick complete the proper groove for the car wheel flanges and make a good substitute for grooved rails. The "stretcher" brick are 9 ins. long and are laid parallel with the rail, only one being required to take the place of about three nose bricks.

This method is in use in Dayton, Delaware and Bellefontaine, Ohio; Battle Creek and Kalamazoo, Mich.; South Bend, Ind., and other cities.

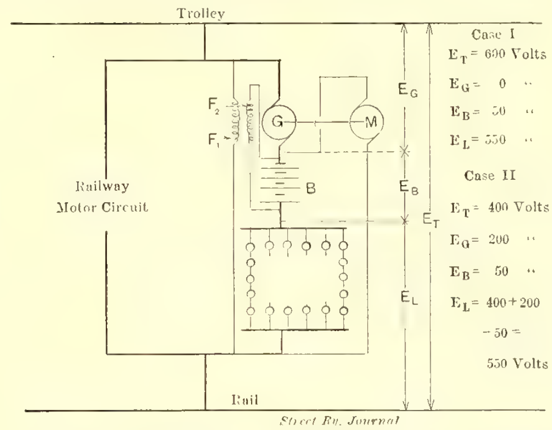
POCKET TEST LAMP

The Chase-Shawmut Company, of Newburyport, Mass., has recently put on the market a pocket test lamp. It is designed especially to overcome the difficulty and annoyance connected with determining whether enclosed fuses have blown out, but is useful in all cases where it is desirable to determine whether or not a circuit is alive. It is made up of a specially designed incandescent lamp enclosed in a fiber casing. The casing has ferrules and knurled binding posts on either end, while at the middle a fair-sized hole through both walls of the casing allows the illumination of the lamp to be plainly seen. For the majority of switches and fuses the metal ends of the test lamp will bridge parts of opposite polarity, but for work where the distance is greater than the length of the test lamp the binding posts afford a convenient means of clamping leads of sufficient length. The device is not designed for continuous service, and should be used only for flashing, as the small, enclosed casing will soon become too hot if left long in circuit.

The test lamp is made in two sizes: one for 110-volt, measuring 3⅞ ins. over all, with a diameter of 11-16 in.; the other for 220-volt, measuring 4¾ ins. over all, with a diameter of 1 1-16 ins.

INTERURBAN CAR LIGHTING SYSTEM

The accompanying diagram shows an ingenious system for maintaining a constant voltage on the lighting circuit on an interurban car, patented last month by Thomas Marshall, of Chicago. As shown, a small generator *G*, driven at a constant speed by a small motor, is placed in series with the lights across the trolley circuit. There are also inserted in this circuit a number of cells *B*, known as electromotive-force cells, which will maintain a constant counter voltage when any current passes through the circuit, but



WIRING AND SPECIAL GENERATOR TO MAINTAIN CONSTANT LAMP VOLTAGE

as they have no active material they absorb practically no current and have practically no capacity. The generator has two windings, F_1 and F_2, one connected directly across the trolley circuit, the other across the counter-electromotive-force cells. As these cells maintain a constant voltage across the terminals, the field due to F_2 is constant. These two fields, F_1 and F_2, are wound to oppose each other, and are so proportioned that when the trolley voltage is at a maximum the fields due to these windings are equal. As they oppose each other there is no resulting field at this time, and, therefore, no voltage will be generated by *G*. This is the condition when the trolley voltage is at its maximum, or say 600 volts, and is represented in Case I.

Suppose, however, the trolley voltage falls to 400 volts. Field F_1 is then overpowered by F_2, and the generator supplies current, and as the strength of the generator field is proportional to the drop in the trolley voltage, the voltage at the generator terminals will be proportional to this drop. This condition is represented in Case II., where the trolley voltage is assumed to be 400 and the battery voltage 50, as in Case I. The result is the maintenance of a constant voltage of 550 on the lamp circuit.

It is claimed that the system can be applied very readily to cars wired at present, the only difference being the motor-generator set and the cells. The latter require no attention except the addition of water to replace that lost by evaporation. If through any accident the motor-generator set should break down, the lights would still be available, as the current would pass through the generator armature.

The Grand Rapids Railway, of Grand Rapids, Mich., recently carried the following advertisement in the local papers: "To Fathers and Mothers: The season is now here when boys and girls begin playing in the streets. To avoid possible accidents to your children, we respectfully urge you to call their attention to the dangers and to give them strict instructions particularly to look out for the street cars. The motormen are on the alert, but the children cannot be too careful."

SINGLE PHASE VS. DIRECT CURRENT FOR HEAVY ELECTRIC TRACTION

The discussion on single-phase vs. direct-current traction, based upon the institute paper of Messrs. Stillwell and Putnam, is being carried on as vigorously abroad as in this country. The opening gun for the d. c. advocates was fired by H. M. Hobart, the well-known engineer and author, who contributed the following letter to the "London Times" Engineering Supplement of April 10:

"In Messrs. Stillwell and Putnam's recent American Institute paper 'On the Substitution of the Electric Motor for the Steam Locomotive," the standpoint is taken that the single-phase system is the only system worthy of consideration for railway electrification. 'Where, ten years from to-day,' they ask, 'will be the 1200-volt or the 1500-volt continuous current systems which have been suggested as substitutes for high potential alternating-current systems in heavy electric traction?' In my opinion, these gentlemen have allowed the desire, shared by all engineers, to secure the best system for long distance work, to supplant sufficient study of adverse details in the single-phase system. My opinion is that within ten years, continuous current systems, as applied to railway electrification, will employ line pressures more of the nature of 2000 or 3000 volts, and these systems will, in all probability, have come into extended use. The single-phase delusion will meanwhile have been exposed (at the expense of the capitalist), and the system discredited.

"Railway electrification on an extensive scale will, however, have been retarded for years—first, in consequence of the waiting policy which is being maintained pending the completion of the single-phase experiments; secondly, in consequence of the prejudice against electric operation of railways which will inevitably follow as a consequence of the analysis of the results obtained with single-phase plant.

"It is highly desirable that railway people should realize that a large number of electrical engineers dissociate themselves from the claims put forward by the single-phase school. This is important for the reason that there is a wide range of railway work where electric operation is of demonstrable advantage if undertaken on sound lines. For long distance non-stop runs, however, it will for some time be difficult or impossible for trains depending for their power on electric energy supplied over long distances, to compete with trains hauled, as at present, by steam locomotives. It is only for such cases, however, that single-phase systems can possibly hold their own in comparison with high-tension continuous current systems. It is very unfortunate that electrical engineers should be handicapped in their endeavor to enter the legitimate field offered by urban, suburban and interurban sections of railways (where the traffic is intense and consists in operating trains at short headway, and with frequent stops, at relatively high schedule speeds), for the sake of the vague possibility of some time entering with this single-phase incubus on a field of railway work where the steam locomotive is, by right of merit, most strongly established.,

"For such 'legitimate' work, high acceleration is all important This is readily obtained by the continuous-current motor; it is impossible with the single-phase motor, a mere apology for a motor at the best, which is seen at its very worst when starting and during acceleration. Another important feature for such a service is low weight of train, as almost all the energy delivered from the motor is devoted to imparting momentum to the train during acceleration, and is immediately thereafter converted into heat at the brake shoes (although a considerable proportion of it could well be restored to the line by one or other of the now well-developed systems of regenerative control).

"Now, the electrical equipment, for a given schedule speed, will be twice as heavy per ton of train when single-phase apparatus is employed, as with continuous-current apparatus. The tracks must consequently be stronger and heavier. Thus for a schedule speed of some 25 m. p. h., with one stop per mile, a train to seat 300 passengers will weigh some 250 tons, when equipped for single-phase operation, as against about half this weight when equipped for continuous-current operation. The energy consumption for this schedule speed will also be fully twice as great. The brake equipment must be more expensive and its maintenance much greater. The wear of rails and permanent way is inevitably greater.

"It must be remembered that it is not sufficient to show by electric operation only a very slightly higher acceleration and schedule speed than is attained by steam, but there must be shown a very appreciable gain. The rate of acceleration of a heavy single-phase train, quite aside from the limitations imposed by the disabilities of the motors, cannot approach that readily provided by the light train of equal seating capacity equipped with continuous-current motors.

"Of course, there is always the possibility that a light, efficient and satisfactory single-phase motor may in the future put in its appearance. Indeed, a main contention put forward by Messrs. Stillwell and Putnam, in the paper above referred to, sets forth that a frequency of 15 cycles per second should be substituted for the 25 cycles, towards which standardization has been tending. It was stated that 15-cycle motors would materially surpass 25-cycle motors in the matters of higher efficiency, lower weight, better commutation and less cost. This is true. It is, however, also true that these advantages are in great part offset by the increased weight and cost of the transformers, and by the lower tractive force at starting, and it must appear that this low periodicity does not remove the disabilities of the single-phase motor with respect to acceleration and schedule speed.

"When, however, the legitimate field for single-phase railway electrification is opened up—namely, the operation of trains over long non-stop runs at high speeds—it will be highly desirable to employ low frequencies, probably considerably lower frequencies than the 15 cycles now suggested. Much could be said in favor of a frequency of 5 or 10 cycles per second, and amongst the possibilities which at once suggested themselves long ago is that of a good single-phase induction motor without a commutator.

"It must also be kept in mind that the three-phase system can by no means be ignored as a determinant in the situation; in fact, for long distance, non-stop runs, it has points of superiority over any other system of electric traction as yet put forward. But, at present, it is with the object of obtaining better speed and shorter headway with frequent stops, and the more intense utilization of termini, that resort will be made to electrical methods, and for this work the continuous-current system is distinctly superior."

As two main line railways in England—the Midland Railway and the London, Brighton & South Coast—are introducing single-phase traction, this communication attracted wide attention and resulted in the following letters among others to the editor of the "London Times." These letters are slightly abstracted:

Midland Railway, Derby, April 15.

Sir:—The attitude adopted and the statements made by Mr. Hobart in depreciation of single-phase traction are so exaggerated that they appear likely rather to damage than to assist the cause of direct-current traction, of which apparently he is so strong a partisan. Further, most of the points brought up are rather academic than practical.

Mr. Hobart's contention that a single-phase train seating 300 passengers and operating on the schedule he mentions of 25 m. p. h., with one stop per mile, will weigh 250 tons, is absurd on the face of it, and still more absurd is his claim that such a train will weigh twice as much when equipped with single-phase apparatus as when equipped for continuous-current operation.

A five-car train, composed of three motor cars and two trailers of the Midland Railway Company's stock now built for the Heysham-Morecambe electrification, will seat 324 passengers, and actually weighs 156 tons, inclusive of seated passengers.

The weight is made up as follows:

	Tons	Cwt.	Qr.
Coach bodies and underframes	53	0	0
Seven trailing bogies	31	10	0
Three motor bogies	16	10	0
Electrical equipment	33	0	0
Passengers	22	0	0
	156	0	0

This would allow 20 seconds' stop at every station and give the scheduled continuous overall speed, inclusive of stops, of 25 m. p. h. throughout. The energy consumption (so far as it can be ascertained in limited time) would be about 129 watt-hours per ton mile.

Single-phase motor efficiency may be, and is, lower than direct-current motor efficiency, but it does not follow, as Mr. Hobart implies, that the consequent greater heating must necessarily be taken care of by making the motors twice as large and, still less, twice as heavy. Granting this, however, for the moment, in the above train a direct-current equipment would save 16½ tons, a percentage of 8⅓.

In granting that single-phase apparatus can make the best showing for long-distance work, Mr. Hobart supplies his own answer to his query as to why railway engineers are devoting particular attention to single-phase working. No railway engineer is going to lay down for his terminal and urban lines a system of traction which he may either have to scrap in coming years or which may restrict him to making choice of the second best system for his long-distance work, which latter, when it does come, will be by far the more important. Mr. Hobart, in pointing out the probability of the development of a thoroughly good single-phase motor, recognizes the law of supply and demand, but most of his statements certainly do not appear to have been made with this law in mind.

As for acceleration, this is a mere question of getting the power into the motor. There is no difficulty in this direction with a single-phase motor, and the acceleration with it can be secured quite as well as with direct-current, and much more efficiently, since rheostatic losses are avoided. Presumably, Mr. Hobart has in mind the reactance of the single-phase motor, but this merely amounts to the latter holding back the power till it is ready to take it, while the d. c. motor loses it. The avoidance of rheostatic losses gives the single-phase motor a very considerable advantage for the particular work which Mr. Hobart outlines. As regards regenerative control, neither single-phase nor d. c. motors can yet claim this advantage, badly though it be wanted, but there is at least as much prospect of success with the former as with the latter.

Even against 2000 or 3000 volts direct-current working, which is not here yet, and which, taking everything into account, it is questionable whether we shall be happy with when it comes, if ever, there is very much to be said for single-phase working, even on such lines as those which Mr. Hobart has in mind. The elimination of rotary converters and their supervision and of all moving machinery requiring attention from the power station to the car is of the highest importance, and, with the much higher trolley voltages possible with single-phase traction, feeders are very much less costly.

It is also of importance that the actual high-tension apparatus in a single-phase car is reduced to a minimum, and, being so, can be very easily dealt with as regards protection. With high-tension direct current, on the other hand, there will be a large amount of power wiring at high tension, even granting that the train bus—which would be the most objectionable of such cables —disappears with the third rail and its dead sections, while motor generators, if not secondary batteries, will have to be provided for the lighting, heating and controlling power.

J. DALZIEL.

SIR:—Most of the electrical engineers have a far too optimistic opinion of single-phase traction. Naturally the a. c. system is the ideal system for power distribution, and possesses two features which at once recommend themselves—namely, the elimination of the troublesome rotary converter and the economy in copper, owing to the higher voltage which can be employed. The chief advantage gained by these features is a large saving in the initial cost of equipment. On the other hand, the a. c. car equipment costs more than a corresponding d. c. equipment for a similar service and for the same temperature rise in the motors. The a. c. car equipment is also considerably heavier than the d. c. equipment, owing to the a. c. motors and the transformer. The increased cost of car equipment practically counterbalances the initial saving of the rotary converters, and, owing to the lower efficiency of the a. c. motor, the saving in power resulting from the elimination of rotaries is about offset. The efficiency of a. c. control during accelerating is greater than that of d. c. series parallel control, as voltage control is available owing to the transformer on the car. The a. c. motor does not accelerate as rapidly as the d. c. motor, and consequently the a. c. motor cannot be used where rapid acceleration and frequent stops are essential. The much-abused third rail is very often preferable to an overhead trolley on account of being easy to maintain. As regards the running costs of the two systems, there should be little difference between the two. The maintenance of an a. c. motor equipment costs more than that of a similar d. c. equipment, owing to the higher armature speed and smaller air gap. This, again, balances the cost of maintaining rotary converters. Turning next to heavy locomotive equipments for high-speed passenger and freight service one finds that, owing to the limitations imposed by available motor space, two locomotives each with four a. c. motors are required to do the work which could be performed by one locomotive with four d. c. motors. The following figures may prove of interest. They are taken from the technical papers, and represent the most recent practice in electric locomotives:

	D. C. Locomotive, N.Y. Central	A. C. Locomotive, N. Y., N.H.&H.
Weight	95 tons	85 tons
Length over all	37 ft.	36 ft. 4 ins.
Number of motors	4	4
Horse-power of each motor	550	200
Normal rated horse-power of locomotive	2,200	800
Maximum horse-power of locomotive	3,000	1,000
Speed in miles per hour with 500-ton train	60	......
Speed in miles per hour with 250-ton train	70	60

The above figures clearly show the advantage of d. c. motors for heavy locomotives. Single-phase a. c. traction is still young, and a good many improvements, especially in motor design, are likely to take place. As main line traction in England is out of the question for a great many years yet, electrical engineers must be content if railway companies electrify their suburban lines. These lines require high acceleration and frequent stops, and the use of single-phase motors would be inviting disastrous results. In my opinion, a. c. traction is eminently suitable for small cross-country lines where local traffic is dealt with, or for high-speed interurban tramways such as are largely used in America. In the meantime, I share Mr. Hobart's opinion that high-tension d. c. motors will be the only solution to the traction problem.

"ENGINEER."

MANCHESTER, April 15.

SIR:—Mr. Hobart's article on single-phase versus continuous-current railway electrification in the "Times" Engineering Supplement of April 10, is not a comparison of systems, as its title would imply, but a comparison of motors. The most enthusiastic advocates of the single-phase system have never claimed that the motor was as light in weight or as low in first cost as the present 600-volt continuous-current motor, but rather that the great advantages of the single-phase system as a whole rendered it peculiarly suitable for general application in the electrification of railways. His statements even in regard to the motors are not in accordance with ascertained facts. For instance, he asserts that high acceleration with the single-phase motor is impossible. The maximum torque at starting, on which the rate of acceleration depends, is limited both in the continuous-current motor and the single-phase compensated series motor only by the current which can safely be commutated, and since the commutation of the single-phase motor is fully as good as that of the best continuous-current motor, whilst it has no tendency to "flash" from brush to brush, it is obvious that the single-phase motor is at no disadvantage in this respect. Assuming that continuous-current motors will be built and operated successfully at the higher voltage prophesied by Mr. Hobart, they will necessarily be more expensive than the present 600-volt continuous-current motor, and certainly more sensitive to "flashing." The railway motor, which operates under more severe conditions than any other piece of electrical apparatus, is emphatically not the place for high voltage. Again, with a high-voltage continuous-current system, the generating or sub-station plant, which feeds the trolley, must be wound for high voltage, and the cost of such plant will certainly be higher than that for the present 600-volt continuous-current system.

Mr. Hobart states that, under given conditions, a train equipped on the single-phase system will weigh twice as much as when equipped with continuous-current apparatus—250 tons in the former and about 125 in the latter. It would be interesting to have some details of these weights. In the meantime I give below a few particulars of two standard car equipments of equal capacity (600 hp). Column I. is for single-phase apparatus of the compensated series motor type, and Column II. for apparatus of the 600-volt continuous-current type, both include multiple-control apparatus, and are complete equipments:

Weight of four motors complete	24,000	22,000
Weight of control apparatus and remainder of equipment	9,800	6,000
Total weight of electrical equipment for one motor car	33,800	28,000

From the above table it will be seen that the continuous-current is 5800 lbs., or 17 per cent, lighter than the corresponding

single-phase equipment. Much wider differences in weight than this occur in different types of railway rolling stock of equal passenger capacity, so that the total weight of a motor car equipped on the single-phase system might be even less than that of a car of equal capacity equipped with continuous-current apparatus. Certainly the slight excess in weight of the single-phase equipment would not necessitate any material increase in the structural dimensions or weight of the bogies and car framing, which are always liberally designed in English practice.

A. C. KELLY.

LONDON LETTER

(*From Our Regular Correspondent.*)

Two interesting pieces of work in connection with the London County Council Tramways are now under way and will both have an important bearing upon the Embankment Tramways. The first is the widening of the Blackfriars Bridge, which probably will take a couple of years. The other, which is more visible to the ordinary passer-by, is the linking up of the Embankment Tramways to the shallow subway which goes underneath Aldwych and connects with the northern system. As the tramways on the Embankment are on the river side of the Embankment, the lines will, naturally, have to cross the Embankment to be able to get into the subway, which is to have its exit on the west side of Waterloo Bridge. As may be remembered, when describing the work of the Embankment Tramways in the STREET RAILWAY JOURNAL of Nov. 3, 1906, reference was made to the fact that in making provision for the conduit it was found that the arches of the District Railway came quite near the surface of the Embankment and had to be cut to provide for the tramway conduit. In crossing the Embankment, therefore, special provision has had to be made and a large portion of the arches of the Underground Railway has been cut away entirely. These arches are now being replaced by a strong steel girder floor which will be at this portion the roof of the District Railway and will support the Embankment Tramways. Work has also been commenced at the end of Waterloo Bridge, and one of the staircases which led down from Wellington Street to the Embankment is now in course of demolition to make room for the exit of the tramway subway. It is estimated that eight months will elapse before the connection is completed. It was originally intended to have a station at the Strand, but it is now possible that the Council will consider this station unnecessary, as it is only a few hundred yards from the Strand to the station at the bottom of Aldwych, or to the Embankment. A station at the Strand would cost perhaps £20,000, and as the subway would have to be at some little depth below the street at this point to get down to the level of the Embankment, it is considered no great inconvenience will arise by not having a station there. There is little new to add to the tramway situation in other portions of London, although the electric railway from Holborn to Stamford Hill has now been opened, the line having been stopped for some considerable time to allow for the necessary alterations. It is also a matter of regret that the Council have been compelled, owing to the determined opposition of the boroughs, to withdraw that portion of their bill in Parliament relating to the construction of tramways along Tottenham Court Road, although the sum of over £226,000 has recently been spent on the widening of Hampstead Road chiefly on account of the proposed electrification of tramways from that road to the north. It is, therefore, reasonable to infer that no electric tramways will penetrate that portion of North London for some years to come.

As to the power bill of the London County Council, and the two other power bills which are proposed, nothing further can be said about them at present. It would not be a surprise to a good many if in the whole circumstances, and with the new Council, the matter fell to the ground for the present.

Another alarming accident has happened to a car in the metropolitan area, this time to one of the South Metropolitan Tramways Company at Croydon, where a car appears to have overturned in taking a somewhat sharp corner. In this particular case one lady has been killed and a number seriously injured, as the car was crowded both inside and outside. A similar accident has happened in a city in the North quite recently, so that it would appear that something has yet to be done in the way of brakes to make cars perfect, and, in fact, it is a question if the present cars are not a little topheavy when fully laden, especially when taking curves at a sharp speed.

The long-waited-for tramways of the popular watering-place of Torquay have at last put in their appearance. Last month they were formally inspected by the Board of Trade and recently the inauguration ceremony took place, since when the cars have been in daily service on such of the routes as are completed. The work on these tramways was commenced as long ago as October, 1905, but for one reason or another and certain engineering difficulties, their completion has been unduly delayed. The system is interesting, as it has been equipped on the Dolter surface contact type. It embraces about 10 miles, although many more are contemplated, as Torquay has many outlying suburbs and other interesting towns in the immediate vicinity. The portion opened to the public now is between the Strand and the Torre Railway Station.

Speaking at the annual meeting of the Metropolitan Electric Tramways, Mr. Garcke, the chairman, made a strong protest against the extremely low fares which are now in evidence all over the London area, not only as regards tramcars but on motor buses and the various electric railways and tubes. The company which he was representing had had a very satisfactory year, but at the same time Mr. Garcke pointed out that within twenty years the fares had been reduced by a halfpenny per passenger notwithstanding increased facilities, and he hoped that a traffic board would eventually be set up for the provinces as well as with London. What Mr. Garcke states is undoubtedly true, and the same complaint might be heard from the officials of practically all of the transportation companies of London. The London County Council is not making sufficient money out of its rapidly growing system, and some of the fares are undoubtedly too cheap. Sufficient money is not being realized to put away enough for reserve and for renewals and depreciation. The Central London Railway, the original "Twopenny Tube," is also suffering not only from the reduced fares in opposition, but because there is now getting to be in London almost too much transportation facility. The business of this most popular tube is gradually falling off. The various motor-bus companies are also suffering from the same causes, and the underground electric railway companies brought into existence by the late Mr. Yerkes are certainly not in a healthy condition. The whole of the District Railway has been electrified, the Baker Street & Waterloo Tube has been completed and put into operation, the new Brompton, Piccadilly & Great Northern Tube is also now in operation and there now remains only the Charing-Cross, Euston & Hampstead Tube to be completed. Anything but satisfactory reports are being had from the District Railway, where, although more people are traveling by it, less money is being made. The proceeds from the Bakerloo Tube are increasing, but half of the rolling stock which was purchased for this tube is idle. The same may be said for the Brompton & Piccadilly Tube, so that over-estimates have undoubtedly been made as to the number of people which would daily use these tubes. A more conservative estimate has been taken of the tube to be opened this summer, so that fewer cars will be provided. For these reasons the result of the great power station at Lots Road, Chelsea, has been disappointing, not more than perhaps one-third of its capacity being called upon, and even after the new tube is opened it is doubtful whether more than one-half of its capacity will be in operation. The motor bus, of course, is largely responsible for these reduced fares, and it would appear that no one could have foreseen the tremendous competiton which has come up by these motor omnibuses, which though doing a vast business are not making money. The whole transportation situation in London is not a healthy one, and the outlook for shareholders, at least, is far from promising.

The Select Committee of the House of Lords has now completed its consideration of the Oxford & District Tramways bill, declared the preamble proved and ordered the bill to be reported to the House. This, for the time being, closes the long drawn out dispute about the Oxford tramways. Some time ago the Oxford Corporation made a contract with the National Electric Construction Company to lease the tramways for forty-two years, the company agreeing to construct the tramways on the Dolter surface contact system. There has, however, been much opposition, and the foregoing statement is the result up to date.

The annual meeting of the Devonport & District Tramways Company was held last month, and though distinct progress has been made, the company is yet far from a dividend paying condition. The chairman stated that negotiations were in progress with the obect in view of arriving at some satisfactory arrangement with the Plymouth Corporation, so that it might run cars through into Plymouth and afford the Plymouth Corporation the same privilege of running its cars into Devonport. There are, of course, many such arrangements being operated successfully in England, and it is to be hoped that a similar one may be effected. The question of carrying parcels was also referred to, and it is expected before long that a service of this nature will be started.

While on the subject of parcel carrying, it is perhaps a matter of interest to note that Mr. J. B. Hamilton, general manager of the Leeds Tramways, has been asked by the Tramways Committee to obtain full information on the subject of parcel carrying, and to report on the matter. The Leeds Corporation has had powers to undertake the carriage of parcels for some time, but has only exercised them in a very small way. With the results before them of Bradford, Manchester and other towns, the Leeds Corporation is now going to make an effort to extend this portion of its business. It may be interesting to note also that the Gateshead Tramways Company is putting its scheme for carrying parcels into operation, and appears to be making quite a success of it. Its vans can be seen even in Newcastle collecting goods to be transmitted over the Gateshead tramways system. The Newcastle authorities, however, have not yet done anything regarding the transport of parcels, as some of the members of their committee appear to have arrived at the conclusion that the results are not commensurate with the costs of organizing such a system.

Without ceremony, the Filton extension of the Bristol Tramway Company's system was opened recently, and there is every reason for supposing that this section will prove exceedingly popular, especially during the summer months of the year. The new line makes the length of the section from the tramways center about 4¼ miles. The ordinary fare for the through journey is three-pence with sectional fares of a penny each. With regard to the fares for workmen's cars, the company has a Parliamentary right to charge three halfpence for the whole journey, but the directors have decided to charge a penny through fare, while retaining halfpenny workmen's fares for each of the three sections on which the fare for the ordinary passenger is a penny.

The East Ham Town Council and the West Ham Town Council have at last come to an agreement as to through running from East Ham to West Ham. East Ham is to make the junction at Green Street, and West Ham is to run a ten-minute service. It will be an undoubted convenience to the public, but the committee do not seem very enthusiastic about it, regarding it as involving but a problematical profit to West Ham.

The electric tramway constructed by the Hertfordshire County Council from High Barnet to the Middlesex boundary at Whetstone has been opened for traffic. At the boundary the new tramway joins the Middlesex County Council's tramway which runs from the Archway Tavern, Highgate, through Finchley to Whetstone. Both counties lease the lines to the Metropolitan Electric Tramways Company, Ltd., and the cars run right through from Highgate to High Barnet. The fare is fourpence all the way, and the distance nearly 8 miles.

The Accrington Corporation has decided to engage Mr. T. L. Millar, of Manchester, to advise them respecting the value of the Accrington Steam Tramway Company's rolling stock, which will be taken over by the corporation, owing to the expiration of the company's lease. The corporation has sealed a draft arrangement with the company to carry on temporary running arrangements during the conversion of the tramways.

At a recent meeting of the Manchester Tramways Committee Alderman Wainwright said that instructions had been given for the building at the works of the department of fifty additional car bodies, thirty-eight to be of the large double-deck type and twelve of the small double-deck type, all such cars to be provided with covered tops of the type already adopted for the existing small cars. The committee has gone to a very large expense, and now possesses car construction works which are of a capacity sufficient to carry on the work of the department. He believed a large saving would result to the city from the building of its own cars.

The steam tramway system running through the Rossendale division is at present the property of the Rossendale Valley Tramway Company, but an agreement has now been arrived at by which it will become the joint property of the corporations of Bacup and Rawtenstall, through which boroughs it passes. Each corporation is to purchase that part of the tramways within its boundaries; to reconstruct it and electrify it. Instead, however, of the two municipalities being joint partners in the expenditure and receipts, Bacup will lease it to Rawtenstall for thirty years, during which term Rawtenstall will pay, as rent, per annum a sum exactly equal to the amount paid by Bacup each year for sinking fund and interest.

The twelfth annual convention of the Incorporated Municipal Electrical Association is to be held at Sheffield, from June 24 to 29. The headquarters of the council will be the Royal Victoria Hotel, Sheffield. The following provisional program has been arranged, but it is subject to alteration: First day, Tuesday, June 25, morning, presidential address; reading and discussion of papers; afternoon, visit to Vickers, Sons & Maxim, Limited, River Dam Works; evening, reception and dance, given by the Rt. Hon. the Lord Mayor of Sheffield, at the Town Hall. Second day, Wednesday, June 26: Excursion to the Dukeries, all day. Third day, Thursday, June 27: Morning, annual general business meeting, members only; afternoon, reading and discussion of papers; evening, members' annual dinner. Fourth day, Friday, June 28: Morning, reading and discussion of papers; afternoon, visits to tramway and electric light stations. The following are some of the subjects which will probably be discussed during the convention. The list may be extended or altered: Depreciation; Three-phase Distribution; Extensions to Outlying Districts; The Selling Price of Current; Alternating Current Distribution.

Interesting developments are in prospect in connection with the new extensions of the South Lancashire Tramways Company through Worsley and Swinton. The company's lines through Worsley include a branch which joins up with the Salford system at the Worsley-Eccles boundary at Winton, but this branch has until now been left unused. Arrangements have now been made between the company and the Salford Corporation for the company to run cars from Atherton, through Worsley, to the curve at Winton, where the Salford Corporation cars pass to and from Peel Green, thus making only one change necessary between Atherton and Manchester.

A decision of vital importance to electric tramway companies and local authorities was given on Thursday in the Court of Appeal, where three judges decided that a track constructed under the Light Railways Act, 1896, is not a tramway, and that it is exempt, therefore, from three-fourths of the district rate. Wakefield and District Light Railways Company contends that, having constructed its line under Provisional Orders, in accordance with the Light Railways Act of 1896, it is a railway running upon land used only for the purposes of the railway, and as such was under the Public Health Act, exempt from three-fourths of the district rate. Wakefield Corporation, on the contrary, contended that the undertaking was merely a tramway running along the highway, and that as the plaintiffs had all the benefits of the work for which the rate was levied, they were liable to be rated at the full value of their undertaking. The Wakefield justices found in favor of the corporation, but on appeal by the company the Divisional Court reversed the decision of the justices. An appeal by the corporation has now been dismissed in the Court of Appeal, with costs.

The Master of the Rolls, in giving judgment, said that he did not propose to consider at length whether a line of rails that ran along a public highway was a tramway or a railway for the purposes of the Act. It seemed to him too plain for argument that the line in question was a railway, and not a tramway. That other persons had a right to use the road did not seem to him to affect the question. For reasons which were substantially those on which the Divisional Court based their decision, he held that the appeal failed and must be dismissed with costs. Lords Justices Vaughan, Williams and Buckley concurred.

The Leeds Corporation Tramways Committee has announced that the gross profits for the year ending March 31 amounted to £156,000. After allowing for interest and sinking fund, and placing £30,000 to the reserve fund, £50,000 will be available for the relief of the rates. The number of passengers carried was upwards of 14,000,000 and the total receipts were £323,900.

A conference of representatives of fifty municipal tramway

authorities, including the London County Council and Corporations of Glasgow, Manchester, Sheffield, Birmingham and Leeds, met at Westminster Palace Hotel, London, recently, to consider the proposed introduction in the London County Council, Manchester, Glasgow and Sheffield Tramways bills in the present session, provisions under which the post office may use posts, standards and brackets of these tramway authorities as supports for telegraph and telephone wires. Alderman Wainwright, Manchester, presided, and it was agreed to ask the Postmaster-General to receive a deputation on the subject, and to request the promoters of the bills named strenuously to oppose the introduction of the proposed new clauses. The conference also decided that the Lights on Vehicles bill, under which it is proposed to make compulsory the carrying of lights on the front of vehicles after dark ought to be amended so as to make it compulsory also that red lights should be carried on the rear of such vehicles.

At the Sale District Council offices a County Council inquiry was held into an application by the Ashton-on-Mersey District Council for an alteration of the boundary between Sale and Ashton-on-Mersey along the tramway track on the main road, and for a definition that the boundary shall be considered to be in the middle of the road throughout its length. It was agreed that the boundary should be the middle of the tram track, the chairman observing that he did not see why it should not be possible for Sale to have one line of tramway within their boundary and Ashton-on-Mersey one in theirs throughout the full length. A. C. S.

NO BIDS FOR CONSTRUCTING NEW YORK SUBWAYS—TEN MORE SUBWAYS NEEDED, SAYS ENGINEER RICE

No bids were received by the New York Rapid Transit Commission on April 25, the time appointed for the opening of bids for the construction of the new subways. President Shonts, of the Interborough Rapid Transit Company, however, wrote a letter offering to construct and equip at cost under proper conditions two extensions of the present system, one on the West Side from Forty-Second Street to the Battery, and the other on the East Side from Forty-Second Street to the Bronx, provided a reasonable return on the company's investment is ensured. This letter suggested that the officials of the company and the members of the board discuss terms on which parts of each proposed route might be built by the company. In brief, the conditions proposed by the company included a guarantee that the company should earn at least enough to meet its interest debt to the city and a reasonable interest on its own investment.

After a few formalities incident to the meeting had been gone through a report of the vice-president, stating that no bids had been received, was read, and then Mr. Starin asked Mr. Shonts if he had anything to say. For answer, Mr. Shonts handed the secretary the letter before mentioned, which is abstracted herewith:

New York, April 24, 1907.

Alexander E. Orr, President, Board of Rapid Transit Commissioners.

It is with great regret that I have now to advise you that, after very careful study by our engineers and officers of the plans and specifications for the new subways and the proposed form of contract for their construction and operation, the directors of our company have been forced to conclude that the building of the proposed four-track, double-deck Lexington Avenue subway, north of Forty-Second Street, and the four-track West Side subway south of Forty-Second Street, and the operation of those lines in connection with the existing subway under the burdens imposed by your proposed contract and the existing law, are financial impossibilities.

There are several reasons for this conclusion. In the first place, as will be seen from the report submitted herewith, our engineering advisers, including Mr. William Barclay Parsons and Mr. John B. McDonald, agree in the conclusion that the proposed extensions (exclusive of pipe galleries), built in conformity with the plans and specifications of your Commission, would, under existing conditions, cost (including an allowance for easements and interest during construction) not less than $64,000,000, without equipment, and that the necessary equipment, including tracks, rolling stock, power plant, etc., would involve an additional expenditure of not less than $24,000,000, making the aggregate cost of building and equipping about 39 miles (single track) of rapid transit subway approximately $88,000,000, as compared with the cost of about $71,000,000 for building and equipping the existing rapid transit lines (including the extension to the Battery), comprising about 63 miles of single track.

Not only would the construction of the proposed extensions involve a capital outlay per mile of track double that involved in the original subway lines, but under the proposed form of contract and the existing law, the expenses which must be provided out of income are very much increased as compared with the original subway contract. In the first place, it may be assumed that the interest upon city bonds issued for the cost of the proposed subways will be from one-half to three-quarters of 1 per cent higher than in the case of the original rapid-transit bonds, and this conclusion is based on the supposition that the city can sell its bonds on a 4 per cent basis. In the second place, unlike the original subway, the entire investment in the new subway, including the lessee's property in the streets and equipment, will be subject to taxation. In the third place, various advantages conferred by the original contract are now eliminated; and, finally, the lease is limited to twenty years (subject to a renewal upon a revaluation, the terms of which cannot be fixed in advance), making it necessary to increase the annual charges by an amount sufficient to provide for the difference between the original cost of such of the equipment and other property as may be taken over by the city at the expiration of the lease and the probable value at which such property will be appraised at the end of the twenty years.

Another important consideration is the exceptionally broad power conferred by your form of contract upon the public authorities to require from time to time any changes in the construction of the subway and in the equipment and other appliances used therein, as shall to them seem proper. Such a requirement, especially in the case of a subway operated under a lease for only twenty years, creates a serious liability for additional expenditures for which adequate allowance would have to be made under any conservative financial plan.

I have, therefore, to advise you that we are prepared to enter into a contract for the construction, at actual cost, of two extensions of the existing municipal subway, one upon the West Side extending south from Forty-Second Street to the Battery, the other upon the East Side extending north from Forty-Second Street into the Bronx, and for the equipment and operation of such extensions, provided the cost of construction can be brought within the city's borrowing capacity, and provided the terms of the contract are such that we may reasonably expect the earnings from these additional subways to be sufficient to cover the interest and sinking fund upon the bonds of the city issued for their cost, a proper annual charge for depreciation in equipment and other property which the city may take over at an appraised value at the end of the twenty years' lease, and interest upon our additional investment for which city bonds would not be issued. In other words, we are willing to complete the existing rapid transit system so that there shall be, as originally planned by your Board, two complete longitudinal lines, one upon the East Side and the other upon the West Side of the city, without any prospect of profit beyond a fair rate of interest upon the additional investment involved, and obviously without an expectation of such a return no capital could be secured for additional subway construction.

We shall be very glad to co-operate in carrying out some such plan as above outlined if the opportunity is offered. Very respectfully yours,

THEODORE P. SHONTS,
Chairman of the Executive Committee.

Attached to this was a letter to Mr. Shonts signed by the various engineers employed by the company, setting forth that the estimates of cost had been made as low as was safe, and that the cost of lands for stations and terminals, which would be charged as part of the cost of the railroad, had also been included in the estimate. Equipment charges had been estimated on the basis of five-car locals and eight-car expresses, and not according to the ten-car basis set forth in the form of contract. The conclusion of the engineers were as follows:

To construct a four-track railway northerly from connection with the present subway near Forty-First Street and Park Avenue via Lexington Avenue to the Harlem River, and then a two-track railway to 156th Street, in the Bronx, and a four-track railway southerly from a connection with the present subway near Forty-Second Street and Broadway, via Seventh Avenue and West Broadway to the Battery, in accordance with the contracts, plans and specifications of the Rapid Transit Commission,

will cost	$56,200,000	
Easements	2,500,000	
Terminals	1,300,000	
Interest during construction	4,000,000	
		$64,000,000
Equipment		24,000,000
Total		$88,000,000

This, it was learned later, was divided on the basis of $22,161,752 for the lower half of the Seventh Avenue route and $29,780,064 for the upper half of the Lexington Avenue route, with 7 per cent added as interest on investment for construction.

Mr. Shonts consented to an interview after the meeting. He said, in part:

"This is a keen personal disappointment to me. I had no idea

but that we could frame up a proposition for new subways that we could stand by. Although we instructed the engineers to make their estimates as low as possible, the aggregate cost of the proposed subway would be at least double that of the present one."

Mr. Shonts went on to say that the increased cost of labor and material, the conditions of the contract and the additional legislation were responsible. The officials of the company, he said, had devoted hours and days of time to meet the situation, because they believed there was a moral obligation on the lessees of the present lines to build new roads, but it was a financial impossibility to build the road proposed.

Asked as to the conditions of the contract to which specific objection was made he mentioned easements, private property for stations, the method of construction, meaning the cut and cover, as against the open ditch, the increase in the size of the tunnels and the liability of the contractors for all damage to abutting property of every description. Speaking of the Lexington Avenue route he said that the company had no definite proposal to make as yet, but that the proposed double-decked subway was an "operating monstrosity." To provide for the operation of ten-car trains, he said, would practically bankrupt the existing property, the stations of which would have to be reconstructed if the two systems were connected.

The report of Chief Engineer George S. Rice, of the Rapid Transit Commission, which will soon be made public as part of the report of the Commission, will contain figures regarding the daily carriage of passengers on all transit lines in this city and on the remarkable increase of population and traffic, which will strongly emphasize the seriousness of the transit situation, due to the refusal of the Interborough to bid on the new subways and the failure of independent bidders to appear.

According to Mr. Rice's figures, the population of the Boroughs of Manhattan and the Bronx alone, in 1916, will be not less than 3,170,000, and the total number of passengers in the two boroughs which will have to be carried during that year will reach the enormous total of 1,626,000,000, or 4,454,800 a day. The total facilities, subway, elevated and surface, of the city under conditions that prevail to-day is 818,273,413.

Mr. Rice draws six important conclusions as the result of his investigation and statistics compiled from present ticket sales and population estimates. They are: That the population of Greater New York has practically doubled itself every twenty-five years, and will probably double itself again by 1930.

That the total paid passenger traffic is increasing at such a rate that it will probably about double itself within the next decade.

That in order to bring about the discontinuance of the overcrowding conditions which are now prevailing on all transportation lines in Greater New York, it is imperative that the following additional subways be constructed and put in operation:

Within the next five years, or by 1911, as follows: For Brooklyn, two four-track subways, in which ten-car trains can be operated, providing for eight additional tracks crossing the East River either in tunnels or on bridges, and traversing the borough. For Manhattan and the Bronx, three four-track subways, for operating ten-car trains, traversing the two boroughs.

Within the second five years, or by 1916, as follows. For Brooklyn, two more four-track subways. For Manhattan and the Bronx, three more four-track subways.

Or, within the next decade altogether, for Manhattan, Bronx and Brooklyn ten four-track subways.

For four years, in the greater city, Mr. Rice says the increase in the passenger traffic has been about the same each year, except last year. The average had been about 63,000,000 passengers a year, but the increase last year jumped to 110,000,000, supposedly on account of an increase in the population invited by the opening of the subway. After thoroughly discussing the increase in population, Mr. Rice takes up each borough separately.

He finds that in Richmond, where 8,957,414 passengers were carried on the surface lines in 1906, and 6,614,457 on the steam roads, a daily average of 43,000, there should be in 1916 26,000,000 to be carried. The transportation problem there, however, can be taken care of by an extension of the tracks of the present lines.

Conditions in Queens are similar to those in Richmond, Mr. Rice finds. To handle the traffic increase, however, only an increase in car mileage is necessary, and to take care of the travel from Queens to Manhattan, about 60 per cent of the total, there is the new Blackwell's Island Bridge and the Belmont tunnel, which should prove ample.

Brooklyn, in Mr. Rice's report, makes the following showing for last year:

Elevated lines	125,221,831
Surface lines	264,333,194
Total	389,555,025
Daily average	1,067,000

It is to Manhattan that Mr. Rice gives by far the most attention. It had a population of 2,167,585 last year, an increase of 15 per cent in five years, and the traffic on all lines had increased 39 per cent during the same period, though the latter increase had not been uniform in each year.

In the last five years the number of long distance passengers riding in Manhattan has increased 108 per cent. This increase, however, is not likely to be maintained. As the Bronx and Manhattan traffic are closely identified, Mr. Rice considers them together in closing his report. He says:

The population of Manhattan and the Bronx has been estimated at 2,436,002 for the fiscal year of 1906. It will probably be about 2,740,000 in 1911, and 3,170,000 in 1916. The total paid passenger traffic for the last five fiscal years has increased about 41 per cent, to 818,273,413 per year, or an average of about 2,242,000 per day.

At the 41 per cent rate of increase for five-year periods the total traffic in Manhattan and the Bronx will be about 1,153,000,000 in 1911 and 1,626,000,000 in 1916, daily averages of 3,131,000 and 4,454,000. Transportation must be provided for the rush-hour conditions, or maximum number carried in one hour in one direction. The capacity of the existing elevated and subway roads, based on such conditions, if all passengers are to have seats, is not far from 200,000,000 per year.

Deducting the estimated capacity of the existing elevated and subway lines from the total estimated traffic to be taken care of in 1911 and 1916, we have either, when seats are furnished, 492,000,000 and 921,000,000, or with moderate crowding, 392,000,000 and 821,000,000 passengers, respectively, for whom transportation must be provided in new subways yet to be constructed.

Under moderate crowding, two additional subways must be completed within five years and six within ten years. If seats are to be provided, three additional four-track subways will have to be put in operation within the next five years and three more within a decade, in order that the inhabitants of Manhattan and the Bronx may be transported to and from their daily business in comfort and decency.

ELECTRICFICATION OF LINES IN ADIRONDACKS IMPRACTICABLE AT PRESENT

Chauncey M. Depew, as chairman of the board of directors of the New York Central Railroad Company, has written to Commissioner Whipple, of the State Forest, Fish and Game Department of New York, informing him that it will not be possible to consider this year a suggestion made by the Commissioner that the railroad electrify its lines through the Adirondacks, with a view of diminishing the danger of forest fires. The letter was in response to one sent to Mr. Depew by Commissioner Whipple,, suggesting that in selecting the lines for the extension of the use of electricity as a motive power on the divisions of its system, preference be given to the Adirondacks. Mr. Depew says that he considers the suggestion of Commissioner Whipple valuable, and adds that his own interest in Adirondack preservation is great, but announces that the railroad has too much other work on hand to take up now the change suggested.

STRIKE IN SALT LAKE

A strike was declared, April 28, on the lines of the Utah Light & Railway Company, 450 men walking out. Numerous scenes of disorder followed attempts made by the company to operate a few cars with non-union crews, and all efforts to maintain even a partial service soon were abandoned. Determination to strike was reached by the men shortly before 4:00 a. m, and the calling of the strike was a complete surprise, as announcement had been made that arbitration had been agreed to by both sides. This followed several conferences between Mayor Thompson and a committee of citizens on the one side and President Bancroft of the company on the other.

THE CLEVELAND SITUATION

Notwithstanding the petition containing 4000 names asking that a renewal of franchise be granted the Cleveland Electric Railway Company on Central Avenue and Quincy Street, and over the protest of the Councilmen representing the wards through which these lines pass, the City Council, at an adjourned session Saturday, gave the Low Fare Company a grant to build and operate lines on these thoroughfares. These grants were made to get around the suits now pending against the Forest City Railway Company, which already holds grants over the same streets. Little attention was paid to the petition of the residents of that section of the city, and less to the revocation of consents to the new companies that were presented to the law-making body, although they are said to have covered more than half of the frontage along which the lines operated. At the same time the Board of Public Service gave the Cleveland Electric Railway Company a new permit to remove its tracks from these streets under conditions that are not so onerous as those contained in the first. This was done because of fear that the courts would not allow the new companies to use the tracks of the old company in the operation of their cars along these lines, and the board considered that they had as well be removed as to remain there and not serve the purpose of the administration.

At the same time a curative ordinance was passed with the design of getting around the objection that had been raised against the Low Fare Company's using Euclid Avenue from East Fourteenth Street to the Public Square, and from that point west on Superior Avenue to West Twenty-Eighth Street. This covers all the territory from which the Municipal Traction Company and the Low Fare Company have been barred by injunction. The plan is to continue to lease the cars to the Low Fare Company and get around the injunction against the Municipal Traction Company. The Low Fare Company was barred from the use of Euclid Avenue because it had the consents of none of the property owners. In this case the lines had never been used by any of the new companies, while in Superior Avenue the Municipal Traction Company had been operating from the viaduct to the Public Square under a suspended injunction.

The advocates of the new companies had secured consents of many property owners on Central Avenue and Quincy Street, but it seems that the name of neither of the companies appeared in the agreement, by which the property owners were promised $3.00 per front foot as a rebate on the cost of paving. The Cleveland Electric people secured the revocation of a large majority of these consents and at the same time secured consents for its own line. It agreed to pay $4.00 per front foot, and did pay $1.00 per foot down on all the consents it secured. In all probability this will form the basis for litigation that will follow any attempt of the new companies to build lines on either of these streets. The Cleveland Electric claims that it has a sufficient number of consents to bar any other company from the streets. It is said that City Solicitor Baker advised that the new ordinances be passed without counting the frontage represented in these revocations, and said that the property owners could not legally revoke their consents. The city is passing beyond the limits of a free country according to this course of reasoning.

Councilmen representing wards through which these lines pass made the objection to the passage of the ordinances that their constituents desire that the Cleveland Electric continue to operate the lines at its proposition of seven tickets for a quarter, as it is the only system that is able to carry people to any part of the city on one fare. In case the new companies have lines on these streets and people desire to go to a part of the city not reached by them, the fare will be 8 cents instead of 3.

As briefly mentioned in the STREET RAILWAY JOURNAL last week, the injunctions were granted barring the Forest City Railway Company from operating the lines mentioned and the Low Fare Company from using the Cleveland Electric's tracks on Euclid Avenue. With these conditions existing the people who used the two lines now have to walk to other lines. The company placed all the cars taken off these lines on those that the people would naturally use and thus provided transportation facilities for them, although they are inconvenienced by the distance they have to go to reach the cars. According to interviews in a local paper, business men on those streets are divided as to the company they desire to operate the lines, but a majority of them favor the old company and say the offer it made is fair.

Another thing enters into this fight. The city needs rapid transit lines badly, and the old company in its original proposition agreed to build them. The new companies will never be able to provide such a service from present indications, and the city must suffer as a consequence. The distances are now so great that the extension of building toward the country must cease unless better facilities are provided. The steam roads do not provide commuter service in Cleveland, and people must depend altogether upon the electric lines.

Most of the past week was spent by the Mayor and the City Council in adjourned sessions, endeavoring to formulate plans to defeat the Cleveland Electric in the various moves it has made. The franchise ordinances were railroaded through, Johnson being unwilling to allow the usual time in taking care of such matters. The low-fare cars are still operated over the Cleveland Electric's tracks to the Public Square.

Monday evening the City Council gave the Low Fare Railway Company a permit to build lines on Central Avenue and Quincy Street, following the franchise ordinance given the company a few days before. A resolution, offered at the request of people on those two streets, asking the Cleveland Electric Railway Company to continue the operation of cars on the streets until the rights of the companies are legally determined, was defeated by a vote of 21 to 9, the boosters of the new companies claiming that such a permit would be construed as a grant by the old company and that the settlement would be complicated.

Under the permit granted it the Cleveland Electric began taking up the track on the two streets Tuesday morning. The work went along all right until the men began taking out some special work at the crossing of Central and East Fifty-Fifth Street, when they were stopped by the police. The matter was at once taken to Judge Chapman, who has the injunction suits in hand. The city officials were informed there that they were looking at this matter in a narrow way, and that the company has the right to take up its special work on these lines. It is claimed that the new companies cannot get this material within three months, and that the Mayor contemplated using force to keep the old company's property in the street for the convenience of the Low Fare Company.

Notwithstanding the temporary injunction against the Low Fare Company, Council instructed it to make connection with the Cleveland Electric tracks at Euclid and East Fourteenth Street. The hearing on the injunction to prevent the Low Fare Company from operating cars on Central Avenue and Quincy Street is being held in Judge Chapman's court this week.

Councilman Felton introduced an ordinance in the City Council, Monday evening, giving the Cleveland Electric Railway Company a franchise on the abandoned streets for six years. He asked that a special meeting be held Tuesday evening for a second reading. Opponents of the road objected, but the Councilman forced the matter, saying he wanted to put the members of record. An ordinance was also introduced providing for the operation of the Low Fare Railway Company's cars over the Denison Avenue line of the Forest City Railway Company.

Council passed the ordinance compelling an exchange of transfers to and from all lines and companies on all union depot traffic, the transfer point being at West Ninth Street and Superior Avenue. This will cause another tangle, as the Cleveland Electric will refuse to abide by the terms of the ordinance.

BOSTON ELEVATED WINS "THIRD-RAIL EYE" CASE

A verdict in favor of the Boston Elevated Railway Company was handed down on April 26 by the Superior Court in connection with a suit brought on the claim that the plaintiff was injured by sparks falling from a passing train on the elevated structure. This is the first case which has been tried since the spring type of contact-shoe was adopted. The company contended that everything possible had been done for the safety of travelers under the structure and at the same time furnish the rapid transit the public has a right to demand.

REGULAR RUNS ON ERIE ELECTRIFIED DIVISION

Regular test runs are being made over the electrified branch of the Erie Railroad between Mt. Morris and Rochester.

PLANS BEING MADE FOR BUILDING SYSTEM IN BAHIA

New York interests, said to be allied with the Havana, Mexico City, Rio de Janeiro and other West Indian, Central and South American electric traction and lighting properties, have completed financial arrangements in Europe for the construction and operation of street railways in Bahia, Brazil. A lighting monopoly has been taken over and extensive water power rights have also been acquired. The development of the Bahia projects will entail an expenditure of nearly $10,000,000. The Bahai Tramway, Light & Power Company will carry out the work. It has been incorporated under the laws of Maine, with a capital of $3,500,00 in common stock. Seven million, five hundred thousand dollars of 5 per cent fifty-year first mortgage bonds are also authorized. An issue of $3,500,000 of these bonds has just been made in the London and Brussels markets. The New Yorkers interested in the company include Percival Farquhar, William Lanman Bull, of Edward Sweet & Company, and F. S. Pearson.

PRETENTIOUS NEW YORK STATE PROJECT

The Buffalo, Rochester & Eastern Railroad Company, formed to operate a standard gage railroad by steam, electricity or gasoline from Buffalo to Rochester, and thence to Troy, a distance of 300 miles, filed incorporation papers at Albany, Tuesday, April 30, with the Secretary of State. The principal office of the road will be in Rochester. The capital stock is $3,500,000, and the directors are Ralph D. Gillett, Henry W. Ely and Archie D. Robinson, of Westfield, Mass.; Arthur W. Eaton, of Pittsfield; Franklin Weston, of Dalton; Henry W. Bowman and Fred. T. Ley, of Springfield; Joseph O. Skinner, of Holyoke; James H. Caldwell, of Troy; John E. Whipple, of Brockton, and James F. Shaw, of Manchester, all being Massachusetts men except Mr. Caldwell. Mr. Gillett subscribes for $1,835,000, or over one-half of the capital stock of the company. The railroad will parallel the New York Central and pass through 125 postoffice towns, including Batavia, Utica and Rome, but will not go through Rochester. The proposed line will have connections at its eastern terminus with the Boston & Maine, and on its western end with the New York Central and Grank Trunk, and will furnish a direct route between the Hudson and Lake Erie.

THE CANANDAIGUA SOUTHERN COMPANY'S PLANS

The Canandaigua Southern Electric Railroad Company, which was recently granted a certificate by the New York Railroad Commissioners after a series of hearings, was incorporated in January, 1907, to build an up-to-date interurban electric road from Canandaigua southwest through Centerfield, South Bloomfield, Vincent, Bristol Center, Bristol Springs, Naples and North Cohocton, to meet the Lackawanna and the Erie Railroads at Atlanta. The line will open up a large area of fertile and productive territory not now served by any railroad, will pass through a number of flourishing villages and hamlets and thickly settled farming communities, and by reaching the head waters of Canandaigua Lake, form in conjunction with the Rochester & Eastern Rapid Railroad and the Canandaigua Lake Transportation Company, a popular excursion route for the people of Rochester and other neighboring cities. It is said that the line will be one of the most picturesque in New York State. The board of directors of the Canandaigua Southern is composed of the following men: Edward G. Hayes, vice-president of the McKechnie Bank, Canandaigua, N. Y.; Alexander Davidson, manufacturer and director of the McKechnie Bank, Canandaigua, N. Y.; Denison H. Maxfield, president of the Hiram Maxfield Bank, Naples, N. Y.; George W. Hamlin, vice-president of the Canandaigua National Bank, Canandaigua, N. Y.; Hyatt C. Hatch, of Hatch, Otto & Company, Atlanta, N. Y.; Clinton W. Richardson, president of the Richardson Manufacturing Company, Bath, N. Y; Gooding Packard, of Hemmenway & Packard, Canandaigua, N. Y.; George H. Switzer, engineer, 42 Broadway, New York City; Edwin D. Hamlin, attorney, 26 Court Street, Brooklyn, New York.

Part of the arrangements for financing the road have been completed. It is rumored that extension papers will be filed very soon to extend the line from Atlanta 5 miles to Wayland, N. Y., to connect with the Pittsburg, Shawmut & Northern Railroad.

INCREASE IN CAPITALIZATION OF THE BOSTON ELEVATED RAILROAD

At a special meeting, Tuesday, April 30, the stockholders of the Boston Elevated Railway Company authorized an increase in the capital stock from $13,300,000 to $21,300,000. They also authorized an increase in the bonded debt from $7,500,000 to $13,300,000. The increase in the capital stock is to defray the expense of the construction of the Cambridge subway. The increase in the bonded debt is to provide for other construction, new equipment and the funding of the company's floating debt.

FRISCO TRACTION DEAL DENIED

With regard to reports from San Francisco that negotiations for the purchase of the United Railroads of that city have been in progress for the last month and that the sale of the street railway properties may be consummated at an early date, Ernst Thalmann, of Ladenburg, Thalmann & Company, who is president of the United Railways Investment Company, which controls the United Railways of San Francisco, is quoted as stating: "There is not the slightest foundation for the rumor. No negotiations have been opened for the sale of the property; in fact, no such proposition has even been suggested."

The dispatch from San Francisco said in part:

"Three representatives of Eastern capitalists have been for the last three weeks investigating the system. H. E. Huntington has been mentioned as a probable purchaser of the stock. He has just returned from the East, and it is rumored that he has determined to renew his connection with traction interests in San Francisco. Another who has been mentioned as a possible purchaser is Thomas F. Ryan, who has been active in acquiring traction properties throughout the country."

THE MERCHANTS' ASSOCIATION ON THE PUBLIC UTILITIES BILL

The committee on domestic commerce of the Merchants' Association of New York, has just rendered a report to that body, recommending certain changes in the Public Utilities bill now before the New York Legislature. Many of the criticisms of the bill are along the lines of an editorial recently published in this paper. The committee says that public control of public service corporations, "if just and reasonable, will be beneficial not only to the public but to the corporations affected thereby. But such control should not be arbitrary or excessive, nor carried to such an extent as to interfere harmfully and needlessly with that freedom of action without which great business enterprises cannot be operated with the best results. In our opinion some of the provisions of the bill are needlessly and harmfully restrictive, and if adopted would tend to impede rather than to promote efficient service by making difficult or impossible legitimate and necessary financial operations, without which the capital required for the best service could not be obtained."

The report then considers the tenure of office of the commissioners. In the bill this depends on the pleasure of the Governor. The committee compares this method with one requiring the assent of the Senate, and finally recommends the removal by the Governor only and on charges reviewable by the courts to decide whether the evidence warranted the removal. The committee believes that the salaries of the commissioners should be not less than $20,000 a year, in order to secure men of sufficient ability, experience and large capacity in practical affairs. The report also favors the permission to organize holding corporations, which are now prohibited by the bill, as it believes that such corporations are often necessary for the most effective operation of public service properties. It also recommends that the issue of promissory notes should be made an exception to the provisions of the bill prohibiting "the issue of stocks, bonds, evidence of indebtedness and other forms of security of capital account without the approval of the commission." It also recommends the adoption of a clause looking to a reasonable and fair judicial review of any order of the commission, such power being lodged in the Appellate Division Other suggestions are made.

ALL ELECTRIC SERVICE ON NEW YORK CENTRAL OUT OF NEW YORK

Electric service between the Grand Central Station and High Bridge on all trains of the New York Central lines was instituted last week. For several months most of the local and suburban trains have left the station drawn by electric locomotives, which have been specially built for Park Avenue tunnel traffic, but now the Twentieth Century, the Empire State Express and the other through trains for the West are hauled through the tunnel. Hereafter all trains entering or leaving the Grand Central Station will be hauled from or to High Bridge by the electric locomotives.

MONTGOMERY STRIKE SETTLED

An agreement has been reached between General Manager Ragland, of the Montgomery Traction Company, and a considerable number of the former employees of the company, by which they returned to running the street cars, at the same wages they were receiving before they went out on strike. The strike of the motormen and conductors against the Montgomery Traction Company has lasted more than three weeks, having been inaugurated at noon, March 27.

THE PHILADELPHIA RAPID TRANSIT PLAN AMENDED

A committee representing the Retail Merchants' Association has presented to Mayor Reyburn the amended rapid transit plan. Ordinances carrying the plan into effect, it is expected, will be introduced at the next meeting of City Councils.

The two changes in the original plan are: First, that of the proposed $30,000,000 sinking fund, the city is allowed the use of all money in this fund after the first $5,000,000 is accumulated; second, the Rapid Transit Company shall pay yearly a sum of money to be used for street paving and the like, instead of a lump sum, as first intended. As amended, the important features of the plan are:

A mutual contract for fifty years is to be entered into between the city and the Rapid Transit Company, at the end of which the city may possess itself of the leases, franchises and property of the company without cost. During the fifty years the company is to maintain a sinking fund which will extinguish its $30,000,000 of capital. The Mayor, the president of the Rapid Transit Company and the president of the Board of City Trusts are to compose the Sinking Fund Commission, and after $5,000,000 has accumulated the city can use it, and the money that is to follow, for any municipal purpose whatsoever.

The Mayor, the president of the Board of Education and the president of the Board of City Trusts are to become directors of the company, with the right to vote, but they incur no liabilities for themselves or the city. The city and the company are to share equally the net profits after a 6 per cent dividend is paid on the stock.

A fixed sum is to be paid yearly to the city for car licenses, snow removal, street paving, taxes and the like, which shall be equal to the present cost of these items. This sum is to be fixed by the city every year.

No contracts are to be made by the company extending beyond fifty years, and in this period the company shall have the right to build elevated and subway lines as they may be needed, issuing securities for no greater amount of money than is actually needed. The city is also to join with the company to have the present route of the Frankford elevated line changed so as to make its construction possible.

The ordinance of 1857 giving the city the right to take existing railway lines at their appraised value, and the ordinance requiring the company to put wires under ground when directed to do so by the authorities, are to be repealed.

The company is to call the remaining $9,000,000 still assessable on its stock, and the money is to be used in improving the service.

During the term of the contract the City Controller or experts in the employ of the city will have the right to audit the company's accounts.

AN INTERURBAN UNION STATION

The development of interurban railroads in Kansas City has brought forward a project for an interurban terminal station in the heart of the city. A site has been selected, and as soon as the deal is closed the plans will be made public. Two electric interurbans now enter Kansas City—one from Leavenworth and the Strang line from Olathe to Kansas City. Two other lines are building, one from Kansas City to Topeka and the Bonner Springs line. J. J. Heim and his associates expect to have an electric railway from Kansas City to St. Joseph and between Kansas City and Excelsior Springs before the end of next year. The Heim system of interurbans in Southern Kansas and Southwest Missouri will be extended to Kansas City, and a joint terminal station for these lines would mean the quick handling of mail and baggage and much more convenient facilities for passenger traffic.

THE YOUNGSTOWN & SOUTHERN OPENED

The Youngstown & Southern Railway Company's line between Youngstown and Columbiana, Ohio, has been put in operation. This road connects some of the best towns in Eastern Ohio, and will eventually reach the Ohio River through connection with the Youngstown & Ohio River. The roadbed was used three years for a steam road. It is of standard steam railway construction and laid with 70-lb. rails.

For a time the power will be furnished by the Mahoning & Shenango Valley Railway Company and the Cherry Valley Iron Works at Leetonia. A power station is being erected at West Point, and as soon as it is completed the company will have plenty of power to operate its line. In all probability the plant will be completed late this summer or early in the fall. It will furnish a three-phase current which will be stepped up to 22,000 volts and transmitted to a sub-station at North Lima, where it will be stepped down to 600 volts and converted to direct current for the motors.

The cars, built by the Niles Car & Manufacturing Company, are finished on the interior in cherry, with light green ceilings. while the exterior is in Pullman green. The seats are of the Hale & Kilbourne steam railway type, upholstered in green plush, while those in the smoking compartment are in green leather, each having a seating capacity of fifty-four. Heat is furnished by a Peter Smith hot-water system.

The cars are 51 ft. 9 ins. long and equipped with four Westinghouse motors of 75 hp each, giving a total of 300 hp per car. Westinghouse air brakes are employed as well as electric signals and air sanders. Baldwin Locomotive Works trucks, standard steel forged wheels, air whistles and foot gong complete the equipment. Two of the four cars are combination passenger, baggage and smoking cars, with seating capacity for forty people. The same length as the others with the same general finish, they have an 11-ft. space reserved for baggage.

The equipment of the freight car is the same as the passenger cars, with the exception of the employment of automatic air, the same as used on railroads. It is of a bright yellow color to distinguish it from the passenger cars. The management has felt it wise to make this difference, as it is an easy matter for passengers to tell which are the passenger and which the freight cars or *vice versa*. It is arranged for handling a large amount of freight and is a high-speed car, which guarantees prompt service.

Oakland and North Lima are the two principal towns between Youngstown and Columbiana. The latter place has a population of about 3000 people, but all the country between the termini is populous. At present the line is 16 miles long, but within three or four months it will be completed to Leetonia, a distance of 3 miles. At this point it will connect with the Youngstown & Ohio River which, when completed, will reach Salem, Lisbon, West Point and East Liverpool. It is thought the Youngstown & Ohio River road will be completed some time this summer. The arrangements between these two roads is such that they will operate practically as one.

The officers of the company are as follows: John Stambaugh, president; J. S. Dill, vice-president and general manager; David Tod, secretary and treasurer; W. F. Bass, assistant treasurer and auditor; E. H. Raupp, assistant superintednent; Otto Lind, master mechanic; J. McCluskey, road master; Edward Travis, superintendent of line construction.

RUMORED CHANGES IN THE WASHINGTON RAILWAY & ELECTRIC COMPANY

It is reported in Washington that important changes are soon to be made in the personnel of the Washington Railway & Electric Company, and that William Loeb, Jr., secretary to President Roosevelt, will be made president of the company, to succeed Allan L. McDermott, former representative of New Jersey at Washington. The report that prompted the statement by the papers about Mr. Loeb was a story to the effect that a prominent local banking house in Washington had recently bought for local clients all the stock it could secure of the company, the holdings taken over including those of the New York, New Jersey and Philadelphia interests which were in control of the property. At present there is a voting trust, but this expires June 1, after which the affairs of the company will be in the hands of the individual stockholders.

BOSTON ELEVATED COUNTS TRAFFIC IN CAMBRIDGE

The Boston Elevated Railway Company has completed a three days' traffic count in Cambridge of passengers boarding its cars between Howard and Central Squares, the object being to secure accurate data upon the need of a subway station in the Dana Hill section. The count was taken by enumerating the number of passengers on each car at both squares, the excess representing the accessions in the disputed territory. On the first day 1080 cars were run, the added passengers being 4295, or 4 passengers per car. On the second day there were 1075 cars and 4088 passengers. For the three days the average totals were 1077 cars per day and 4228 passengers, the average number of added passengers per car remaining constant at 4. The heaviest traffic each day was between 7:00 and 8:30 a. m.; the average number of passengers gained in the disputed territory being 8. During the later evening hours this average dropped to 2 passengers.

Vice-President Sergeant stated in connection with these figures that the showing made does not argue for a station at or near Dana Street, and pointed out that the more intermediate subway stations there are constructed, of necessity, the fewer surface cars there will be, and no one appears to want the surface car service diminished.

NEW DEMANDS BY SAN FRANCISCO EMPLOYEES

The employees of the United Railways & Electric Company, of San Francisco, have made demands for a flat rate of $3.00 a day and 8 hours work; all overtime to be paid for at the rate of time and a half; full recognition of the union and its authorized agent; employees to be discharged for cause only, and when a discharged employee feels aggrieved at having been discharged unjustly, or without cause, that the union shall intercede in his behalf and shall be granted a hearing by the company. The company has determined to continue in effect for another year the schedule of hours and the wages fixed by the board of arbitration. President Calhoun says: "The award of the arbitration committee practically amounted to a decision requiring the company to expend $1,100,000 a year additional upon the wages of its men. This $1,100,000 a year advance included the construction department. The actual increase for operating department alone amounted to $600,000 a year. The present desire of the men for an 8-hour day and pay at the rate of 37½ cents an hour would require an extra expenditure by the company of $400,000 a year in wages to the operating department. In other words, the present demands of the men, if granted, would mean that the company would be paying to its present employees of the operating department $1,000,000 more a year than it was paying the same number of men before the fire. Carmen in San Francisco to-day receive the highest carmen's pay known in any city in America, except Butte, a mining town, where there is a small system operated under abnormal conditions. The next highest pay is that received by the carmen in Oakland, where they get 30 cents, 31 cents and 32 cents an hour, according to first, second or third-year service, and they work a period of 10 hours a day. In all the great cities in America the carmen work 10 hours a day, except in Detroit, where they work only 9 hours. Not a city in the whole country has an 8-hour day for its carmen. The average day for carmen throughout the country is 10 and 11 hours. In the city of New York on a 10-hour day my recollection is that the carmen are paid 24 cents and 25 cents an hour. Here in San Francisco the pay is 31 cents, 32 cents and 33 cents an hour. To increase this already highest wage to 37½ cents an hour and also cut the work period down to 8 hours a day would place an additional financial burden on the company amounting, with the present number of operatives, to an expense of $400,000 a year, which means 8,000,000 cash fares."

DEWEY DECIMAL CLASSIFICATION FOR ELECTRICAL LITERATURE

The Engineering Experiment Station of the University of Illinois has recently issued Bulletin No. 9, "An Extension of the Dewey Decimal System of Classification Applied to the Engineering Industries." This bulletin is in effect a fifth edition of the extension previously issued by the mechanical engineering department. It contains the extensions previously worked out for mechanical and railway engineering, and in addition a very complete extension for electrical engineering, and more or less complete extension for bridge engineering, sanitary engineering, metallurgy and architecture. An alphabetical index of subjects adds to the usefulness of the classification.

The decimal system of classifications devised by Mr. Nelvil Dewey was intended primarily for the use of librarians in classifying and arranging books and pamphlets. It has, however, been used extensively by engineers, manufacturers and business concerns for indexing technical data of all kinds, catalogs, reports, drawings, etc. Bulletin No. 9 extends the work of Mr. Dewey to practically all fields of engineering industry, and presents a system of classifications of great value to engineers and those engaged in engineering industries. Copies may be secured by application to the Director of the Engineering Experiment Station, Urbana, Ill.

SHORT FRANCHISES OBJECTIONABLE

August Belmont, Controller Metz, ex-Lieutenant Governor Woodruff and several other men interested in traffic and the development of Long Island, delivered addresses at the dinner of the Queens Borough Real Estate Exchange, held recently, when Controller Metz repeated his assertion that Mr. Belmont should have a monument built for him, and added: "The time is coming when we will cease to hound the corporations. Instead we are going to knock at their gates and beg them for God's sake to lay some tracks for us. While we are talking about how much the railroads are getting we are unable to get to our homes. While we are discussing the need of fresh air and parks for the masses we cannot get across the bridges to Brooklyn and the rest of Long Island." Mr. Metz said that Mr. Belmont deserved the monument "for taking a chance and building the subway for us when no one else could see anything in the proposition." Mr. Belmont, in his speech, said in part: "Unfortunately there is a spirit of criticism against corporations prevalent. It would not be proper or becoming for me to criticise this spirit, but I know that this hostile spirit frightens the investor, and the moment hostility is started the corporations find it difficult to get capital with which to make improvements or additions. Conditions confronting us are not now what they used to be, and corporations find it difficult to get along in any community. They are threatened with regulation of all sorts. The regulation may be proper or it may be improper, but the threat militates against enterprise. If this condition prevailed when the subway was first contemplated, I very much doubt if any corporation would have undertaken the great task of building it. I repeat that conditions are not attractive to capital. Short franchises are very well in theory, but when a man is going into business he wants something with safety or stability and definiteness. He does not want either to build up a business or buy it, if at the end of twenty-five years or less he finds that it has no value. I do not believe that the city is any better off for giving short-term franchises than it was when long-term franchises were given."

AFFAIRS AT HARRISBURG

If the Legislature passes the trolley eminent domain bill, now through the House and tied up in the Senate committee, it is expected that more than 2000 miles of new trolley lines will be built throughout the State within the next five years. Just now it is the Land Owners' Association of Philadelphia which is protesting most strenuously against the passage of the bill in its present form. The speakers for this association who appeared before the Senate committee on railroads last week stated that their clients were not opposed to the bill, but to certain provisions which took away from them the protection they ought to have. They urged that instead of the consent of 51 per cent of the property owners trolley companies should be required to obtain the consent of 75 per cent, and asked that amendments be inserted providing for the immediate payment of damages for land taken, requiring the companies to fence in their private right of way, to file plans with the County Recorder so as to insure publicity, to deposit $2,500 a mile with the State Treasurer as an evidence of good faith, as is done in New Jersey, this money to be returned as fast as the road is completed, and to except gardens and yards attached to homesteads from the provisions of the act.

The bill would grant to trolley companies the same rights as held by steam railroads. A provision that is particularly offensive to the land owner is that, after the land has been seized and it comes to the point of assessing damages in favor of the owner of the land taken, any advantages derived from the fact that the road runs through his property should be considered as an offset for damages.

It is believed that all this opposition to the bill has been inspired by the big steam lines, which enjoy this same privilege without paying any greater tax to the State. The steam railroads are taxed 5 mills on their capital stock, 4 mills on bonded indebtedness, and 8 mills on their gross receipts. Trolley roads are compelled to pay exactly the same taxes under the general law. But after paying the same taxes as the steam roads do under the State law, trolleys are compelled to pay the various municipalities through which they run a car license tax, a tax on poles and a tax on wires. The right to carry freight will be of little value to new companies unless the right of eminent domain is also granted.

A number of trolley companies are preparing to take advantage of the bill allowing them to carry light freight. Among them might be mentioned the Wilkesbarre & Wyoming Valley Traction Company, the Lewisburg & Mifflinburg Company, the Lewisburg, Milton & Watsontown Company, the Philadelphia & West Chester Traction Company, the Eastern Pennsylvania Traction Company, the Chester Traction Company, the Allentown & Reading Traction Company, the Central Pennsylvania Traction Company, the York County Traction Company, the Easton Transit Company, the Montgomery County Rapid Transit Company, the Susquehanna Railway & Light Company (which operates the lines in Lancaster County), the Altoona & Logan Valley Company, the Blue Ridge Traction Company, the Erie Traction Company, the Lehigh Traction Company, the Pottsville Union Traction Company, the Shamokin & Edgewood Company, the Sunbury & Northumberland Company, the United Traction Company of Reading, the Warren & Jamestown Company, the West Chester, Kennett & Wilmington Company, the West Penn Railways, the Pittsburg & Butler, the Johnstown Passenger Railway Company, and the Scranton Railway Company. The Quick Delivery Express Company, which owns the right to carry freight upon the lines of the Scranton Railway Company, have ordered twenty-five cars from the builders in Philadelphia, and will extend the service on all lines of the railway company from Pittston to Forest City. The act will also very materially affect the Laurel line, which, although it had been carrying freight between this city and Wilkesbarre since the opening of the road, had to use a locomotive and the regulation freight cars to transport the business from one destination to another, thus converting the road, for the time being, into a steam road. The express business was carried on through the day at schedule hours, electricity being the motive power.

Now that it is lawful for an electric road to carry freight, the Laurel line plans to extend its business vastly. The express business of the Quick Delivery Express will not be affected by the new law. The charter of the People's Street Railway had the right to carry freight, and it is on those lines that the Quick Delivery Express had confined its operations.

The House has passed the bill providing that courts can decree the forfeiture of the franchise of any public service corporation which does not fulfil its corporate functions.

The trolley eminent domain bill was favorably reported from the Senate railroads committee on April 30, and its final passage is now pretty well assured, although a final effort will be made by the Landowners' Association of Philadelphia to amend it before final passage. A large delegation of advocates of the measure appeared before the Senate committee, among the speakers being C. L. S. Tingley, Philadelphia; H. C. Reynolds, Scranton; Ex-Judge Richard H. Koch, of Pottsville; Thomas A. H. Hay, of Easton; J. C. McGinnis, of Frackville; Ex-Speaker Harry F. Walton and Hon. John H. Dow also spoke for the opponents of the measure as it was reported from committee.

The House has passed the bills providing that all trolley companies which accept the act of 1889 may become common carriers of freight, and requiring trolley companies to equip their cars with vestibules.

STREET RAILWAY PATENTS

[This department is conducted by Rosenbaum & Stockbridge, patent attorneys, 41 Park Row, New York.]

UNITED STATES PATENTS ISSUED FEB. 16, 1907

850,136. Amusement Riding Device; John A. Cole, Hackensack, N. J. App. filed Feb. 28, 1907. A pleasure railway in which the car is suspended. Two trolley wheels engage an inverted V-shaped track, the wheels being supported in journals connected with bands surrounding the car.

850,154. Car Mover; Randolph F. Hageman, New Madison, Ohio. App. filed Dec. 26, 1906. A block, shoe and lever produce a compound action when actuated.

850,157. Windo wfor Cars; William H. Heulings, Jr., Philadelphia, Pa. App. filed May 11, 1906. Means for locking the two sashes of a window together and storing in the roof of the car.

850,198. Rail-Joint; Benjamin Wolhaupter, New York, N. Y. App. filed July 12, 1906. A rail-joint having a side plate and a universally-reversible filler block co-operating therewith.

850,202. Slack Adjuster; Charles O. Anderson, Omaha, Neb. App. filed June 7, 1906. A slack adjuster for brake rigging consisting of two brake beams, one of which had an operating arm pivoted thereto, a clevis pivoted to the operating arm and connected to the second beam, a screw operating in the clevis and means for automatically operating the screw to take up the slack in the brake rigging.

850,294. Tramway Switch; Robert H. Carlisle, Covington, Ky. App. filed Jan. 4, 1907. The switch is held in either of its two positions by means of a leaf spring.

850,318. Street Railway Switch; Clarence A. Ridley, New Orleans, La. App. filed June 21, 1906. The switch is controlled by a lever pivoted in the roadbed in a suitable casing, which lever is engaged by a projection on an approaching car.

850,335. Brake Beam; James H. Baker, Allegheny, Pa. App. filed July 16, 1906. A compression member having a channel shape, a tension member passing through the web of the compression member at an angle to the axis of the latter, portions of the legs of the compression member adjacent to the ends being bent outwardly to such an angle that the rivets for securing the brake-shoe head to the compression member may be passed to position above the tension member while the latter is in position.

850,373. Railway Track Construction; Alphonse King, San Antonio, Tex. App. filed May 15, 1906. A composition rail-tie having transverse arches on its under side and having a metallic insert plate in the top for engaging the rails.

850,422. Hinge for Doors and Like Movable Objects; Oliver M. Edwards, Syracuse, N. Y. App. filed March 16, 1905. Details of construction of a hinge for the trap doors of vestibule cars.

850,436. Brake; Van Buren Lamb, New Haven, Conn. App. filed May 26, 1906. The brake-shoe is formed of two parts dovetailed together longitudinally.

850,511. Train Signaling System; James S. Anderson, Ames, Neb. App. filed May 29, 1906. Means whereby the accidental breaking of a train will be instantly reported to the engineer.

Has mechanical levers on the cars which hold one another in a relation to separate circuit closing contacts when the cars are connected.

850,542. Cross Tie; John William Peploe, Long Island City, N. Y. App. filed Aug. 30, 1906. The tie consists of a cement filled shell recessed for the reception of the rails and a fastening plate engaging the base of the rail and the top and sides of the tie.

850,564. Air Brake Mechanism; John J. Coit, Venice, Cal. App. filed Nov. 15, 1906. Provides an air-operated track brake which may be thrown into operation when more braking force is required than the ordinary brakes will provide.

850,604. Switch-Operating Device; Elton J. Rice, Spokane, Wash. App. filed Jan. 25, 1907. Electromagnets are carried at the ends of arms which may be swung from side to side so that the electromagnets will attract the switch point and move it to the desired position.

850,733. Block System; Fred. B. Corey, Schenectady, N. Y. App. filed Oct. 20, 1905. A block system for single-track roads operating on the "staff" system. Provides a system adapted to suburban trolley roads where cars pass in both directions in groups and where automatic devices dispensing with attendants are required.

850,790. Railway Safety Apparatus; George E. Ryan, New York, N. Y. App. filed Sept. 28, 1906. Devices spaced in the roadbed operate electrically to "block" the trains.

850,796. Trolley Stand and Pole; George Q. Seaman, New York, N. Y. App. filed March 26, 1906. The pole is provided with link connections by which it is impelled upward by a spring through an intermediate detent, and in case of sudden upward movement the detent is released to permit the pole to drop.

850,804. Appliance for Shifting the Point of Application of the Weight on the Trucks of Cars and the Like; Perry Steffee, Missoula, Mont. App. filed Sept. 11, 1906. Each truck is provided with an air cylinder having a piston therein which lifts the car when air is admitted, thereby throwing the weight of the car upon the other truck.

850,856. Automatic Slack Adjuster for Brakes; Edwin M. Swift, Ballard, Wash. App. filed Nov. 9, 1906. A slack adjuster mechanism having a ratchet supported for rotation in opposite directions, and mechanism for operating the ratchet including two fluid motors of relatively small and large cross-sectional area.

PERSONAL MENTION

MR. THOMAS WHINSTON PEEPLES, who was chief engineer of the Manhattan Elevated Railroad system for nearly a quarter of a century, is dead, at the age of 77.

MR. O. D. COLLINS, superintendent of the Home Gas & Electric Company, of Redlands, Cal., has resigned, to become superintendent of the Redlands & Yucaipe Electric Railroad, with which he has been connected as a director since the incorporation of the company.

MR. C. W. E. CLARKE, of Sargent & Lundy, of Chicago, has resigned as assistant engineer of that firm, with which he has been connected for the past five years, and has accepted the position of steam engineer in the electrical department of the New York Central & Hudson River Railroad at New York.

DR. F. EICHBERG, electrical engineer of the Allgemeine Elektricitäts-Gesellschaft, is in this country. Dr. Eichberg was the joint designer with Dr. G. Winter of the Eichberg-Winter single-phase motor, which has been described in these columns and has been adopted on a number of electric railways in Europe.

MR. CLARENCE P. HAYDEN, for five years superintendent of the Eastern division of the New Hampshire Traction Company, has been appointed superintendent of the Haverhill and Salem divisions of the company, to succeed Mr. Robert Dunbar, whose resignation was noted in the Street Railway Journal for April 27.

MR. LEONARD BELLAMY, of Liverpool, eldest son of the late Mr. C. R. Bellamy, the former general manager of the Liverpool tramways, has been appointed assistant manager of the Rangoon Electric Tramways Company, and will leave Liverpool early in May for the purpose of entering upon his new post. Mr. Bellamy accompanied his father on a trip to this country several years ago, and for some time has been assistant to the general manager of the Liverpool tramways.

MR. TOMAS TORRES, who recently resigned as subdirector of the general postoffice in Mexico City, has been appointed general manager of the Compania de Tranvias, Fuerza y Luz de Guadalajara, which is taking over the street railway and lighting and power holdings of La Electra and the Compania Industrial de Guadalajara.

MR. THOMAS TATE, chairman of the Victorian Railways, and well known in America because of his former connection with the Canadian Pacific Railroad, is on his way to London, where he will be commissioned to select the consulting engineer to advise him as to the most practical method of electrification of the Australia system. Some time ago the post was offered to Mr. B. J. Arnold, of Chicago, but his work in Chicago and for the New York Central, Erie and other interests, it is thought, will make it impossible for him to accept.

MR. CLEMENT C. SMITH, president of the Columbia Construction Company, of Milwaukee, Wis., has been elected a director in the Fidelity Trust Company of Milwaukee, and also president of the Citizens' Gas Company, of Kankakee, Ill., which has recently been purchased by a syndicate in which he is interested. Mr. Smith is also a director of the Sterling, Dixon & Eastern Electric Railway Company, and of the Lee County Lighting Company, which owns the water power and gas and electric light plants at Dixon, furnishing power to the electric railway, in both of which Mr. John I. Beggs is president. Mr. Smith is also secretary and treasurer of the Wisconsin Electric and Interurban Railway Association.

MR. S. C. COOPER has resigned as secretary of the Cincinnati Traction Company, because of continued ill health, due, it is believed, to the climate in Cincinnati. Mr. Cooper has held this office since the Cincinnati Traction Company took over the local lines six years ago. Previous to that he had been with Mr. Schoepf in connection with his properties in Baltimore, Washington and other places for about fifteen years. Mr. Walter Draper, secretary of the Zoological Garden in Cincinnati, has been chosen to succeed Mr. Cooper. Mr. Draper will become secretary of the Ohio Traction Company, the Cincinnati Car Company, the Southern Ohio Express Company and the Cincinnati Traction Company, positions which Mr. Cooper also held.

MR. WILLIAM J. JOHNSTON, publisher of the "American Exporter," died at his home in New York, April 28. Mr. Johnston was well known in the electrical field as publisher for many years of the "Electrical World." He was born in Ireland in 1853, and came to America in 1868. Shortly afterward he founded "The Operator," an electrical paper now known as "The Electrical World," and the first paper of its kind in this country. In 1899, Mr. Johnston sold his interests in "The Electrical World" to the McGraw Publishing Company. He then took a trip around the world. Later he purchased the "Engineering and Mining Journal," but sold it to the Hill Publishing Company. At the time of his death he was owner and publisher of the "American Exporter," a paper devoted largely to the South American trade. In the interests of this paper he went to South America with the party organized and headed by Secretary Root. The results of this trip, embodying Mr. Johnston's observations on South American trade, were given in a series of very interesting articles which recently appeared in his paper.

MR. C. F. BRYANT has resigned as auditor of the Connecticut Railway & Lighting Company, of Bridgeport, owing to the consolidation of that company with the Consolidated Railway Company, of New Haven. Mr. Bryant, who is second vice-president of the American Street & Interurban Railway Accountants' Association, was appointed auditor of the Connecticut Railway & Lighting Company in 1900, and has occupied that position since that time. Previous to 1900 he was traveling auditor of the United Gas Improvement Company, of Philadelphia, and it was while in that position that he was sent to Bridgeport to examine the accounts of the constituent companies which were subsequently organized by the United Gas Improvement Company, to constitute the Connecticut Railway & Lighting Company. Previous to his connection with the Philadelphia corporation he was secretary and treasurer of the Chicago Economic Fuel Gas Company, of Chicago. Mr. Bryant is now engaged on some special work for the American Street and Interurban Railway Association in connection with the committee on standardization.

TABLE OF OPERATING STATISTICS

Notice.—These statistics will be carefully revised from month to month, upon information received from the companies direct, or from official sources. The table should be used in connection with our Financial Supplement "American Street Railway Investments," which contains the annual operating reports to the ends of the various financial years. Similar statistics in regard to roads not reporting are solicited by the editors. * Including taxes. † Deficit. ‡ Including Rapid Ry. System, Sandwich, Windsor & Amherstburg Ry. and Detroit, Monroe & Toledo Short Line Ry.

Company.	Period.	Total Gross Earnings.	Operating Expenses.	Net Earnings.	Deductions From Income.	Net Income, Amount Available for Dividends.
AKRON, O. Northern Ohio Tr. & Light Co.	1m., Feb., '07	116,858	72,711	44,148	41,400	2,747
	1 " " '06	106,472	68,931	37,542	39,947	†2,405
	1 " Mar., '07	133,834	83,215	50,619	41,290	9,329
	1 " " '06	113,168	78,586	34,582	39,947	†5,365
	3 " " '07	375,883	235,507	140,376	124,029	16,346
	3 " " '06	334,608	224,373	110,235	119,841	†9,606
BINGHAMTON, N. Y. Binghamton Railway Co.	1m., Feb., '07	20,229	13,816	6,413	8,031	†1,618
	1 " " '06	19,364	11,881	7,483	7,372	111
	1 " Mar., '07	23,338	13,103	10,235	8,178	2,057
	1 " " '06	21,567	11,750	9,816	7,437	2,380
	9 " " '07	228,749	123,872	104,877	70,468	34,409
	9 " " '06	214,938	111,851	103,087	65,573	37,514
CHARLESTON, S. C. Charleston Consolidated Ry., Gas & Elec. Co.	1m., Mar., '07	56,135	37,129	19,006	13,517	5,489
	1 " " '06	51,841	31,833	20,008	12,967	7,041
CHICAGO, ILL. Aurora Elgin & Chicago Ry. Co.	1m., Feb., '07	86,940	53,809	33,131	27,131	6,000
	1 " " '06	75,611	47,246	28,365	24,106	4,260
	1 " Mar., '07	101,354	57,653	43,701	26,992	16,709
	1 " " '06	82,090	55,355	26,735	24,106	2,629
	9 " " '07	978,043	531,460	446,582	237,310	209,273
	9 " " '06	870,152	477,870	392,282	219,201	173,081
Chicago & Milwaukee Elec. R.R. Co.	1m., Mar., '07	64,114	32,401	31,713	......	......
	1 " " '06	40,453	22,219	18,234	......	......
	3 " " '07	179,523	95,440	84,083	......	......
	3 " " '06	120,490	65,963	54,527	......	......
CLEVELAND, O. Cleveland, Painesville & Eastern R.R. Co.	1m., Mar., '07	18,585	*9,948	8,638	7,213	1,425
	1 " " '06	15,450	*9,869	5,581	6,842	†1,261
	3 " " '07	52,073	*30,140	21,932	21,638	294
	3 " " '06	45,238	*27,585	17,653	20,200	†2,546
Cleveland Southwestern & Columbus Ry. Co.	1m., Mar., '07	51,374	30,692	20,682	......	......
	1 " " '06	42,321	27,311	15,010	......	......
	3 " " '07	145,639	89,119	56,520	......	......
	3 " " '06	128,604	81,839	46,765	......	......
DALLAS, TEX. Dallas Elec. Corp'n.	1m., Feb., '07	78,073	*64,151	13,922	16,647	†2,725
	1 " " '06	69,195	*51,247	17,948	14,875	3,073
	12 " " '07	1,041,010	*731,857	309,153	189,029	120,124
	12 " " '06	956,436	*590,676	365,760	182,281	183,479
DETROIT, MICH. ‡Detroit United Ry. Co.	1m., Feb., '07	443,731	*307,887	135,844	108,336	27,508
	1 " " '06	379,334	*234,319	145,015	92,296	52,719
	1 " Mar., '07	520,402	*321,953	198,449	116,239	82,210
	1 " " '06	449,282	*275,530	173,752	103,775	69,977
	3 " " '07	1,451,351	*941,542	509,809	332,677	177,132
	3 " " '06	1,246,449	*760,084	486,365	288,314	198,051
Detroit, Jackson & Chicago Ry.	1m., Mar., '07	33,278	*26,020	7,258	15,012	†7,754
	2 " " '07	60,473	*47,965	12,508	30,025	†17,517
DULUTH, MINN. Duluth St. Ry. Co.	1m., Feb., '07	52,857	32,903	19,954	17,529	2,425
	1 " " '06	50,348	29,722	20,626	17,450	3,176
	2 " " '07	112,341	66,506	45,835	35,104	10,731
	2 " " '06	104,772	63,444	41,328	34,986	6,342
EL PASO, TEX. El Paso Electric Co.	1m., Feb., '07	36,559	*29,967	6,592	4,564	2,027
	1 " " '06	27,797	*18,537	9,260	3,759	5,502
	12 " " '07	410,114	*296,782	113,332	48,741	64,591
	12 " " '06	298,377	*199,810	98,567	44,034	54,533
FT. WAYNE, IND. Ft. Wayne & Wabash Valley Tr. Co.	1m., Feb., '07	83,340	52,270	31,070	......	......
	1 " " '06	71,951	44,528	27,423	......	......
	2 " " '07	174,518	107,065	67,453	......	......
	2 " " '06	152,096	92,259	59,837	......	......
FT. WORTH, TEX. Northern Texas Tr. Co.	1m., Feb., '07	67,292	*45,558	21,735	10,300	11,435
	1 " " '06	49,566	*35,124	14,441	9,942	4,499
	12 " " '07	893,280	*567,295	325,985	120,137	205,848
	12 " " '06	683,605	*410,457	273,148	120,425	152,723
GALVESTON, TEX. Galveston Elec. Co.	1m., Feb., '07	23,437	*15,403	8,034	4,167	3,867
	1 " " '06	18,300	*13,706	4,594	4,167	427
	12 " " '07	326,471	*195,750	130,721	50,000	80,721
	12 " " '06	271,612	*177,718	93,894	46,667	47,227
HOUGHTON, MICH. Houghton County St. Ry. Co.	1m., Feb., '07	15,205	*13,243	1,962	3,877	†1,915
	1 " " '06	13,677	*12,676	1,001	3,824	†2,824
	12 " " '07	231,886	*149,113	82,773	47,089	35,683
	12 " " '06	167,757	*167,588	168	44,571	†44,402
HOUSTON, TEX. Houston Electric Co.	1m., Feb., '07	45,278	*31,046	14,232	8,021	6,212
	1 " " '06	39,269	*27,811	11,458	7,729	3,729
	12 " " '07	604,377	*386,072	218,305	93,233	125,073
	12 " " '06	534,170	*329,146	205,025	104,522	100,503
KANSAS CITY, MO. Kansas City Ry. & Lt. Co.	1m., Feb., '07	423,509	230,314	193,195	146,877	46,319
	1 " " '06	386,752	215,365	171,387	133,969	37,417
	9 " " '07	4,275,152	2,127,054	2,148,097	1,312,011	836,086
	9 " " '06	3,858,120	1,903,922	1,954,198	1,229,155	725,043
MANILA, P. I. Manila Elec. R.R. & Ltg. Corp'n.	1m., Jan., '07	78,000	39,750	38,250	......	......
	1 " Feb., '07	73,000	36,250	36,750	......	......
	1 " Mar., '07	78,000	37,750	40,250	......	......
	3 " " '07	229,000	113,750	115,250	......	......
	3 " " '06	220,880	114,339	106,541	......	......
MILWAUKEE, WIS. Milwaukee Elec. Ry. & Lt. Co.	1m., Mar., '07	309,154	155,998	153,156	95,751	57,405
	1 " " '06	277,476	140,030	137,446	89,017	48,429
	3 " " '07	902,589	469,311	433,278	280,267	153,012
	3 " " '06	812,834	405,948	406,886	259,328	147,558
Milwaukee Lt., Ht. & Tr. Co.	1m., Mar., '07	54,273	25,395	28,878	30,509	†1,631
	1 " " '06	44,854	19,561	25,292	24,503	790
	3 " " '07	156,484	78,455	78,029	90,147	†12,118
	3 " " '06	130,641	57,309	73,332	68,193	5,138
MINNEAPOLIS, MINN. Twin City R. T. Co.	1m., Feb., '07	419,802	217,468	202,334	115,258	87,076
	1 " " '06	380,385	188,843	191,542	109,708	81,834
	1 " Mar., '07	479,301	233,731	245,570	115,258	130,312
	1 " " '06	418,250	198,056	220,194	109,708	110,486
	3 " " '07	1,355,941	694,297	661,644	345,775	315,869
	3 " " '06	1,206,501	592,418	614,082	329,125	284,957
MONTREAL, CAN. Montreal St. Ry. Co.	1m., Feb., '07	243,468	182,275	61,193	36,493	24,699
	1 " " '06	213,416	156,039	57,377	36,124	21,253
	1 " Mar., '07	271,588	185,461	86,127	43,212	42,915
	1 " " '06	235,307	156,458	78,848	39,663	39,185
	6 " " '07	1,599,048	1,073,657	525,391	238,878	286,513
	6 " " '06	1,406,322	928,632	477,691	178,625	299,066
NORFOLK, VA. Norfolk & Portsmouth Tr. Co.	1m., Feb., '07	128,558	91,154	37,404	......	......
	1 " " '06	116,941	73,950	42,991	......	......
	2 " " '07	280,578	187,941	92,636	......	......
	2 " " '06	243,600	156,370	87,230	......	......
PHILADELPHIA, PA. American Rys. Co.	1m., Mar., '07	227,144	......	......	......	......
	1 " " '06	196,000	......	......	......	......
	9 " " '07	2,121,660	......	......	......	......
	9 " " '06	1,933,651	......	......	......	......
PLYMOUTH, MASS. Brockton & Plymouth St. Ry. Co.	1m., Feb., '07	5,485	*5,471	14	1,796	†1,782
	1 " " '06	5,401	*5,166	236	1,864	†1,628
	12 " " '07	112,318	*71,240	41,078	21,773	19,304
	12 " " '06	103,487	*71,312	32,175	21,257	10,917
ST. LOUIS MO. United Railways Co. of St. Louis	1m., Mar., '07	903,145	*596,247	306,898	230,868	76,030
	1 " " '06	790,838	*521,329	269,509	231,475	38,034
	3 " " '07	2,494,162	*1,722,595	771,567	693,734	77,833
	3 " " '06	2,286,291	*1,475,738	810,553	695,521	115,032
SAVANNAH, GA. Savannah Electric Co.	1m., Feb., '07	43,947	*28,223	15,724	11,335	4,389
	1 " " '06	45,821	*29,247	16,574	10,904	5,670
	12 " " '07	605,165	*376,772	228,393	135,675	92,719
	12 " " '06	600,844	*359,854	240,991	128,395	112,595
SCHENECTADY, N. Y. Schenectady Ry. Co.	3m., Mar., '07	231,989	182,494	49,495	29,881	19,614
	3 " " '06	192,802	140,925	51,877	55,056	†3,179
SYRACUSE, N. Y. Syracuse R. T. Co.	1m., Mar., '07	102,141	56,998	45,143	25,185	19,958
	1 " " '06	88,220	50,364	37,856	22,386	15,470
	3 " " '07	289,798	162,253	127,545	74,904	52,641
	3 " " '06	253,630	144,304	109,326	66,236	43,090
TAMPA, FLA. Tampa Elec. Co.	1m., Feb., '07	38,693	*29,375	9,318	994	8,323
	1 " " '06	35,873	*19,322	16,551	......	16,551
	12 " " '07	478,196	*300,754	177,442	3,378	174,064
	12 " " '06	423,746	*239,561	184,186	17,928	166,258
TERRE HAUTE, IND. Terre Haute Tr. & Lt. Co.	1m., Feb., '07	69,081	*45,375	23,706	15,207	8,499
	1 " " '06	54,902	*36,196	18,706	12,632	6,074
	12 " " '07	853,982	*489,226	364,756	167,213	197,542
	12 " " '06	657,500	*428,978	228,522	127,408	101,114
TOLEDO, O. Toledo Rys. & Lt. Co.	1m., Feb., '07	153,744	*89,618	64,126	45,207	18,919
	1 " " '06	142,811	*75,165	67,646	42,304	25,342
	1 " Mar., '07	171,988	*97,065	74,923	45,337	29,586
	1 " " '06	158,285	*84,702	73,583	42,200	31,383
	3 " " '07	496,417	*285,722	210,695	134,731	75,964
	3 " " '06	460,147	*243,016	217,131	126,794	90,337

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CHANGE OF ADDRESS.—The old address should be given, as well as the new, and notice should be received a week in advance of the desired change.

BACK COPIES.—No copies of issues prior to September, 1904, are kept on sale, except in bound volumes.

DATE ON WRAPPER shows the month at the end of which the subscription expires. The sending of remittances for renewal prior to that date will be much appreciated by the publishers.

NOTICE TO ADVERTISERS

Changes of advertising copy should reach this office by 10 a. m. Monday preceding the date of publication, except the first issue of the month, for which changes of copy should be received two weeks prior to publication date. New advertisements for any issue will be accepted up to noon of Tuesday for the paper dated the following Saturday.

Of this issue of the Street Railway Journal, 8200 copies are printed. Total circulation for 1907 to date, 155,350 copies, an average of 8176 copies per week.

Electric Track Switches in Interurban Service

The automatic electric track switch has come into such wide use on city routes where the traffic is heavy that it is pertinent to inquire whether in some cases interurban lines cannot profitably consider the adoption of this means of reducing delays at intersecting points on certain parts of the routes traversed by through cars. Branch line service on interurban systems is not, as a rule, conducted by deflecting main line cars from trunk routes; the headway between cars is much greater than that encountered on most urban lines, and the extensive use of switch types common to steam railroad practice does not encourage the development of semi-automatic switch mechanism except in layouts where interlocking apparatus is justified. Hence there is little apparent need of the electric track switch, either in its usual or a more specialized form, on purely interurban track at the present time.

In the city sections of interurban runs the conditions are entirely different. As through electric railway practice broadens in scope, the need of reducing all delays to the lowest possible amount becomes absolutely essential to first-class service. It is unfortunately the case, in many instances, that a very high percentage of the total running time of interurban cars between terminals is wasted in delays in the city streets at the ends of the routes. Many of these delays cannot be avoided, but others can be eliminated to a large extent by giving the through car the right of way over the following or intersecting local, and by providing for a clear run without a single preventable stop being made. Valuable time is often consumed by obliging through car crews to stop and set track switches by hand in leaving the city streets or in passing branch tracks in urban territory. Electric track switches at these points will frequently well repay their cost. It may not seem that these extra stops are important, but they are loose ends in the operating scheme and have a direct connection with the tediousness or comfort of a busy man's trip.

Why Rapid Transit Failed

A critical study recently made of a regular interurban run of 14 miles between terminals over a double-track road in the East, suggests a number of points of interest to companies endeavoring to furnish high-speed service in well populated territory. The car was equipped with four motors, capable of attaining a maximum speed of about 35 m. p. h.; the schedule time over the route was 1 hour and 15 minutes, and the trip was taken in the middle of the forenoon when traffic was light. As is frequently the case in the East, only a small part of the run, possibly 4 miles, was made on a private right of way, the balance of the route being in the public streets and roads. The car was operated in strictly urban territory about 40 minutes of the total running time.

In the run of 14 miles, which was made on schedule time, the total number of full stops made by the car was forty-one, the average being about three stops per mile. Numerous slow-downs were also noted, and the total time consumed by all the stops was 6 minutes 42 seconds, or 9.05 per cent of the schedule. Only once in the entire trip did the car attain the full speed of which its motors were capable. The streets were not congested with general travel, with the ex-

ception of about 3 miles of track in the terminal city where the car started. These 3 miles were covered in 15 minutes.

The company fulfilled its promised schedule; carried its passengers comfortably to their destinations at from 50 to 60 per cent of the fares charged by a competing steam line, yet, rapid transit, as made possible by a costly equipment in roadbed, rolling stock and motive power, failed. The equipment was not utilized to anything like its full capacity, and the schedule speed which resulted—11.2 m. p. h.—was rightly deemed unworthy of the possibilities of modern electric railway engineering.

The reason why better time was not made on this run was clearly due to two fundamental obstacles—the large number of stops and slow-downs, and the failure of the company to insist on sharp, clean service at points where slow movement was necessary. The longest period of running without a stop was one of 7 minutes, a second like period of 6 minutes being noted. The average length of stop, 9.8 seconds, was doubtless held at this minimum by the use of pneumatic doors at each vestibule, controlled by the motorman. The stops were too close together for the best service; in one case the car came to a standstill just before passing over a switch leading to a branch route, accelerated to a speed of 5 or 6 m. p. h. and stopped again on the other side of the switch to receive passengers. Obviously the white post should have been located in advance of the switch to avoid the double delay. On the last half mile of the run, which was a single track in a narrow street, a double stop, aggregating 2 minutes 48 seconds, was made on a turnout to allow a local car to pass, so that the through passengers, anxious to reach the end of their journey, were held up an undue time.

It is pertinent to inquire the advantage of making better time on such a road, which is inherently a great addition to the transportation facilities of the territory served. The nub of the whole question is the effective competition of the steam road. There is no doubt that many patrons make the journey by steam because of the slow schedule of the electric line, which might recapture a good share of the traffic if the equipment were properly forced over the road. The extra fare of 15 cents required on the steam line is an insignificant matter to the average business man, and if a limited service on a 45-minute schedule were put in effect by the electric road there is little doubt that it would be patronized to a much greater extent.

Public Service as a Public Trust

The address of President Hadley at the dedication of the United Engineering Societies' Building, of which we printed some extracts at the time, but which appears in its entirety in the Transactions of the American Institute of Electrical Engineers, is worthy of careful reading. Dr. Hadley points out that the old ideas of a dominant professional class, following upon the ruder days when there was a dominant military class, has in these more peaceful times of rushing industry given place to an appreciation of active achievement, so that at last the engineer had begun to come into his own. More than this, he must accept the obligations which come from this condition—obligations to society which cannot be shunned. The successful engineer leaves behind him enduring monuments in benefits conferred upon his fellowmen. It is a cheering sign of the times when one realizes the civic awakening that has come out of times too often condemned as wholly sordid. An era of great industrial prosperity seems sometimes, at first thought, to choke idealism and foster social decline; yet one must remember that, historically, there is scant evidence to support this depressing conception. In early centuries there were no periods more filled with healthy commercial activity than the "Golden Age" of Augustus Cæsar and the time of the Italian Renaissance. Yet these were precisely the times when there was also splendid intellectual and artistic achievement. Similarly, later in the age of Elizabeth, with its awakened world-commerce, came the greatest day of England's intellectual progress prior to the nineteenth century.

Perhaps the fact is that with general prosperity, attained sometimes as it may be by selfish means for selfish ends, there yet comes a lifting of humanity out of the grinding struggle for existence that gives at last a chance for better things. Certain it is that within the last few years there has been a great quickening of the civic spirit, an awakening of devotion to the common good, that is the most cheering sign of the century begun. And we cannot refrain from noting the feeling of responsibility to mankind that shows itself among those who are conducting public enterprises. In spite of great combinations of capital, sometimes improperly used, there is daily growing among those whose relations are with the public a feeling that they have public duties to perform. In our own street railway field, often criticised, as it is, we can see a gradual evolution of the idea of public duty, looking away from the railroad as a purely private enterprise toward the conception of it as in some sense a public trust. No other business comes into so intimate touch with so many people, and through recent years there has certainly been a far quicker response to their needs than ever before. Their needs indeed are greater and not so easily satisfied as once they were, hence the necessity for greater activity; but there is a growing spirit of public service that is certainly making itself felt. One does not have to go back many years to find railways wrangling in utter disregard of the effect of their bickerings upon public needs. To-day they are apt quickly to sink dissensions and get to work. Call the motives selfish if you like, or charge it all to the gathering force of public opinion, the fact is that the change has come and every year makes it more evident. In one way or another it is part of a growing commercial feeling which makes for a better civic life and for larger achievements in the growth of civilization.

A like sentiment is expressed in the report of the committee on municipal ownership which was presented at the Columbus Convention, but has only just been made public. Where President Hadley traced the development of the engineering and ethical ideal through its history, the committee, of which Mr. Charles D. Wyman, of Boston, is the chairman, discusses the much briefer history of public service corporations and their arrival at the goal presented by the maxim that a public service is a public trust. For many reasons, which the report fully discusses, it is most inadvisable to place the operation of a large public service in the hands of the municipalities; but if the cor-

poration receives the cordial co-operation of the authorities in its efforts to improve its service and then administers this service in the modern spirit described in the address and report mentioned, the most satisfactory results should be secured.

The Cleveland Situation

From the people's standpoint the street railway situation in Cleveland has assumed an alarming phase. On two of the main arteries service has been entirely suspended, and, owing to difference of opinion as to the validity of franchises granted the Forest City Railway Company and the Low Fare Railway Company, together with the determined fight of the Cleveland Electric for a renewal, a long legal battle will probably precede a resumption of traffic, no matter which side is finally declared the victor. Franchises of the old company on several other lines will expire next spring and the matter will probably become more complicated than ever.

This condition has been brought about through a plank in Tom L. Johnson's original Mayoralty campaign to secure a three-cent fare for the people of Cleveland. Although he had been an operator of electric railways on a large scale, he claimed that the local system could be operated on this basis, and has adhered to the point, notwithstanding the fact that the Cleveland Electric Railway Company has spent large sums of money in demonstrating to him that a good service, with plenty of first-class cars, cannot be maintained at that rate with sufficient margin to induce people to purchase the securities. For several years this argument has been kept up between the company and the Mayor, with tests of the zone idea and the six-for-a-quarter plan, but none of them seemed to convince Mr. Johnson that the company should not come down to flat three cents.

Finally, as a means of bringing the company to terms, the Forest City Railway Company was organized under the guiding hand of the Mayor with three-cent fares as its basis, and about 11 miles of track have been constructed and put into operation. However, it apparently commences at no place and ends at no place, the cars now reaching the center of the city over the Cleveland Electric's tracks. The Forest City Railway Company was attacked by the Cleveland Electric forces on the ground that Mayor Johnson is financially interested in it. This suit is still pending in the courts, but to get around a possible adverse decision, the Low Fare Railway Company was organized and given grants around the Erie Street cemetery on the East Side, with the right to apply for extensions anywhere and everywhere. This has been dubbed the "graveyard" company, owing to the fact that all construction so far has been in the vicinity of the cemetery, and, in fact, a number of poles have been set within the enclosure of the resting place of the dead. A track has been laid to connect with the Euclid Avenue line of the Cleveland Electric, but actual connection has been held up under an injunction on the ground that the company must have the consents of the property owners on Euclid Avenue to operate its cars.

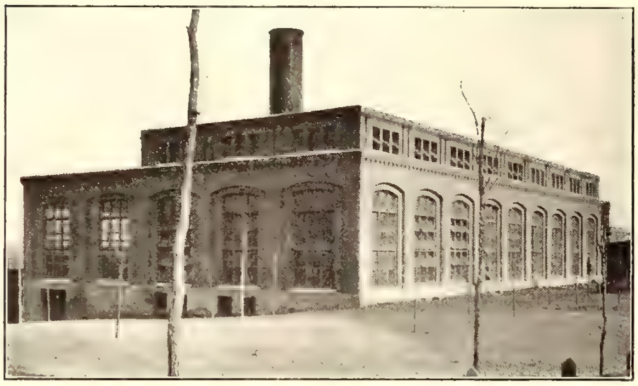
Grants were given the Forest City Railway Company to operate on Central Avenue and Quincy Street before the decision of the United States Supreme Court was rendered declaring the franchises of the old company had expired, the City Council assuming that this was true; but since the "financial interest" suit was instituted there has been a hesitancy on the part of the company to press its claims, the city administration apparently feeling that the grants would not stand the investigation of the courts. Within the past week, therefore, a franchise ordinance for the Low Fare Railway Company has been railroaded through the Council for Central Avenue and Quincy Street, notwithstanding the fact that all but two Councilmen representing that territory fought against the measure and a petition containing 4000 names of people affected was presented, asking that the franchise of the old company be renewed.

This has not been a fight of one corporation against another for the ascendency, but of Mayor Johnson and the Council, which is under his control, against the Cleveland Electric Railway Company. It has been a war in which all the machinery of a great city has been brought to bear against a company because it would not meekly obey the behests of Mr. Johnson, who has proved himself first, last and all the time a politician, although ostensibly fighting for the rights of the people. If the latter idea was the one aim of his administration, great honor would be due him as a reformer and a philanthropist; but that this is not true is shown both by the fact that he absolutely refused to consider the offer of the old company to sell seven tickets for a quarter, when the proposition would have been perfectly satisfactory to the people, and again refused to consider the lease of the property of the Cleveland Electric to a holding company when he was asked to guarantee that the fare inside the city limits would never be more than three cents and five cents outside. To be sure, he afterward recanted on this proposition, but not until the Cleveland Electric had once and for all called negotiations with the proposed holding company off. To cap the climax here, he endeavored to place the responsibility of failure to lease upon the shoulders of the Cleveland Electric officers.

The better class of people in Cleveland do not feel that Mayor Johnson is sincere in his efforts to secure a three-cent fare or that he is consistent in his negotiations with the old company. He acts and talks as if the whole business is with him, as the representative of the city, and that no proposition must be considered unless it exactly accords with his ideas. He refused to accept the offer of seven tickets for a quarter, when it is a better rate than is enjoyed in any other city of the size in the country. He wanted to limit the reduced fare to the city boundaries and thus enforce congestion in the poor districts of the city, with its resultant suffering and demoralization, while there is plenty of good territory and fresh air in the districts reached by the various lines of the old company. His ideas are at variance with what appears to most people to be really for the good of the city. People are growing tired of the fight, as they did in Chicago. They see the stubbornness of Mr. Johnson as well as the decision of the old company to protect its interests, and it is believed that he is losing ground. The settlement, apparently, must come through an arbitration, as the Cleveland Electric has offered, or at the polls this fall.

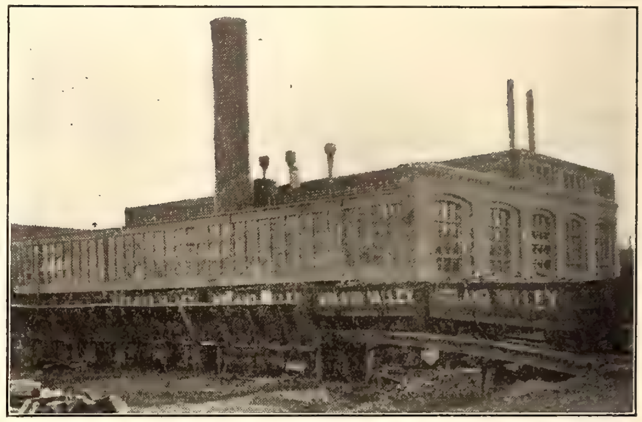
THE POWER STATION OF THE LITTLE ROCK RAILWAY & ELECTRIC COMPANY

In general design and in many details the power station of the Little Rock Railway & Electric Company departs considerably from the usual type of modern power station. This station was completed about two years ago to take the place of one in which the generators were located on the floor above the boilers. The notable features of the plant are the provisions for light and ventilation in the construction of the building, the vertical loop system of the main steam and of the main feeder headers and the cylinder lubricating system. The station is located a few blocks west of the business portion of Little Rock. Surrounding the building on three sides is a plot of ground about 100 ft. wide, kept in grass and planted with trees and flowers. In the rear is a coal switch.

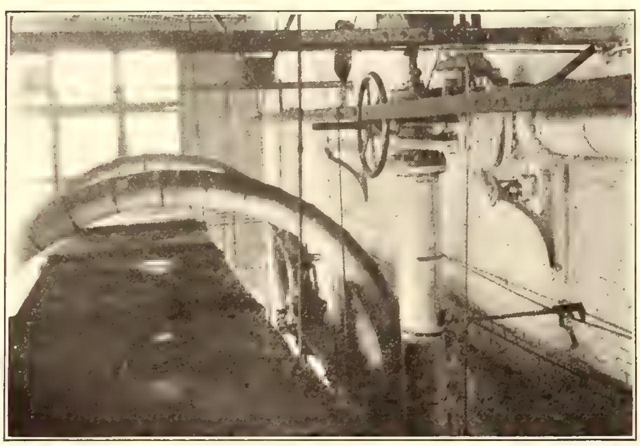


FRONT VIEW OF THE LITTLE ROCK POWER PLANT

The building is a brick and steel structure, with concrete foundations which are carried up to the window openings, steel roof trusses and tile roofs. The appearance of the exterior of the building is heightened considerably by the salmon-colored brick with which the walls are faced. The size and number of the window openings are particularly noticeable. All of the windows are provided with attachments for swinging them open. The rear side of the building may be opened completely. Kinnear rolling steel doors with steel columns between them form the lower portion of the rear wall, and the upper portion is made up entirely of windows which may be swung open. Further provision for ventilation is made by slat ventilators placed in the roof over the boiler room. The upper tier of windows in the engine room are just under the roof and consequently no ventilators are required in this room. The building is 165 ft. long and 110 ft. 4 ins. wide. The boiler room in the rear, which is 46 ft. wide, is constructed with its floor level 15 ft. 6 ins. below that of the engine room. Under the entire engine room is a basement with its floor level 10 ft. below that of the main floor. All of the condenser apparatus is located in a pit under the engine room, the floor of the pit being 16 ft. below the boiler room floor and 31 ft. 6 ins. below that of the engine room. The station is not built on the "unit plan," yet the loop system of boiler feed mains and main steam headers and the installation of duplicate condenser apparatus permits, with the exception of the use of one stack, independent operation of the two halves of the plant.



REAR OF STATION, SHOWING COAL TRACKS AND BINS UNDER THEM



EAST END OF THE VERTICAL LOOP. BOILER MAINS PASSING OVER BREECHING AND ENGINE MAIN DESCENDING FROM UPPER LINE OF LOOP

BOILER ROOM, SHOWING THE ROLLING STEEL DOORS AND METHOD OF FEEDING

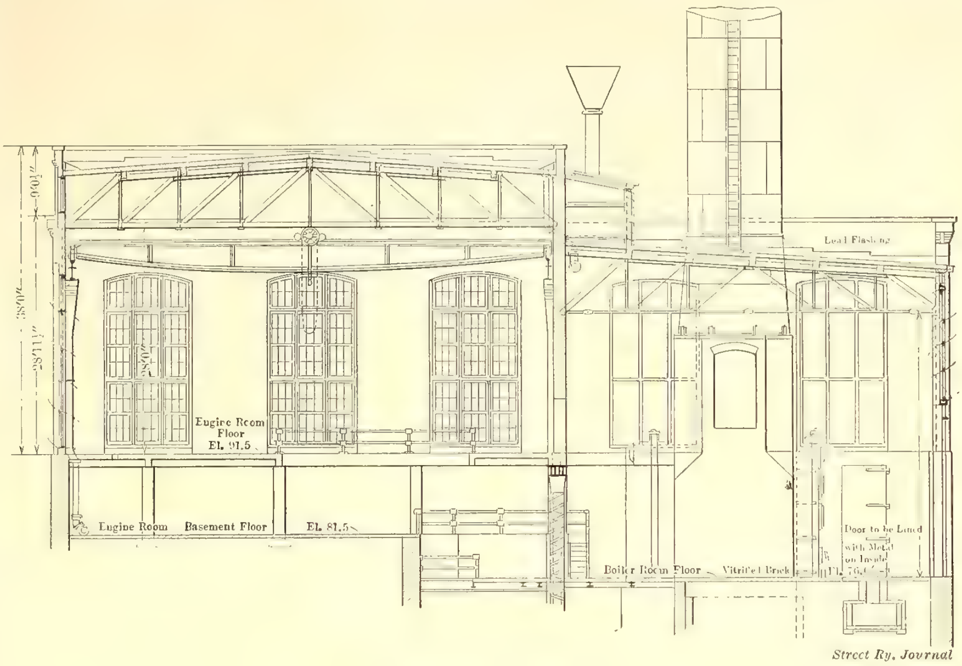
BOILERS

The boiler equipment consists of eight 550-hp hand-fired Aultman & Taylor water-tube boilers installed in four separate batteries. Three of the boilers are provided with Foster superheaters, but in the remainder no provision for superheating is made. One stack into which the breech-

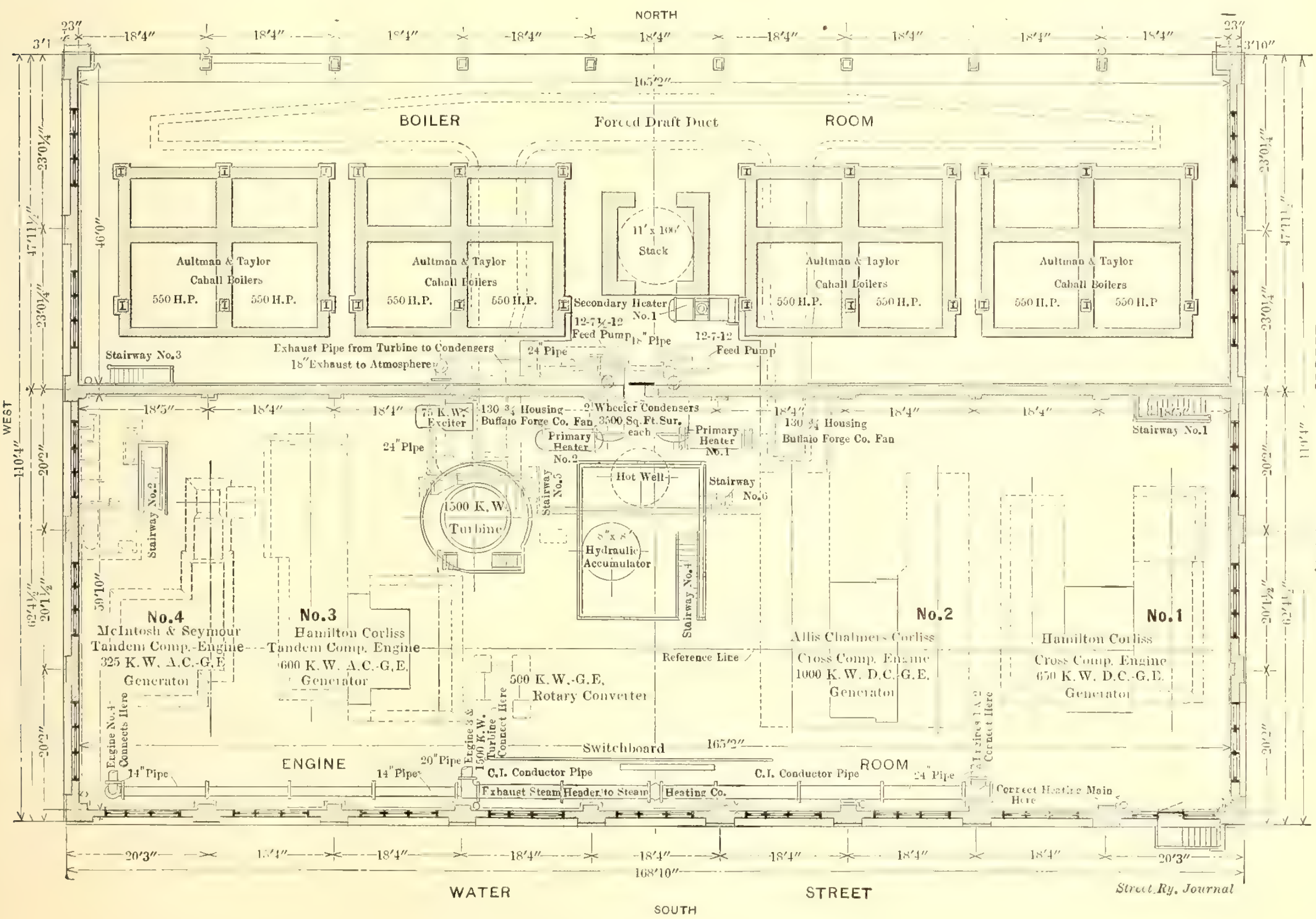
ings from all the boilers are carried is located between the two central batteries. The stack proper, which rests on a brick stub 30 ft. high, is of steel, 11 ft. in diameter and 70 ft. high, and has inside a 4-in. brick lining. The top of the stack is only about 100 ft. above the boiler room floor, the unusually low height being due to the fact that the boilers are provided with forced draft.

A forced-draught duct built of concrete extends under the floor in front of all of the boilers. This is connected to two lateral ducts each of which leads to a 130-in. steam-driven Buffalo Forge Company fan installed in the engine room basement. Forced draft is used only when the boilers are heavily loaded.

The switch track already mentioned as running along the rear side of the building has under it a wood hopper. Coal unloaded from the cars falls just outside the rolling steel



TRANSVERSE SECTION



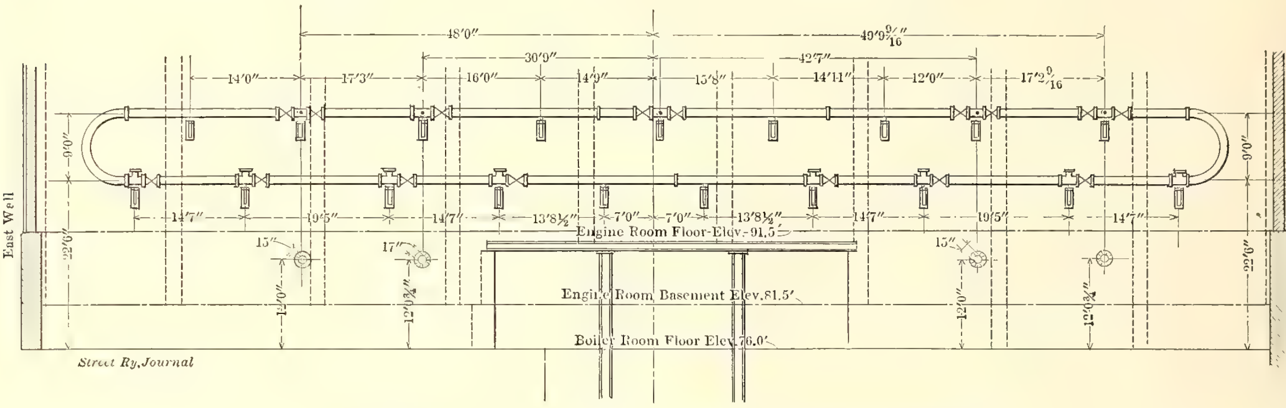
PLAN OF LITTLE ROCK POWER HOUSE

doors of the boiler room and is wheeled into the boiler room in barrows. The loop system of the boiler feed mains has already been referred to. From a 14-in. x 9-in. x 18-in. Blake duplex outside-packed plunger pump, installed on the boiler room floor behind the smoke stack, a 4-in. feed main is carried under the floor just in front of all of the boilers. A similar feed line from a similar pump runs just above the front of the boilers. At each battery the two feed lines are connected by a 3-in. riser. The feed line for the three drums of each boiler is taken off this riser between two globe valves in the riser. This arrangement permits feeding any or all of the boilers from either or both of the pumps.

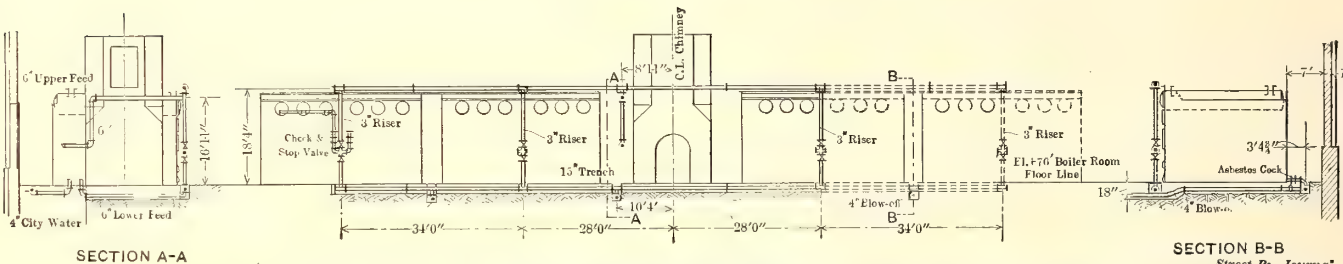
MAIN STEAM HEADER

The vertical loop system of the main steam headers consists of two lines of 10-in. pipe placed one above the other with centers 9 ft. apart and connected to each other at both ends by return bends. The boilers feed into the lower section of the loop and the mains to the engines are taken

turbine exciter set. The two direct-current units consist of an Allis-Chalmers Corliss cross-compound engine driving a 1000-kw, 600-volt General Electric generator. The other units include the turbo-generator, a Hamilton-Corliss engine driving a 600-kw generator, and a McIntosh-Seymour engine connected to a 325-kw generator. Both of these

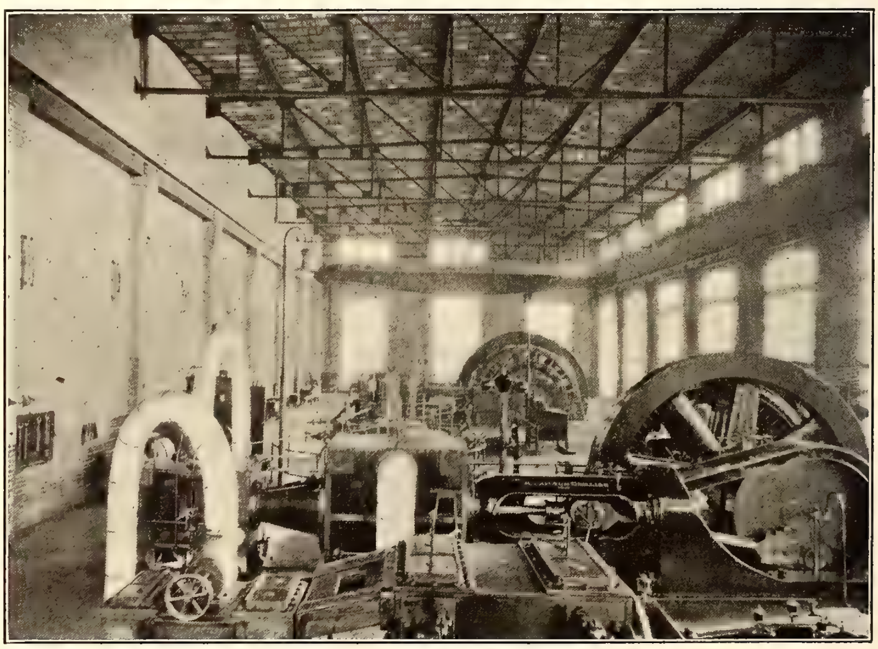


VERTICAL LOOP SYSTEM OF THE MAIN STEAM HEADER



ELEVATION AND SECTIONS OF FEED-WATER AND BLOW OFF PIPE LINES

off from the upper line. Between each boiler main a gate valve is placed in the main header and each engine main is taken off the header between two valves. The location of the valves it may be seen necessitates only one boiler being cut out in case of derangement to the lower portion of the header, and it would be possible to remove or repair sections of the upper portion of the header without shutting down any of the engines or boilers. All of the heavy piping connected to the main headers is made with long sweeping steel bends. The boiler mains make a semi-circular bend over the boiler breeching, while the engine mains drop down from the steam headers almost to the floor, pass horizontally through the adjacent wall and then each is carried up through the engine room floor and to its engine by a 90-deg. and a 180-deg. bend. The main to the turbine, however, does not come above the engine room floor. Although the manner in which steam is taken from the headers reduces the liability of entrained moisture being carried over with the steam, separators are placed in each engine main at the lowest point. The lower header drains into a 2-in. drip main not provided with steam traps, and the drip is returned through the feed pumps to the boilers.



GENERAL VIEW OF ENGINE ROOM, LOOKING EAST

GENERATING UNITS

The engine room contains five generating units having a total capacity of 4075 kw, a 500-kw rotary converter and a

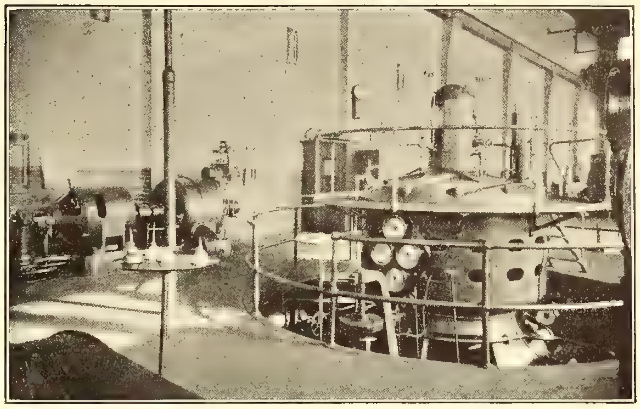
engines were used in the old power house of the company and are of tandem compound type, while both generators are General Electric 60-cycle, three-phase machines. An additional 1500-kw turbo-generator will be installed in the station during the coming year. All of the a. c. machines are excited from the 75-kw turbo-generator exciter set previously referred to. The rotary converter is used either as an a. c. or a d. c. machine. After midnight the a. c. machines are usually shut down and the lighting load is car-

ried through the converter by the railway generators. At other times the rotary converter furnishes power from the a. c. generators to the railway circuits.

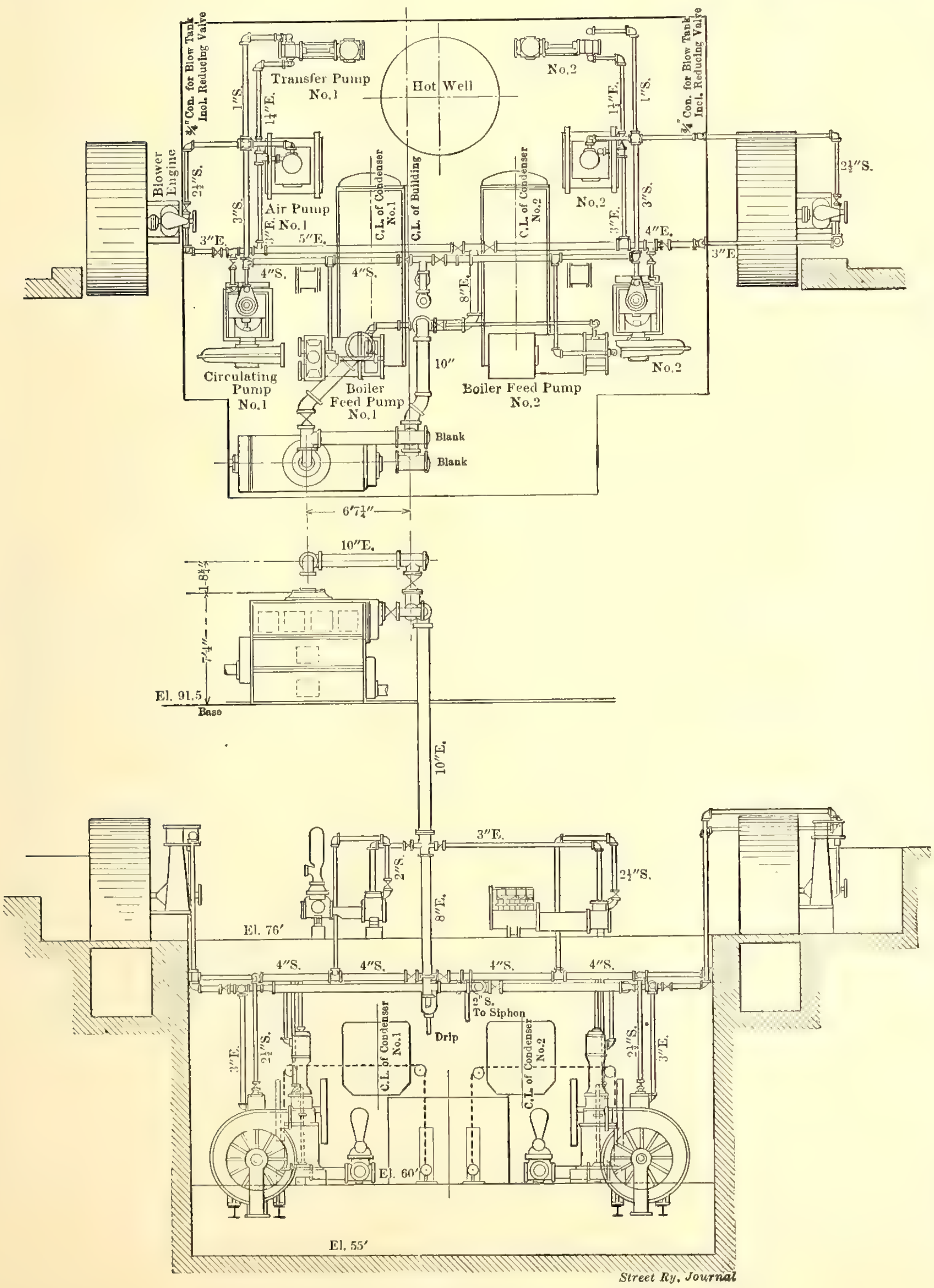
The hydraulic accumulator for the turbine step bearing flotation system extends from its foundation in the basement up through a large square opening in the engine room floor. The cylinder is weighted with 12 cu. yds. of sand retained in a cylindrical receptacle 8 ft. 8 ins. in diameter and 7 ft. deep. Pressure is maintained in the accumulator by two Worthington duplex 7½-in. x 2-in. x 6-in. pumps. The engines exhaust either into condensers or into a 24-in. main connected with a city heating plant. The company has a contract with the heating company whereby exhaust steam is furnished to the mains between Oct. 1 and April 15, at a certain price per 1000 lbs. of condensation, the condensation being returned to the station.

CONDENSERS

Two Wheeler surface condensers, each with 2300 ft. of cooling surface, two independent sets of auxiliary apparatus for them and an 8-ft. x 7-ft. hot well are located in the pit below the basement floor. The auxiliary apparatus is all steam-driven. That for each condenser consists of a 12-in. volute circulating pump driven by a vertical engine, an Edwards vertical vacuum pump and a Blake single hot-well



TURBINE AND TURBINE EXCITER



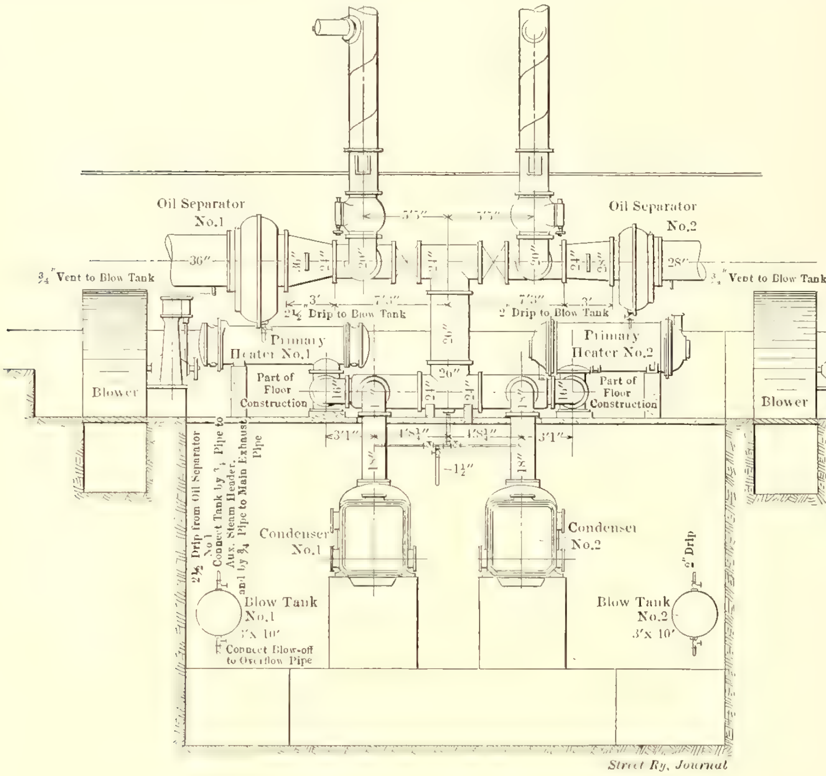
AUXILIARY STEAM AND EXHAUST PIPING LAYOUT

pump. The two sets of auxiliary apparatus are so piped that either set may be used with either condenser.

Circulating water is obtained from the adjacent river. Two 24-in. pipes run from the river to a concrete well just north of the boiler room. The well, which is 37 ft. deep, 6 ft. wide and 14 ft. long, contains a concrete partition through the middle dividing it into two sections. Vertical screens, which are raised for cleaning by a windlass above the well, may be placed in either section. From each section of the well a 24-in. cast-iron pipe leads to the condensers and circulating pumps. The piping is so arranged that either of the two pipes and the two portions of the well may be used either for the intake or the discharge. In summer the water in the river reaches a temperature of 87 degs., and partly because of this and partly because of the impurities in the water it is proposed to drill wells for a better supply.

A 5-in. steam main from the upper section of the main steam header branches out to all of the auxiliary apparatus with the exception of the turbine exciter, which machine is supplied with a separate supply main from the header. The exhaust from the auxiliaries is carried through a 10-in. main to a secondary heater in the boiler room and then through a free exhaust extending through the roof of the room. Two primary heaters used when the engines are exhausting into

the city heating system are connected to the exhaust piping of the engines just before the exhaust enters the condensers. Feed water from the hot well is drawn successively through the two primary and the secondary heaters before it enters the boilers. Surplus water for the boilers is obtained from the city system, the river water being too impure to use in the boilers.



DETAIL OF EXHAUST SYSTEM

OILING SYSTEMS

The engines are oiled by two oiling systems, a gravity system for the bearings and a pressure system for the cylinders. The tank for the gravity system is set up against the smokestack near the boiler room roof, and holds 250 gallons. The housings of the engines drain to a filter in the basement. In this the oil is first filtered through waste and gauze and is then forced through 18 ins. of water. Duplex pumps force the oil into the elevated tank. Two pressure tanks located on the boiler room floor are used in connection with the cylinder lubricating system. Each holds one barrel of oil. One can be shut off and filled while the system is feeding from the other. Lukenheimer sight feed lubricators are employed at the cylinders, two lubricators being used in parallel.

CLEANING WASTE

Since a centrifugal waste cleaner has been in use the waste bill has been cut about 50 per cent. The machine is piped to the filter in the basement.

AIR COMPRESSOR AND CRANE

Dust is blown out of the machines by compressed air obtained from a Westinghouse steam air compressor installed in the engine room. A pressure of 50 lbs. is employed. The engine room is spanned by a 20-ton hand-operated crane.

LIGHTING

General lighting of the station is effected with arc lamps. Those in the boiler room are suspended from the ceiling. The engine room lamps are hung on iron poles with ornamental brackets. Current for lighting the station is taken from one phase of the motor-generator set.

SWITCHBOARD

The switchboard is located 8 ft. from the south wall of the engine room at the center line of the building. The a. c. panels are at one end, the d. c. machine panels in the middle and the railway feeder panels at the other end. All the wiring to the board is carried in iron pipe conduit.

Each railway feeder leaving the station is connected to one lightning arrester located on the back of the switchboard and to a second arrester on a pole outside the building. Near the station the ground return is made up of thirteen parallel 35-lb. T-rails bonded together. Inside the station the negative return consists of about thirty 00 copper wires in parallel. Just outside the building the return is grounded to a copper plate ¼ in. thick and 4 ft. square, buried under a 4-ft. bed of coke and about 15 ft. below the surface of the ground.

A bath room in the west end of the engine room basement contains both shower and tub baths.

The station was designed and erected by Ford, Bacon & Davis. D. A. Hegarty is general manager of the operating company and R. F. Baise, as chief engineer, has been in charge of the station since its completion. During the time the plant has been in operation, Mr. Baise states, an engine has never been shut down because of a hot bearing.

A PORTION OF THE SWITCHBOARD AND THE ROTARY CONVERTER

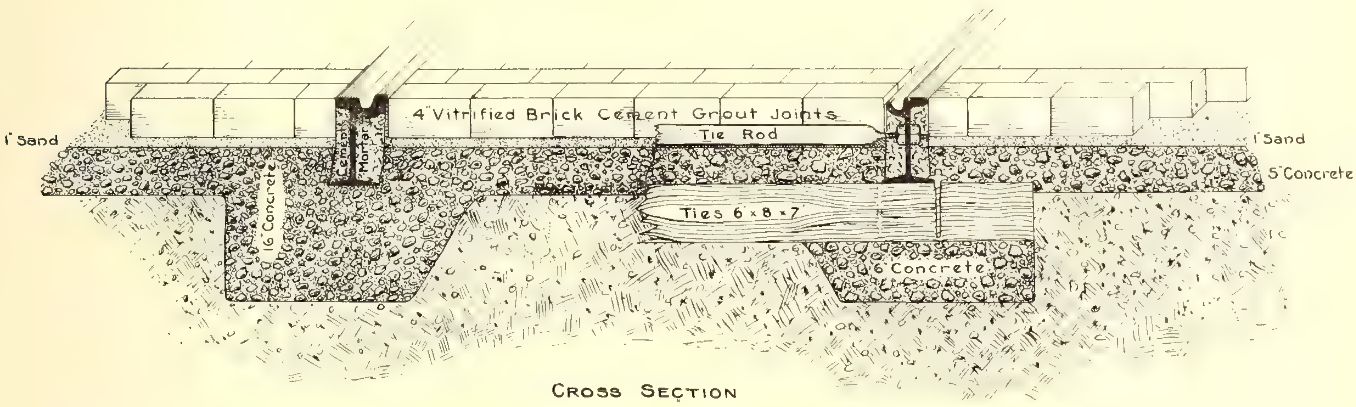
RECENT EXPERIENCE WITH CORRUGATED RAILS ON THE BOSTON ELEVATED RAILWAY SYSTEM

BY ARTHUR L. PLIMPTON, C. E.
Civil Engineer, Boston Elevated Railway Company

It became necessary for the Boston Elevated Railway Company late in the season of 1906 to rebuild in brick pavement a double-track curve, 800 ft. long and about 1300 ft. radius, and one of the worst pieces of noisy corrugated track on the system. The writer felt that here was an opportunity to apply all the known suggestions for preventing a recurrence of the difficulty in the new track.

It was necessary, first of all, to build it in such solid manner that it would be practically free from vibration under the action of passing cars, and the cross section herewith shows how this idea was carried out.

Previous experience had shown that although there may be no movement to ties bedded in concrete, there may be considerable rail movement where the rails are merely spiked to the ties with ordinary spikes, so in this case screw spikes were used, which have much greater holding power. The concrete was allowed to set ten days before the first car was operated over it.



CROSS-SECTION OF BOSTON TRACK ON WHICH CORRUGATIONS OCCURRED

As one cause of corrugated rail is considered to be the constant tendency of the wheels to climb up over the outside rail of the curve, it was determined to use a guard rail on the inside and to build the track wide gage so that the wheels would not touch the gage line of the outside rail, the car being guided wholly by the guard of the inside rail. In addition to this the outside rail was elevated above the inner one on each track. The theory that the cause of corrugation is the chattering of the rollers in the process of making the rails and that the corrugations really exist before a car has been run over the rails, can hardly be reconciled with the fact that the lengths of the corrugation waves vary apparently with the speed of the cars.

Everything aimed at was successfully accomplished, and the writer hoped that here was one curve that would be free from the difficulty. During the winter there was but little opportunity to examine this track, but recent reports having called attention to it, a careful examination was made and it was found that after an interval of only five months it showed distinct marks of corrugation throughout, and, under the heavy travel that it receives, there is no doubt that before very long it will be a badly corrugated track again.

The writer has, therefore, come to the conclusion that it is impossible to correct this difficulty by any method of track construction, and that the difficulty is wholly with the type of trucks now in use. It may be that the only effectual remedy will be to so design the trucks that the wheels will turn independently of each other, and perhaps also that the axles will always be on radial lines. This would introduce such serious mechanical difficulties that it may be that corrugation is a lesser evil, but the writer feels that this is the only direction in which to look for a complete remedy for corrugation.

Others who have studied this problem may not agree with the above conclusion, and the writer would be very glad indeed to have anyone point out in what way, in his opinion, if any, this length of track could have been constructed differently so that no corrugations would have occurred.

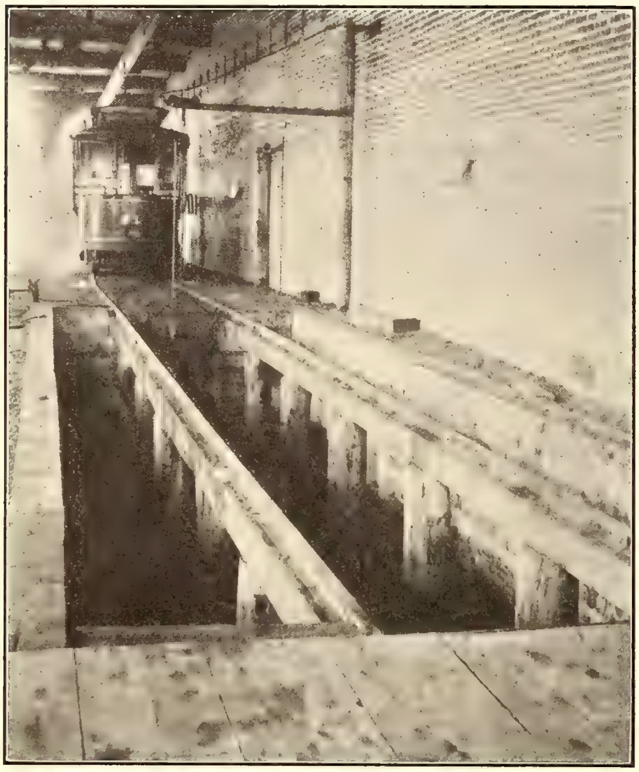
Since writing the above, the writer has read the very interesting paper on "Rail Corrugation," by Joseph A. Panton, in the April 13 number of the STREET RAILWAY JOURNAL. Mr. Panton seems to have arrived at the same conclusion as the writer, namely, that the cause of the trouble lies in the faulty construction of the trucks and not that of the tracks.

ELECTRIFICATION OF THE CASCADE TUNNEL

It is stated that a contract has been placed by the Great Northern Railroad with the General Electric Company for four 100-ton, three-phase locomotives, each to be equipped with four motors, to be used on the Cascade tunnel. These locomotives, which will be geared, will take current from an overhead system at 6000 volts. They are to be designed for single speed with resistance control. A site for a power house has been located about 25 miles from the tunnel, where the conditions are such that adequate power is available. Here the construction of a 2-mile flume will afford a head of 140 ft. In this connection it is of interest to note that the tunnel is 14,400 ft. long and that the grade is 1.9 per cent, one end being 240 ft. higher than the other. The portion to be electrically equipped at present is merely the tunnel, which is near the summit of the section. If successful, the entire section, 60 miles in length, will be equipped with electric power. The section consists of approximately 30 miles of ascending and 30 miles of descending grade, and, if the electrical system is so extended, recuperation will be used. Dr. Cary T. Hutchinson is electrical engineer for the railway equipment.

OKLAHOMA CITY RAILWAY NOTES

The railway system of Oklahoma City has had a growth almost as phenomenal as that of the city in which it is located. Since its charter was obtained, Jan. 28, 1903, it has grown to a system having 20 miles of track and operating thirty-five cars. Development is still continuing at a rapid rate and plans are being formed for making the city lines a portion of an extensive interurban system with lines radiating in several directions from Oklahoma City to neighboring towns.



VIEW OF THE EXTRA WIDE PIT

The fact that the system is located in a district out of the regions where conventions and business relations throw electric railway men together frequently is no doubt responsible for the development of several quite original features of practice.

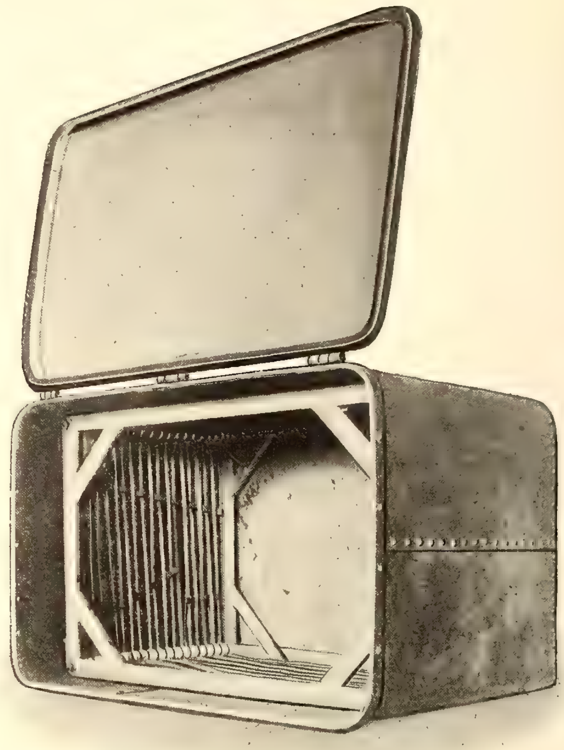
SHOP NOTES

A new car house recently constructed is practically fireproof. The roof is of concrete construction, the walls of brick and the doors are covered with sheet iron. An accompanying illustration shows the type of door fastener used. The doors are held together at two points. The illustration also shows a good scheme for holding the doors open.

The pits as originally constructed in the building extended only between the rails. They have been widened, as shown in the illustration, which type of pit is found more satisfactory.

The armature oven used in the shop consists of a box made of No. 14 sheet iron measuring 3½ ft. wide by 5 ft. long by about 4 ft. deep. The coils are wound on porcelain insulators supported on a wood frame. A temperature of 200 degs. is obtained in about three hours.

The machine shop is well provided with tools, including a 37-in. boring machine and a 26-in. shaper. The woodworking room contains a planer, mortiser, saws and other tools required in car building. For operating air hoists and pit jacks a compressor with a capacity of 160 cu. ft. per minute has been installed.



ARMATURE OVEN

It is the intention of the company to manufacture all of its cars. A work and line car recently constructed in the shops is shown in an accompanying illustration. The tower is elevated by a windlass on the inside. The roof over the body consists of a flat portion on top, on either side of which are two sloping portions. The shops are in charge of Charles W. Day, master mechanic.

LINE CAR BUILT BY THE OKLAHOMA COMPANY

WHEEL PRACTICE

A 450-lb. chilled wheel with a 2½-in. head and a ¾-in.

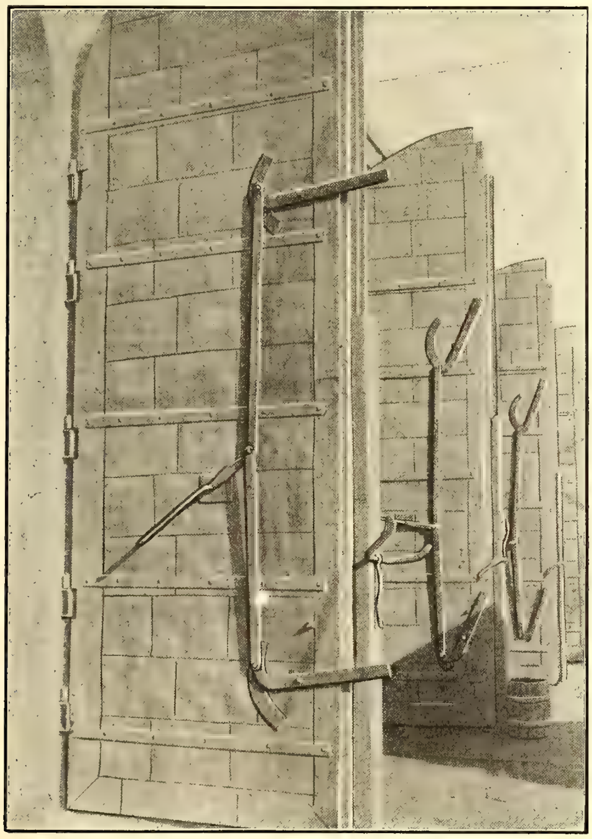
flange is employed. New wheels will have a 2¾-in. head and a ⅞-in. flange. A soft gray iron brake-shoe made in Guthrie is used.

OILING TRACK

Instead of greasing curves they are oiled with "residuum" oil obtained at 9 cents per gallon. Two men are engaged continuously in oiling the track and cleaning switches, and these get over the track two or three times each day. A special oil can holding about three gallons and provided with a valve for shutting the oil off is used. A special tip on the spout of the can fits up against the rail so as to throw the oil against the side of the head of the rail.

POLES AND TIES

In city construction a treated pine pole 30 ft. long and with an 8-in. top is used. These are obtained from the Zinc Oil Pole Company, of Texarkana, Tex., and are guaranteed for twenty years. Poles that have been in use for three years show absolutely no signs of decay. The main reason for the adoption of the treated pine pole is that it is cheaper than cedar. All the ties used in city construction are of treated pine.



DOOR FASTENERS AT OKLAHOMA CITY

TREATMENT OF TRAINMEN

The company believes in the motormen and conductors knowing something in addition to how to run a car, and has supplied a club room adjacent to the shops with technical books and papers. In connection with the club quarters is a bath room for the use of employees.

The company's men have never struck nor have ever made demands for increased wages, yet in four years' time four voluntary increases in wages have been given to them. At present they receive for the first year 17 cents, second year 18½ cents, and after two years 20 cents per hour. In signing an application blank a trainman promises to abstain from intoxicating liquors while in uniform and while wearing the company's badge. He also binds himself to be liable for damages resulting through his carelessness. After his references have been investigated favorably he is sent to a physician, who examines him and collects his fee from him. If he passes the examination he is put on a car for instruction for about ten days, during which time he receives no pay. The claim agent then instructs him how to make out accident reports and concerning getting the names of witnesses, and cautions him against discussing accidents. In regard to accident reports he is given to understand that the company wants facts and not opinions. Instruction from the master mechanic with regard to cutting out motors and caring for derangements of the equipment, and a talk with the general superintendent, Charles W. Ford, completes his instruction. Mr. Ford impresses the new trainmen with the fact that the company will be lenient with a man who displays bad judgment or makes errors, but that it will not stand for untruths in reports.

ROUTEING ORDERS AND FREIGHT TRAFFIC IN INDIANA

Several interurban roads in Indiana have increased their freight considerably by the use of routeing orders, instructing shippers to route goods by way of the interurban lines whenever possible. These orders are distributed for filling in the blanks and for signature to merchants and dealers in the towns along the line and are then collected and sent by the railway company to the shippers. The congestion of freight traffic on steam roads has resulted in considerable freight being thrown over to the electric lines, which usually make quicker deliveries, although the route is indirect. Shipments from Marion, Ind., to Decatur, Ind., a distance of 46 miles, when sent by steam roads are sometimes four or five days en route. When shipped by interurban lines by way of Wabash and Fort Wayne, deliveries are made on the day of shipment, although the distance is almost three times as great as the steam-road route and the goods have to be transferred from one car to another at Fort Wayne.

THE FORT WAYNE & SPRINGFIELD RAILWAY COMPANY

Traffic Department

Routeing Order

................................Ind..................190....

To..

Street Address ....

Town ....

Until further orders, please ship all of our freight via and in care of The Fort Wayne & Springfield Railway Company.

....

Yours truly,

....

The Fort Wayne & Springfield Railway Company handles shipments to and from all points on its lines and connecting traction lines at same rates as in effect via steam routes. Specify The Fort Wayne & Springfield Railway Company when you place your orders, and thus get express delivery at freight rates. Freight train leaves Decatur daily at 9 a. m.; Fort Wayne at 1:30 p. m. Arrives at Fort Wayne 10:30 a. m.; Decatur, 3 p. m.

The lottery of the Mexico Electric Tramways, Ltd., which for the past two years has been a prominent feature of its ticket department, was abolished on May 1. The last drawing took place April 1. According to R. C. Brown, managing director of the company, who is at present acting as general manager, the ticket department from May 1 will be conducted on a strictly business basis, and there will be no further annoyances from lottery drawings.

NOTES ON SINGLE-PHASE ELECTRIC TRACTION

The complete report of the meeting of the British Institution of Civil Engineers, on Nov. 13 to 20, 1906, containing the paper on single-phase electric traction, by C. J. Jenkin, and the resultant discussion, has just been received. It contains a number of interesting points which have not been made public elsewhere.

In describing the magnets for single-phase contactors, the author presents drawings of a self-regulating single-phase contactor magnet designed to give a considerable pull over a long range. To overcome the effect of vibration or chattering when the magnet is closed, a small short-circuit ring is fitted over part of the armature and provides the desired "hold-on force." Referring to lighting, the author believes satisfactory results can be secured by the use of thick filament low-voltage lamps, even when the frequency is as low as sixteen cycles per second, and publishes the following table:

LOW-PERIODICITY LAMPS.

Cycles per Second	Voltage	Three Observers' Notes		
		a	b	c
	Volts			
16	100	Unpleasant	Distinctly noticeable	Noticeable
16	50	Distinctly noticeable	Noticeable	Satisfactory
16	35	Noticeable	Satisfactory (limit)	"
16	24	Satisfactory	"	"
16	15	"	"	"
25	24	"	"	"
25	15	"	"	"

Interferences with neighboring telegraph and telephone circuits from the current in the power circuit of a single-phase railway are due, according to Mr. Jenkin, to (1) earth currents from the rails, (2) electromagnetic induction from the trolley wire and rails, and (3) electrostatic induction. The first can be overcome by the use of an insulated metallic return for the telegraph and telephone circuits, and, as the effect is proportionate to the drop of voltage in the rail return, it can be reduced by choosing a high trolley voltage and low frequency. The effects of electromagnetic induction can be avoided in telegraph circuits by using a twisted metallic circuit. It can also be reduced either by using a copper sheath on the electromagnet of the telegraph instrument as a dampener or by shunting the telegraph instrument by a condenser. In telephone circuits it is desirable to put the wires in cables to avoid electromagnetic induction. To reduce electrostatic induction the telegraph and telephone circuits must be earthed, as while their capacity is small, the induction from the single-phase line is sufficient to create trouble. A metallic return does no good in the case of static induction; on the contrary, the author says, it doubles the capacity of the circuit. Telephone circuits may be earthed at the middle point of a choke coil connected across the terminals of the instrument. The low-frequency induced currents will then flow through the choking-coil to earth, while the higher-frequency telephonic currents will not be short-circuited. This method has been successfully used in Sweden. The author suggests that to reduce electrostatic induction on telegraph circuits they may be earthed at one or more points through high resistances, which will shunt very little of the telegraph currents, but will keep the voltage of the wire within safe limits; but does not know if this method has been used. Static induction may be avoided also by putting the wires under ground.

The author describes all of the well-known catenary forms, but considers by far the best that of the double catenary, in which the working conductor is suspended by droppers from a horizontal cable. This construction is used on the Blankenese-Ohlsdorf road, and was described in the STREET RAILWAY JOURNAL for April 6, 1907. In this form, if the catenary is given a fairly large sag, the change of level of its center point can be kept small for any probable range of temperature. In a 150-ft. span, with 50 ins. sag and 50 degs. C. range, the motion was found to be only 2.28 ins. The variation of length of the trolley wire can be taken up in several ways. On curves the elasticity of the poles and of the construction generally will be sufficient. On straight stretches the trolley wire may be tightened endways at intervals by means of weights and chains over pulleys, as is done on the Blankenese line. As a fall of 50 degs. C. will produce a tension of about 7¼ tons per square inch, a figure just beyond the elastic limit of hard-drawn copper wire, a device of this kind, which allows the tension to be kept constant, is advantageous.

Where the wire passes close beneath any iron structure, such as the girders of a bridge, an arc shield should be used to prevent any arc between the bow and trolley wire from rising and earthing the circuit. For this purpose an iron plate is desirable, and, of course, should not be earthed. Experiments which the author has made show that smoke and steam will not seriously increase the sparking distance from the trolley wire; but flame, such as often issues from a locomotive funnel, is a much better conductor.

In speaking of collectors, he refers to the necessity on high-speed roads of keeping the mass and consequently the inertia of the collector as small as possible. He believes that where the pantograph is used, the best results at high speed will be secured when a jointed collector, consisting of one or more light bows hinged on to the main frame, are employed. By using three springs in series, the effective inertia of the Zossen collector gear was reduced to 1 1-3 lbs.

DISCUSSION

A. P. Trotter referred to some experiments at Leeds, which indicated that electrolytic action could be produced by an earthed single-phase current. He did not consider the elaborate device for taking up the tension of the trolley wire, described in connection with the Blankenese road, to be necessary.

Major P. Cardew discussed the subject of electrolysis to a greater extent, and explained it by the fact that when a wave of negative electricity charged the trolley wire, the negative electricity attracted any moisture there might be, and the leaks temporarily became increased. At that instant the positive electricity was trying to charge the rails, but the total amount of charge being very small, unless there was a bad leak on the trolley wire, it could not polarize the rails to such an extent as to prevent the escape of the electricity to earth. In the next half cycle the trolley wire was positively charged, all the moisture was repelled,, and the leakage became much smaller; and, of course, the corresponding negative electricity leaked from the rails. The general result was a continuous passage of negative electricity to earth from the trolley wires and of positive electricity to earth from the rails, and he thought it was that current which produced the electrolytic effects.

W. M. Mordey said that on the Oerlikon experimental road, where 15 cycles are used, a great deal of telephone disturbance has been traced not so much to the direct effect of the current, but to high-frequency alternations superimposed on the main wave and caused by the commutator

bars passing under the brushes, acting to produce a microphonic effect. He also discussed the question of motor heating, and referred to a new alloy of iron and silicon which had recently been discovered by Mr. Hadfield and Prof. Barrett, which would reduce the hysteresis loss, and, having a very high specific resistance, it had also much less eddy-current loss. Taking two examples, both at a magnetic flux density of 10,000 C. G. S. units and 50 cycles per second, the first example showed that with the new material the lamination need not be so fine. The total loss in a given weight of 0.048-in. sheets of the new material would be the same as with the same weight of 0.014-in. sheets of good magnetic iron. Again, with a given weight of 0.024-in. plates of "Stalloy," as the new material had been called, the loss of energy would be about 1 watt per pound instead of about 2 watts per pound with the best magnetic iron.

A. C. Kelly referred to the alternating-current contactor magnet mentioned by the author, and believed that the maximum pull given for this magnet (116 lbs.) was too small if the contactor was to handle large currents. Tests of contactor contacts indicated that the temperature of the contacts under a given current rose rapidly with decreasing contact pressure. For example, a contact 1 sq. in. in area, carrying 600 amps. continuously, had a temperature rise of about 62 degs. F., with a pressure on the contact of 350 lbs. With a pressure of 100 lbs. on the same contact the temperature rise was found to be about 130 degs. F. He thought pneumatic pressure preferable to the direct action of a. c. magnets.

Edgar C. Thrupp, arguing in favor of separate power stations, said that it was rarely advantageous to install a sub-station of as high as 1500-kw capacity. He had recently made an elaborate study of the statistics of power stations, with a view of obtaining a correct comparative estimate of the cost of working stations of various sizes, and he had arrived at a simple, broad conclusion as regarded fuel consumption. He found that with a load factor of about 15 per cent, the fuel consumption per unit generated was, roughly, inversely proportional to the logarithm of the maximum load in kilowatts. There was, of course, a variation with the load factor as well, and the improvement in fuel economy with an increase of load factor was much more rapid with small powers than with large powers. Consequently, there was less to be gained in this respect by large power stations for railway purposes than for electric lighting.

THE BERKSHIRE HILLS BY TROLLEY

"The Berkshire Hills by Trolley" is the title of a booklet published by Lyons & Gerst, of Pittsfield, Mass., which gives not only the routes of the trolley lines traversing the beautiful Berkshire Hills, but also the automobile routes. The lines are all given with Pittsfield as the center, together with the distance and fare. In this way trips are explained to such places as Lenox, Lee, Stockbridge, Great Barrington, Cheshire, Adams, North Adams, Williamstown and other points. There are also maps showing the lines of the Pittsfield Electric Street Railway Company and the Berkshire Street Railway. In addition, there are any number of illustrations which show the character of the country through which the lines extend. The book is a good example of the attractive kind of literature which can be prepared to advertise trolley routes.

ELECTRIFICATION PLANS FOR ITALIAN STEAM RAILROADS

The Italian Parliament has recently granted 50,000,000 lires ($10,000,000) for electrifying the following trunk line divisions of the State Railways:

1, Pontedecimo-Busalla, 11 km; 2, Savona-S. Giuseppe, 21 km; 3, Bardonecchia-Modane, 7 km; 4, Mailand-Monza-Lecco, 51 km; 5, Usmate-Bergamo, 26 km; 6, Calolzio-Ponte San Pietro, 18 km; 7, Gallarate-Arona, 26 km; 8, Gallarate-Laveno, 32 km; 9, Domodossola-Iselle, 19 km, 10, Pistoia-Porreta, 40 km; 11, Neapel-Torre Annunziata-Salerno, 54 km; and 12, Torre Annunziata-Castellammare, 6 km. This makes a total of 311 km, or about 193 miles. This work is to begin not later than the end of 1911.

Lines Nos. 1 and 2, respectively, are portions of the Genoa-Milan and Savona-Turin trunk lines, while No. 3 is a portion of the Turin-Paris line, of which the Mount Cenis tunnel forms a part. Line 4 is an extension of the Valtellina Railway (Chiavenna-Sondrio-Colico-Lecco) to Milan, and lines Nos. 5 and 6 are branches of the Valtellina Railway covering the connections between Milan and Bergamo and between Lecco and Bergamo. Lines 7 and 8 are branches of the electrically operated trunk line between Milan, Gallarate, Varese and Portoceresio, serving the local traffic between Milan and Lake Maggiore. Line No. 9 is a part of the Milan-Lucerne, Italy-Switzerland Railway, and represents an extension of the electrical operation of the Simplon tunnel. Line No. 10 is a portion of the trunk line between Milan, Florence and Rome. Lines Nos. 11 and 12 form the connection between Naples and the Sorrentine peninsula, which is a very popular pleasure resort for the greater part of the year.

It is understood that lines Nos. 4, 5 and 6, which are part of the Valtellina Railway, and line No. 9, forming the Simplon tunnel extension, will be operated by three-phase current; but lines Nos. 7 and 8, which are branches of the Milan-Portoceresio line, will use the direct-current third-rail system already installed on the portions of this line previously electrified. Three-phase operation has been definitely decided for line No. 1, and the contract is now in the hands of the Westinghouse Company. As is well known, the electrical experts of the Italian State Railways are favorably disposed toward three-phase operation, and it is, therefore, considered very likely that this method will also be used for lines Nos. 2, 3 and 10, but it is possible that lines Nos. 11 and 12 may be equipped for single-phase current.

The sections mentioned under Nos. 1, 2, 3 and 10 are comparatively short branches of the trunk lines to which they belong, but they have especially severe operating conditions. They are all mountain divisions with numerous curves, severe grades, and, in part, with very long tunnels. Owing to the constantly increasing train weights required to carry the business, the steam locomotives are no longer capable of making schedules. This condition has led to numerous delays, especially as most of these divisions are single-track. Another reason for electrification is the smoke nuisance in the tunnels, which in many cases badly hinders operation. This is particularly true of the Mount Cenis tunnel, where the trainmen are frequently made ill by continued subjection to the tunnel gases.

Electrification was also considered desirable for the lines running from the harbors of Genoa and Savona, as they carry the greater portion of industrial material, including fuel used in the heavily populated districts of Northern Italy,

besides doing a large through business to other countries. The rapid development of the Northern Italian industries and the necessity of making the lines able to handle the increased business brought up the subject of electrification to permit higher speeds and heavier train loads. In fact, the freight service has fallen so far behind that numerous factories in Piedmont and Lombardy have been forced to suspend operations in whole or part because they could not get sufficient coal. The necessary electrical power could not be secured to continue work owing to droughts which seriously affected the water-power plants in these districts.

Some idea of the kind of trains and schedules which the government operates on the electrified lines may be obtained from the proposed program for the Ponte Decimo-Busalla division. Up-grade trains are to consist of eighteen loaded cars weighing in all 324 tons, but may be increased to twenty-one cars, equal to a weight of 380 tons, loaded. The maximum train load down-grade may be composed of fifty-four cars. The average weight of a loaded car is placed at 18 tons, and without load, 7½ tons. The freight trains are to run at an average speed of 45 km an hour. The latter will also be the speed of the few passenger trains operated on this section, as this line really is a freight division, since the more important passenger trains are operated on a parallel line through the Ronco tunnel. The freight trains will be operated by two locomotives, one at the head and the other at the end of the train. The service weight of these trains will vary between 70 and 75 tons, distributed on five axles, all of which are drivers. The highest permissible weight per axle is 17 tons. At first, the up-grade trains will run on a 15-minutes' schedule, but later on 10-minutes' schedule, to enable which the line will be divided into three blocks. The down-grade trains will run at half-hour intervals. Under normal conditions the trains will be operated eighteen hours a day.

Power for this line will be generated in a 7500-kw steam turbine station at Genoa, and will be distributed from three sub-stations furnished with stationary transformers. The primary circuit between the power house and the first sub-station has a length of about 15 km, and between the first and the last station, 12 km. The size of the middle sub-station is to be such that operation of the line could be continued should the third or Busalla sub-station be out of service.

NEW ENGLAND TROLLEY ADVERTISING

The Passenger Department of the Boston & Northern and Old Colony Street Railways has in preparation some trolley literature for this season that will be entirely a new departure, distinctly different from anything previously issued by these companies. The main feature of the folder will be a large map of the entire eastern section of Massachusetts east of Worcester, Southern New Hampshire and the larger part of Rhode Island attractively gotten up in four colors. The lines of the Boston & Northern Street Railway Company and Old Colony Street Railway Company, and the lines of every other street railway company operating in this district as well, will be shown, and all of the principal cities and towns, lakes and rivers, parks and groves, seashore resorts and other places of interest not shown on other maps will be given. On the back of the map will appear the schedules of the two companies, arranged as concisely, and with a view to giving the trolley rider the most vital information, as possible. After being folded, what will appear as the covers of the folders will be very artistic designs printed in colors. The folders of the two companies will be distinctly different, except for the large map of the entire district appearing in both.

BONUS SCHEME FOR ENGLISH MOTORMEN

The Tramways Committee, of West Ham, England, has approved a bonus scheme drawn up by Manager H. E. Blain for motormen and conductors, for general efficiency, punctuality and good conduct. There is further to be a bonus for motormen in connection with energy consumption. This is to be paid at the end of each financial year in which a reduction in the energy consumed per car-mile has been effected in comparison with the previous year. Five per cent of the sum represented by and saving of energy is to be divided among all motormen in the service at the end of each year who have been employed for not less than six months in each year.

COMPARISON OF THIRD RAIL AND OVERHEAD TROLLEY CONSTRUCTION AS APPLIED TO THE ELECTRIFICATION OF STEAM ROADS

Many comparisons of the relative advantages and disadvantages of distributing systems have been published, but practically all of them have been mere recitals of the different merits of each method. The subject, however, is taken up in a quantitative way by C. E. Eveleth in a recent issue of the "General Electric Company Review," and an attempt is made to give demerit weights to the different factors or conditions involved in each system. The three columns herewith represent, respectively, (1) the four-track protected third rail for heavy traffic; (2) the overhead high-tension three or four-track bridge catenary construction with 300-ft. spans for heavy traffic; and (3) the high-tension catenary pole construction of the side bracket or cross-span type for light traffic or single cars. No attempt was made to list the advantages of the electric systems over the steam systems, nor has a balance been made of the relative costs of the electric systems, questions which should be considered separately. Numbers have been placed after every item, which may, for convenience, be said to represent units of difficulty.

The totals of these three columns give the following interesting results:

1. Third rail (protected)	14
2. Overhead high-tension bridge construction	50
3. Overhead high-tension side bracket or span construction	27

These figures are not based on any absolute figures, but indicate, to a certain extent, the relative difficulties of the systems, as viewed by the author.

In round numbers, the costs per mile of single-track collectors installed for the various constructions are about as follows:

1. Third rail (protected)	$5,500.00
2. Overhead high-tension bridge construction	7,000.00
3. Overhead high-tension side bracket or span construction	3,500.00

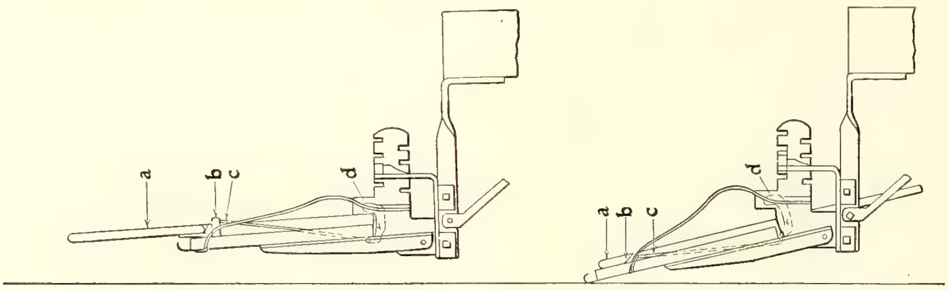
The author states these values indicate that in many instances the increased difficulties encountered with system No. 3, as compared with No. 1, may be more than offset by their relative costs. It would also appear that there must be other reasons than those of economy and freedom from difficulty in operation on the particular section of a road where system No. 2 is used.

RELATIVE DISADVANTAGES

	I Protected Third Rail.		II Overhead High Tension Bridge, Catenary Construction.		III Overhead Side Bracket, Catenary Construction.	
A.	Interference with track maintenance..	3	Entirely clear of road bed..............	0	Same as II..........................	0
B.	Can be maintained by section gang...	1	Requires special tools, crews and work trains..............................	5	Same as II, but not as important......	2
C.	Easily cleared up and insulated when derailment occurs.................	1	In the way of boom of derrick car—liable to be knocked down and put all tracks out of service......................	3	Same as II..........................	3
D.	Hindrance to coupling freights, etc. With protected rail this is not very serious..........................	2	Dangerous to freight brakemen on account of parts hanging down and small bridge clearance. Very difficult to install satisfactory ticklers to warn trainmen when approaching bridges..................	4	This point is of less importance........	1
E.	Interference with clearing snow between tracks.....................	1	Not affected..........................	0	Not affected..........................	0
F.	Ease of satisfactorily collecting current on account of location, where relative motion between track and rail is small. Collectors may be safely replaced on the road................	1	Difficult to collect current, as a more complicated mechanism is required on account of the grade of the wire due to low clearances at bridges and high clearances at road crossings..............	5	Similar to II..........................	3
G.	May be readily inspected by track walker...........................	1	Requires a man with special training....	3	Similar to II, but of less importance...	1
H.	Life of conductor long................	0	Life of conductor and cables comparatively short on account of wear and deterioration due to gases from freight locomotives and work trains. Should estimate that the entire railroad will be out of commission two or three per cent of the time after the first five years.........	4	Life of conductor reasonable...........	2
I.	Ease of sectionalization. Jumpers may be disconnected at the nearest adjacent road crossings.............	1	Difficult of sectionalization.............	3	Sectionalization not of so much importance..............................	1
J.	May be worked on while alive to make track changes or repairs, making system very flexible................	1	Requires that current be shut off no matter how slight repairs are, making system inflexible...........................	5	Similar to II, but not of such importance	3
K.	Work trains can run out on power from the rail..........................	0	Must have independent source of power, such as gas or steam.................	2	Same as II..........................	2
L.	No interference with visual signals....	0	Signals located and seen with difficulty, as they must be lower than the bridges and even then have the distant bridges as a background. Dangerous to maintain signals in this location, as it must be done from ladders..................	5	Not affected..........................	0
M.	Danger of wreck from burning off track rail due to arcing current. This is a possible contingency, but one not very likely to occur...............	1	Danger from dangling overhead work when messenger cable is burned off at a defective insulator..................	1	Same as II..........................	1
N.	Little interference with fire extinguishing apparatus in the car storage yard	0	Difficulty in removing cars on account of high tension interfering with firemen..	1	Probably will have low tension for this work..............................	0
O.	Absolute freedom from lightning disturbances........................	0	Very much exposed to lightning.........	2	Same as II..........................	2
P.	Entire freedom from telephone and telegraph disturbances, also inductive effects on signal wires........	0	Difficult, as yet unsolved problem in connection with these interferences, affecting not only the railroad company's wires, but those belonging to other interests. "Unsolved" should be interpreted to mean at moderate expense...	2	Same as II..........................	2
Q.	No trouble at grade crossings with crossing trolley wires.............	0	Probably trolley crossings will have to be avoided by overhead or undergrade crossings............................	2	Troubles similar to II................	3
R.	Can add sidings or more tracks with little difficulty....................	1	Can make such additions only at considerable expense.....................	3	Difficulty not very great..............	1

FENDER TESTS IN TORONTO

Two series of tests on a considerable number of different types of fenders have recently been conducted in Toronto by the Ontario Railway and Municipal Board. This board was appointed by the Ontario Government under what is known as the Ontario Railway Act of 1906, and a firm of engineers representing the board had charge and supervision of them. The first tests were made on Nov. 28 and 29, 1906, and subsequently those fenders which were not ready for trial on that date were tested on Jan. 15 and 16. The result of these tests was that the board recommended the Jenkins automatic fender for adoption in the city of Toronto, and notified the Toronto Railway Company of its approval of the use of this fender. At the same time the board reserved the right to recall approval of fenders or wheel guards at any time should they prove inefficient or be replaced by something better in design and operation. The experts also expressed the opinion that certain improvements would be made in several of the fenders tested by them, and that before long they expected to be in a position to recommend, for the approval of the board, at least two more automatic feeders.



Running Position of Fender. Position of Fender when Tripped. Street Ry. Journal

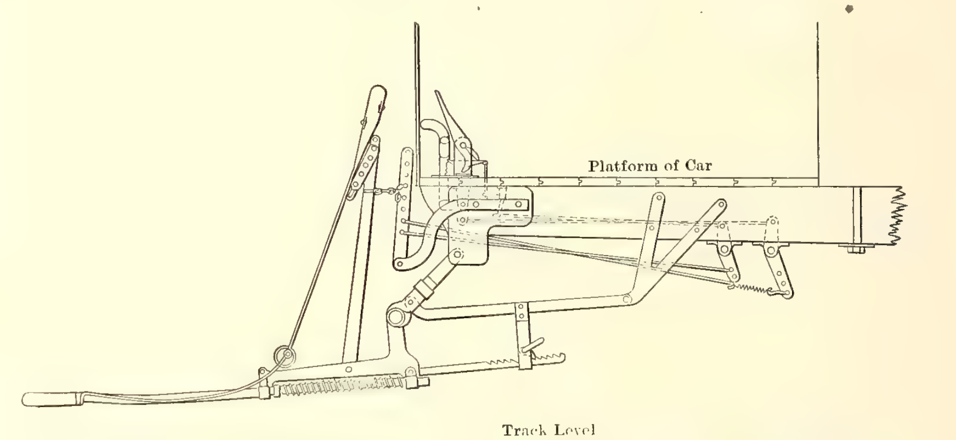
JENKINS FENDER

The Toronto Railway Company has been using and has at the present time on its cars some five or six hundred semi-automatic fenders of the Watson type, known as the twentieth century fender. This fender was considered by the board in its report to have especial merit as a semi-automatic fender, but this principle was not considered as desirable as the purely automatic. The accompanying engraving will give an idea of the twentieth century design. It is of the trip type, that is, it can be dropped by the motorman with his foot by means of a short lever. This fender has given very satisfactory service since it was placed on the Toronto cars, and has been improved from time to time. It folds up into a very small space, is light in weight, is not very expensive to maintain, and is manufactured by the company. Nevertheless, as the trend of public opinion and the report of the board were in favor of a purely automatic fender, which will operate without the action of the motorman, and as it has always been the policy of the Toronto Company to give a fair trial to any reasonable suggestions which promise improvement to its service, the company has decided to equip a number of cars with the Jenkins fender, and has started to manufacture them on a large scale in its own shops. In fact, this right was secured by the company during the early part of 1906, before the Ontario Railway Board was appointed.

Up to the present time the company has equipped with the Jenkins fender about sixty new cars, which were placed in service at the first of the year, and will soon put about one hundred of them in use, so as to give the new fender a thorough practical test.

The Jenkins fender is released by a loose trip-bar and trigger catch, the drop being accelerated by springs. It folds up when not in use, and the buffer and fender proper can both be easily detached separately, to allow cars to be coupled together. The fender is partly suspended from the truck in order to reduce the effect of the car oscillating on single trucks. In the accompanying engraving, *a* is the feeler bar, *d* the gravity hook, and *c* is a rod connecting *d* with a clevis *b*. The drawing does not show a wire guard, 6 ft. or 7 ft. in length, which goes with the fender, and is attached to the side of the car just back of the fender brace, to prevent a body from rolling under the car wheels from the side.

The Toronto Company is still maintaining its twentieth century fender on those cars which are now fitted with it, but probably all new cars which the company will put in service in the near future will be equipped with the Jenkins type of fender.



TWENTIETH CENTURY FENDER

AN ALTERNATING CURRENT POWER STATION AND SUB-STATION FOR THE BROOKLYN & CONEY ISLAND RAILROAD COMPANY

The Brooklyn & Coney Island Railroad Company is planning to make radical improvements in its system of power generation and distribution. At present it has three direct-current stations of rather ancient design, the largest being on the Gowanus Canal at the corner of Smith and Ninth Streets. At this point the company will erect a modern station with turbo units and alternating-current distribution, while the two other existing stations will be abandoned and in their place rotary sub-stations will be built. The plans for this work are being prepared by Ford, Bacon & Davis, engineers, of New York.

THE BREAKING OF TROLLEY WIRES AT EARS

The discussion on the subject of the breaking of trolley wires at ears by the New York State Street Railway Association lends interest to a paper on this subject read by P. S. Sheardown before the Dublin section of the Institution of Electrical Engineers and reprinted in the London "Electrician." Mr. Sheardown states that the breakages usually occur at the spot where the wire joins the rigid suspension, and attributes the weakening of the wire at this point to four principal causes, viz.: (1) The blow of the trolley wheel against the butt of the ear, part of which comes against the wire. (2) The effect of the sparking which occurs at the same place, due to the trolley wheel losing contact with the wire. (3) The molecular change or crystallizing action in the wire due to what the author has termed the damping out of vibration in the suspended wire. (4) The bending or hinging action due to the upward pressure of the passing trolley wheels; and possibly, (5) overheating of the wire when being soldered.

He has found that usually the wires break first at the section insulators, where they are held most rigidly, then at frogs and crossings, and finally at ordinary ears and at splicing tubes. He believes that breakages from an actual tensile stress are rare. In such cases the section had pulled out very thin before fracturing.

As remedies, the author recommended first that the specifications require not so much a high tensile strength as some guarantee that the wire will be able to withstand in practice the bending and vibration stresses it will have to meet. In this connection he says that the Dublin company has secured excellent results with phono-electric wire. This wire has been in use in Dublin for six years, and, so far, only two breaks are on record. Its only disadvantages are that it is somewhat more expensive than hard-drawn copper, and it has less than half the conductivity of copper.

The second conclusion is that trolley wire should be so erected that there is smooth under running for the trolleys, and, if possible, should be so suspended that vibrations in the wire should be free to travel the whole length of the wire, and not hung so that, as far as vibrations are concerned, each span is insulated from the next, the vibration in each span of trolley wire being damped out at the adjacent ears. It would appear as if this construction would be secured with the catenary form of suspension, with which the author has had no experience.

The third conclusion to be drawn is that cars should be run with as little upward pressure of the trolley wheel against the wire as possible in order to reduce the hinging action at the ears. With this action in mind, the author is of opinion that trolley wire, especially when run from span wires, should be erected fairly taut and the span wires left on the slack side; but he does not think the short so-called flexible suspensions on bracket arms are of much assistance, except that these enable one to have better secondary insulation. The fourth conclusion is that, other things being equal, a company is not likely to get a very much longer life before breaking sets in from heavy wire in comparison with light wires, say 0000 compared with 0.

Lastly, as the fracturing referred to gives practically no external evidence that it is going to occur—indeed, in many cases takes place just inside the butt of the ear or under the frog clamps—careful inspection is of very little use, and the question to be asked on existing systems is what is best to be done, as, naturally, no one wants to renew the wire until wear makes it absolutely necessary.

The best way out of the difficulty, in the author's opinion, and the one which he has adopted throughout the Dublin system, is to anchor the wire at all suspensions after it has been up two years, but at section insulators it is safest to anchor them at once.

Anchoring the wire at section insulators, frogs and crossings is a comparatively simple matter. All that is required is a half-anchor ear and a piece of galvanized wire, as there is no difficulty about finding a place to anchor the wire firmly on to some part of the section insulator or frog; but when it comes to anchoring at the ordinary ear suspension, the matter is not so simple, if anchor ears were not put up in the first instance. One method would be to anchor to the span wire or bracket arm, but this would mean the cost of nearly double the number of insulators throughout the system, to say nothing of the fact that the more insulators there are on a job the greater the chance of trouble with them. The method which the author has adopted is known as the K. Q. patent anchoring device. It was designed by two of his assistants, and is at once both cheap in first cost and simple to put up. It consists essentially of a stamped steel plate with a hole in it through which the threaded portion of the insulator bolt passes. The plate to which the anchor wires are fastened is thus securely held in position at the top of the ear, but the strain of the broken wire comes direct on the bolt. The cost of this arrangement of anchoring, erected complete, is about $70 per mile of double track.

It might be claimed that the wire would be liable to fracture at the end of the half-anchor ear, in the same way that it does at the ordinary ear; but the half-anchor ear, if properly designed, will have a sufficient grip of the wire and yet give smooth under-running. Moreover, it is much shorter than an ordinary ear, and is free to move with the wire instead of itself being fastened to a support. In Dublin anchoring has been employed at section insulators for about eight years, and at the present time every suspension is anchored except where the wire has been recently renewed. There are, therefore, about 8000 of these half-anchor ears in use, but on only two occasions has the wire failed at a half-anchor ear.

When the wire breaks at a suspension the anchoring device holds it in position, and, as soon as it is noticed, the emergency wagon is sent for and the men quickly make a temporary repair, and, beyond the fact that a few trolley wheels may leave the wire, no inconvenience or stoppage to traffic is experienced. Although as many as twenty broken wires per month have been reported during the past twelve months, only three have come to the ground. In one case the suspension was not anchored, in another the wire was held in the anchor all right, but was afterwards pulled down by a trolley head getting caught, and in the third case the wire broke outside the anchoring device.

PENNSYLVANIA ORDERS STEEL CARS

The Pennsylvania Railroad has placed orders for two hundred steel passenger cars. Ninety of the cars will be made by the American Car & Foundry Company; eighty-five will be furnished by the Pressed Steel Car Company, and twenty-five will be built in the company's shops at Altoona. Of the eighty-five cars to be built by the Pressed Steel Car Company, sixty will be passenger coaches, twenty baggage and five combination.

THE BRIGHTON BEACH IMPROVEMENT OF THE BROOKLYN HEIGHTS RAILROAD

The Brooklyn Heights Railroad Company, in connection with the Brooklyn Grade Crossing Commission, is making extensive changes in its Brighton Beach line to Coney Island. The main part of the work is about 5 miles long, and was undertaken to abolish grade crossings. The line was formerly the property of a steam road, the Brooklyn & Brighton Beach Railroad, which terminated in a depot at Atlantic and Franklin Avenues, Brooklyn. When the property was acquired by the present owners the depot was abandoned and an incline was built to connect the line with the elevated road in Fulton Street. As heretofore operated, the road ran down from the elevated structure into an open cut, which extended to Church Avenue in Flatbush, where it came to the surface and continued at street grade to Brighton Beach. The main part of the present work is the reconstruction of this latter stretch south of Church Avenue, the first 1¼ miles being placed in an open cut and the remainder on an embankment.

THE WORK IN PROGRESS BETWEEN AVENUES G AND H

The reconstruction is being done under authority of an Act of the Legislature, passed in 1903 and amended in 1905, which established the Brooklyn Grade Crossing Commission, whose duty it is to prepare the plans and specifications and superintend the execution of the grade crossing elimination. The Commission consists of five members appointed by the Mayor of New York, one being nominated by the Long Island Railroad and one by the Brooklyn Heights Railroad. The cost is to be equally divided between the railroad company and the city, except that the limit of the city's expenditure is $1,000,000.

The Brighton Beach line from Church Avenue south serves a rapidly growing residence section, and this fact, in addition to the very large summer traffic to the Coney Island resorts and the Sheepshead Bay race track, influenced the railroad company to build a four-track system on the new work to replace the two tracks now in operation. When the improvement is completed an express service will be inaugurated on the two inside tracks. Work was started on Dec. 30, 1905, and it is hoped to have it sufficiently completed by June 15 of this year to operate two tracks. The reconstruction described in this article starts near Church Avenue. The roadbed for 1¼ miles south of this point will be depressed 10 ft. to 22 ft. below street grade, the sides being protected by concrete retaining walls and the depression spanned by plate girder bridges carrying the streets. The grade finally rises to cross over the tracks of the Bay Ridge division of the Long Island Railroad, and for the remaining distance the roadbed will be elevated about 12 ft. above the ground.

The material in the cut, amounting to 230,000 cu. yds., was sand and gravel, and this fact, combined with the high value of the property bordering the right of way, made it cheaper to build retaining walls than to purchase extra land for slopes. The walls under 14 ft. have a vertical face, and the higher ones a recessed face with curves joining it to the faces of the coping and the footing. The walls are built on an easement of 7 ft. granted by the owners of the abutting property. They are of 1:3:5 gravel concrete made with giant Portland cement, and rest on gravel foundations about 3½ ft. below the roadbed. Vertical expansion joints with a V-shaped groove on the surface are left every 50 ft., tar paper being used to separate the abutting sections. In the interior of the walk are placed vitrified clay conduits for carrying wires. They are made up of sections 18 ins. long connected by iron dowels, with the joints wrapped with two laps of cloth 6 ins. wide, dipped in cement grout before being applied. Manholes for handling the wires are built into the walls every 400 ft.

The problem of draining the cut proved a difficult one. It was desirable to avoid raising the streets to pass over it, but to do this would have required a depression of the roadbed which would have made gravity drainage impossible. A compromise was, therefore, effected which, with the use of very light drainage grades, allowed the run-off to be diverted to the city's sewerage system. Concrete troughs are built the full width of the right of way at intervals of about 600 ft. and connected with a drain which runs the full length of the cut. This system is connected with the city system and is made through a 36-in. sewer

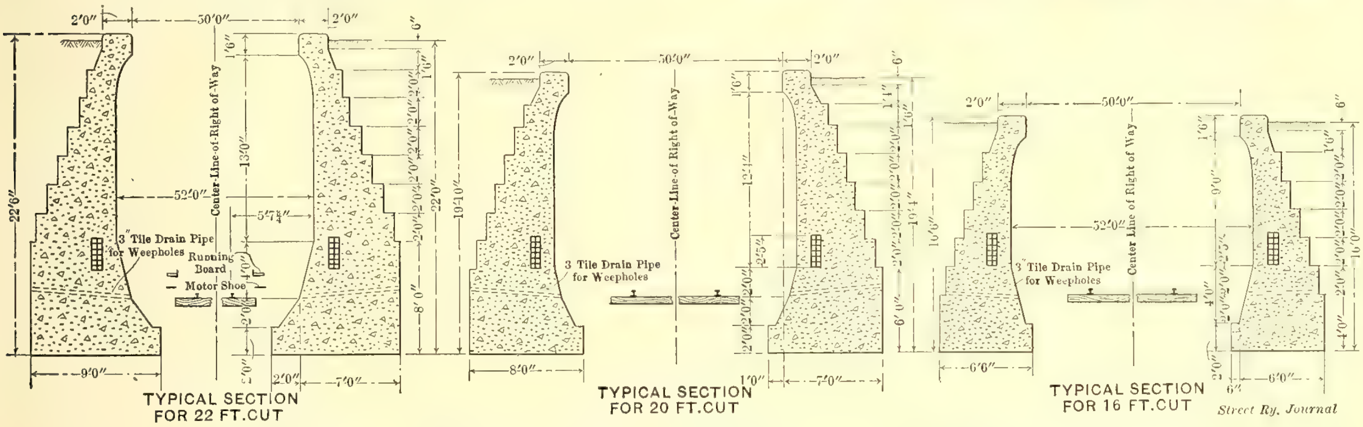
POWER SHOVEL AT WORK ON THE BRIGHTON BEACH LINE

1½ miles long. The transverse troughs vary in width from 18 in. to 24 in. They are covered with iron gratings and are spanned by yellow pine stringers, 10 ins. square, carrying the rails. In addition to this system, rapid drainage is provided by ditches lined with granite blocks, with a covering of cement grout located between the outside tracks and the retaining walls.

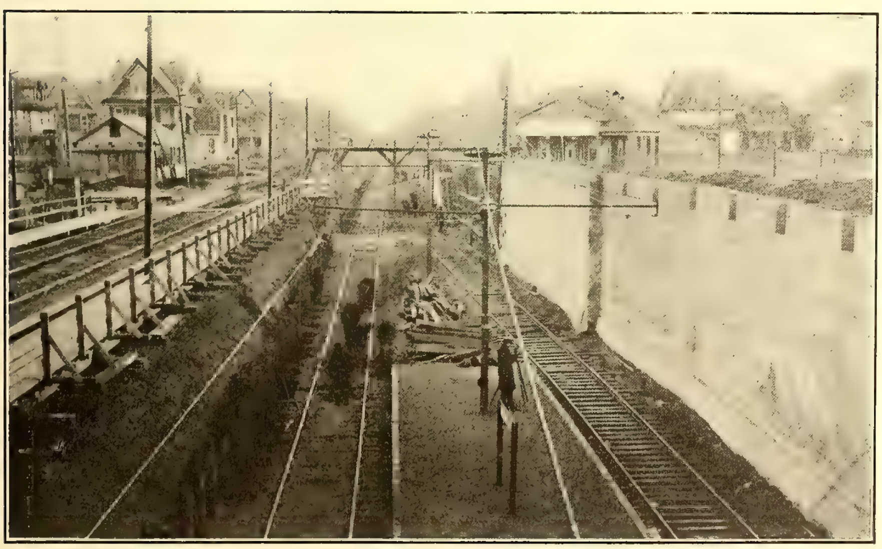
At one street intersection a 10-ft. circular sewer crossed the right of way at an elevation which required its rebuilding. The street was torn up for 60 ft. each side of the railroad property lines and the sewer reconstructed with a section having an extreme depth of 7 ft. 2 ins. and a width of 14 ft. 6 ins. Part of the old invert was left undisturbed, and a flat roof of reinforced concrete and vertical side walls built around it. The rails for the track are carried over the roof in troughs made of plates and angles. The flow in the sewer was not obstructed at any time, a flume of sufficient size to care for a moderate storm having been built in the old sewer before the reconstruction was started.

The tracks begin to rise a short distance north of the Manhattan Beach division of the Long Island Railroad, which will be crossed on a plate girder bridge. Heretofore the crossing has been the reverse of this condition. Just east of this crossing a Y leads off the Long Island Railroad and a double-track system runs parallel to the Brighton Beach line as far as Coney Island, the two lines being close together for a short stretch, and then, swinging outward, run about 600 ft. apart. Under the new plans the old right of way of the Long Island Railroad will be abandoned and its tracks transferred to the fill on which the Brighton Beach line will be built, thus making a six-track embankment. The changes on the Long Island system are being carried on as a part of the Bay Ridge improvement, which is also under the control of the Brooklyn Grade Crossing Commission. The embankment will contain about 1,000,000 cu. yds., the cut above described furnishing about 230,000 cu. yds. and the remainder coming from the Bay Ridge improvement.

PART OF COMPLETED RETAINING WALL



RETAINING WALLS THROUGH DEPRESSED PORTION OF RIGHT OF WAY BETWEEN CHURCH AVENUE AND LONG ISLAND RAILROAD



VIEW FROM BRIDGE AT NEWKIRK AVENUE FACING THE SITE OF A NEW STATION

The streets intersecting the right of way are carried over the cut on plate girder bridges, and on the south end under the embankment through subways spanned by the same type of bridge. The maximum height that any street was raised was 7 ft. and the maximum gradient 3.3 per cent. The maximum street depression was 4 ft. All bridges have solid reinforced concrete floors.

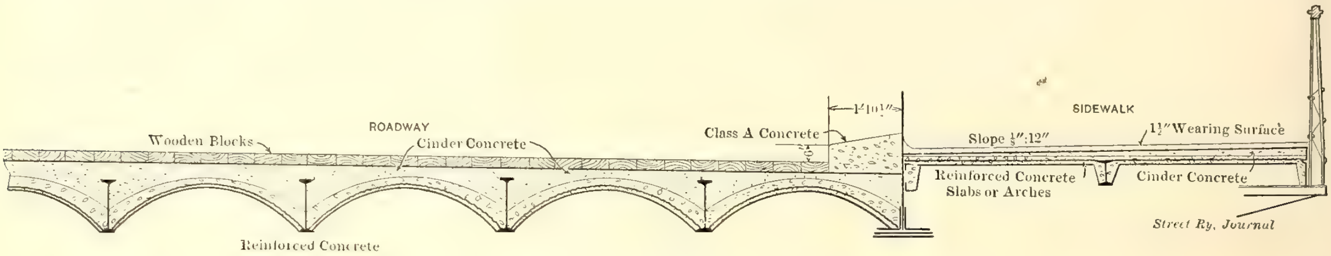
The construction work in the cut was carried on under very adverse conditions. The contract required the maintenance of traffic, and this, combined with the fact that the entire plant had to be confined to the right of way and the easement strips, a total width of 64 ft., necessitated skilful arrangement and handling. The contractor was allowed to use the operating tracks for spoil service so long as it did not interfere with the regular traffic. Work was started

at the south end of the cut, near the point where the contractor had established his auxiliary plant, and opened a gravel pit. A track was built on the east easement strip and used for an operating track, while the western one of the two original tracks was used for spoil service. A trench was then excavated in the west easement strip, the material being shoveled by hand into tubs which were swung by a derrick over to the spoil track and dumped into cars. Operations were carried on at three points simultaneously. The trench was sheeted as the work progressed, and the forms for the retaining wall put in place and concreting begun. As soon as the wall was completed for a sufficient length, a derrick operating a Hayward orange-peel bucket was put in service and removed the material on the inside of the wall until a sufficient width had been excavated to subgrade to allow one or two tracks, depending on the location, to be thrown into the trench. Traffic was then diverted through this cut, single-track operation being carried on for about three-quarters of a mile. The temporary track was next removed from the east easement strip and the construction of the east wall proceeded in a manner similar to that described for the west wall. When the forms were ready to be taken down a steam shovel was cut in to remove the core of spoil between the two walls.

The concrete mixers, three in number, were generally set up at the end of the blocks and the concrete delivered to its place in the wall in cars running over the trench on a narrow gage track furnished by the Henry J. McCoy Company. The Ransome mixers were elevated so as to discharge by gravity into the cars, the materials being raised to them by bucket conveyors. The total amount of concrete in the cut is about 40,000 cu. yds., and it was placed at a rate as high as 180 cu. yds. per day per mixer.

South of the Long Island Railroad crossing the work was carried on without the inconvenience experienced in the cut. The work consisted merely in making the embankment, and, since the Brighton Beach trains were operated over the Manhattan Beach tracks, no special provision for regular traffic was required. Considerable temporary bridging was required in all portions of the work in providing for street traffic.

As the material taken from the cut contained sand and gravel of the grades required for the concrete, a screening and washing plant was installed by the contractor. A spur from the main track led to a depressed hopper, consisting simply of a sheeted trench, beneath which ran a Robbins belt conveyor for elevating the material to the screen. The spur track was high enough to discharge by gravity into the hopper, and the screen likewise was high enough to discharge by gravity into the cars provided for hauling away the sorted and washed material. Near the screening plant is a crusher made by the Good Roads Machinery Company, a gravel pit, a blacksmith shop and a cement warehouse. Owing to the high cost of water, $1 per 1000 cu. ft., the contractor determined to secure an independent supply, and accordingly sank a 3-in. well and installed an electrically-driven pump. A supply pipe, with taps every 400 ft., was laid the entire length of the work, and furnished a handy supply for concrete, the engines and the steam shovel. The pump was a triplex pump with a capacity of 60 gals. per minute, and was made by the Platt Iron Works. It was driven by a 10-hp, 500-volt General Electric motor, supplied with power from the trolley wires. The installation, allowing for the depreciation of the plant, has reduced the cost to about half of the charge for city service. The contractor used three Mogul locomotives weighing 60,000 lbs. each, forty flat cars with a capacity of 50,000 lbs., and thirty-six 6-yd. Oliver dump cars.



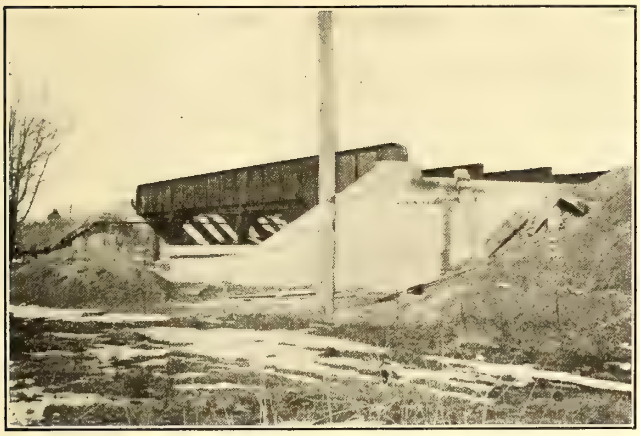
SECTION A-A

SECTION OF PAVING FOR HIGHWAY BRIDGES


A VIEW ALONG THE BRIGHTON BEACH LINE NEAR A STATION

The work is under the supervision of the Brooklyn Grade

Crossing Commission, J. H. Dwyer being engineer in charge; H. B. Snell, principal assistant engineer, and C. T. Bissell, resident engineer. All the work in the cut and the filling as far south as Avenue O is being done by Charles Cranford, with R. L. Russell as chief engineer. The embankment south of Avenue O is being built by the Brooklyn Heights Railroad, W. S. Menden, chief engineer. Milliken Bros., of New York, furnished all the steel for bridges and stations, and the Abbott-Gamble Company built the bridge floors.



A HIGHWAY CROSSING ON THE BRIGHTON BEACH LINE

UNFAIR COMPETITION FORBIDDEN IN OHIO

An important decision, affecting the rights of steam railroad companies in Ohio to discriminate in their passenger rates to the detriment of electric railway companies, was handed down by the Railroad Commissioners of that State on April 18. The case was that of Aaron E. Price, of Athens, against the Hocking Valley Railway Company. This is a steam railroad corporation, which for part of its line is paralleled by the Scioto Valley Traction Company, an electric line. Owing to this fact, the railroad company has reduced its fares on the line which is paralleled by the Scioto Valley line, but not on others. Mr. Price alleged that such a practice was in violation of the State statute which provides that it is unlawful for a public carrier "to give undue or unreasonable preference or advantage to any particular person * * * or locality, or any particular description of traffic, or to subject any particular person * * * or locality, or any particular description of traffic, to any undue or unreasonable prejudice or disadvantage in any respect whatsoever." He showed, for instance, that Athens, which is outside of the competing territory, is 76.3 miles from Columbus, measured along the right of way of the railroad company, while Lancaster, which both lines reach, is 31.5 miles from Columbus, measured along the right of way of the company. The fare from Athens to Columbus is $1.55 for a single ticket and $3.10 for a round-trip ticket, or at the rate of 2 cents a mile. On the other hand, the company sells between Lancaster and Columbus what is known as a "twin ticket," which entitles the holder to one round trip or two passengers to travel on the same train for 75 cents, or at the rate of 1.19 cents per mile. The single fare on the Hocking Valley between Lancaster and Columbus is 65 cents. The single and return fares between Lancaster and Columbus on the Scioto Valley Electric are 60 cents and $1, respectively.

The Hocking Valley Railroad Company, in its defense, claimed that the rate to Athens was within the 2-cents-per-mile rate permitted by law, that the Lancaster tickets were limited to ten days, whereas the Athens tickets could be used within thirty days, that the Lancaster rate was a commutation rate intended to meet electric competition and encourage suburban residence, and that the rulings of the Interstate Commerce Commission justified the right of a carrier to consider competition as a factor in rate making. These defenses were not considered adequate by the Commission, which, in referring to the Ohio statute, said: "It is not the purpose of the law to require the State to act in a paternal manner towards its creatures, but it should be the policy of the State to prevent the destruction of one public service concern, which exercises a part of the sovereign power, at the hands of another and stronger competitor. This seems to us to be the true doctrine of public policy."

As a result, the Commission decided that the rate was adopted not to meet but to destroy competition, and issued an injunction against the steam railroad company, requiring it to cease from this unreasonable and unjust discrimination. The attorneys were H. M. Daugherty, for the complainant, and C. O. Hunter, for the defendant.

PREPARING THE FORT WAYNE-LAFAYETTE LINE FOR OPERATION

Anticipating the inauguration of interurban service between Fort Wayne and Lafayette July 1, Superintendent John B. Crawford, in charge of the traffic department of the Fort Wayne & Wabash Valley Traction Company, is working out the details for the schedule between the two cities. When the road is completed, the company will have a line 110.3 miles in length. With the inauguration of service between Fort Wayne and Lafayette the limited through service between Fort Wayne and Indianapolis by way of Peru will cease. Limited cars will be run between Fort Wayne and Lafayette and will connect at Peru with limited cars to and from Indianapolis. It is probable by that time that through service between Fort Wayne and Indianapolis will be established by way of Muncie and Bluffton, a route that is about 12 miles shorter than the present route. Before this route can be established, however, it will be necessary to raise the Big Four bridge at Hartford City. The Fort Wayne & Wabash Valley limited cars now used in the Indianapolis-Fort Wayne service will be used between this city and Lafayette, and a first-class buffet service will be maintained. The schedule for the Fort Wayne-Lafayette service will include four limited cars each way daily. They will leave Fort Wayne at 6:20 a. m., 10:30 a. m., 3 p. m. and 7:20 p. m., and will arrive there from Lafayette at 10:05 a. m., 2 p. m., 7:45 p. m. and 11:15 p. m.

The Montreal Street Railway Company has adopted a new style of transfer slip, which is less complicated than the one previously in use. The transfer is punched from the direction from which the passenger boards the car and the time same is due at the transfer point. The company has requested passengers to ask for transfers when they pay their fares.

A SIMPLIFIED METHOD FOR INSTALLING PLASTIC RAIL BONDS

Harold P. Brown, of New York, whose plastic rail bond is so well known, has devised a new type which can be in-

BANK OF LAMPS FOR NIGHT WORK

stalled without tearing up the street, removing the angle plate or interrupting traffic. It is so constructed that it will not shear off; in fact, it is claimed that when placed

SECTION SHOWING POSITION OF PLASTIC BONDS

DRILLING A HOLE FOR THE BOND

in the head or tram of the rail every wagon that passes over this bond really increases its efficiency. On exposed T-rails the bond holes are bored through the flange of the angle plate, and into, but not through, the base of the rail. A glance at the accompanying illustrations will show how this is accomplished.

The installation is carried out with an electric drill equipped with tungsten steel drill points that require no lubrication and will bore 1000 holes without regrinding. The drill is held in position by a magnetic clamp, which, in itself, is a most ingenious contrivance. It is fitted with wheels for conveyance from place to place. Interchangeable shoes to fit any type of rail are used; the coils are heavily insulated and boxed in, thus protecting them from possible damage. As shown in one of the illustrations, lamps can be placed on the outside of the box, thus permitting night work. The current for both the clamp and the drill is obtained through a hooked-shape wire attached to a pole and suspended from the overhead wire. Upon the approach of a car this pole can be instantly removed, thus releasing the clamp and giving a clear track for the car. This equipment enables such rapid and efficient work that one mechanic and two laborers can bond from seventy to one hundred joints a day.

Those who visit the Jamestown Exposition within the next few weeks can see this apparatus in active operation installing plastic plugs on the Norfolk & Portsmouth Traction Company's system.

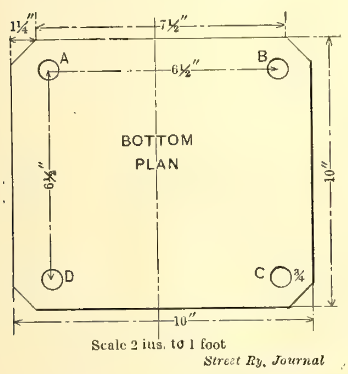
ATTRACTIVE CIRCULARS OF TWIN CITY COMPANY

The Twin City Rapid Transit Company, of Minneapolis, has recently issued two very attractive booklets dealing with its lines, entitled "Twin City Trolley Trips" and "Air-Ship View of Beautiful Big Island Park and Lake Minnetonka." The cover of the first of these is in colors and represents a view at night along the great white way to Lake Minnetonka. It is an excellent specimen of printing, the color combinations harmonizing nicely. In the center of the folder is a panoramic view in colors of the company's lines, showing the famous lakes, rivers, parks and resorts. The booklet is formally addressed thus: "To the Visitor in the Twin Cities." As A. W. Warnock, the passenger agent of the company, says in a sub-heading, it is "A Tale of Two Cities"—prosperous, progressive, picturesque. The Air-Ship View contains, besides the panorama of Big Island Park and Lake Minnetonka, a picture story of Big Island Park and the Lake Minnetonka boats.

CONCRETE POLES

Wood suitable for pole construction in all electrical work is growing scarcer every year, and the condition is especially serious in railway service because a railway company is usually required to comply with certain city ordinances respecting the quality of the poles used. The life of wooden poles depends largely upon climatic conditions, but may be said to vary from seven to eleven years, according to the kind of wood used, local conditions and maintenance precautions. The climate of Southern regions is particularly hard on wooden poles unless some method of preservation is used. Steel poles are expensive in first cost and maintenance. The point of deterioration in this class of structure is usually at the ground line, where a rusting action sets in which will eventually cause the destruction of the poles. Attempts have been made to remedy this defect by the introduction of sleeves and the use of a concrete base, but impose an additional cost to the already high initial expenditure. To overcome these difficulties, the concrete pole has been devised and patented by J. L. Weller, superintending engineer of the Welland Canal, at St. Catharines, Ont., and a number of these poles are in use in that city, Toronto and elsewhere in Ontario.

It is claimed in its favor that the concrete pole does not succumb to the attacks under which a wood or steel pole will fail. No paint, above ground, is necessary to improve its appearance, as the concrete is, in itself, of a pleasing gray color. Concrete is practically a non-conductor, and instances have been noted where bare electric cables have become detached through the breaking of an insulator and have come in contact with the concrete pole without interruption to the circuit. Closely allied with this is the fact that lightning does not harm this pole, as the steel reinforcing rods, to be described later, act as a ground when a ground and top lead are provided.



PLAN OF POLE

CONCRETE POLE

The pole developed by Mr. Weller is essentially the frustum of a pyramid, built of concrete and reinforced by four steel rods running throughout the entire length. The steel is so arranged to obtain as nearly as possible the theoretical requirements, viz.: that the stresses increase from the top to the bottom of the pole, when a horizontal strain is applied, in a direct ratio to the distance from the top. To meet this requirement the steel reinforcement should increase from nothing at the top to a maximum at the bottom. While not absolutely feasible, this effect is practically obtained by rods of various lengths and increasing in cross-sectional area from the top to the bottom. This gives a tapering reinforcement, and, as the concrete and steel are in a constant ratio, the pole is tapering, as is the case in ordinary wooden pole structures.

Poles constructed along these lines have been built under the Weller patents by the Concrete Pole Company, of St. Catharines, in lengths varying from 25 ft. to 150 ft. The smaller poles were constructed to withstand a horizontal strain of 500 lbs or 1000 lbs., and the 150-ft. poles a strain of 4000 lbs applied at the top. In transmission lines, of which about 15 miles have been equipped, the heights of the poles are generally from 35 ft. to 50 ft. and carry strains of 2000 lbs., with several strains of 10,000 lbs. The weights of the finished poles vary with the different strains they are required to stand. For instance, a 30-ft. trolley pole to stand 500 lbs. weighs about 1300 lbs., while a pole of the same length for 1000 lbs. will weigh about one ton. The 150-ft. poles, to stand the 4000-lb. strain previously mentioned weigh about 45 tons. In all of these cases the calculated strength has been very close to the actual strength of the pole as determined by tests. In many cases there was not a difference of 25 lbs. between the calculated and actual strength. It will thus be seen that the greatest economy of construction is obtained.

In the building of the pole a wooden form is used, conforming in size to the estimated size for a given strain. As a matter of structural convenience, the cross section is made square with the corners chamfered off. The mold is made in sections of the most economic length for poles of a certain height. The bottom of the mold is first set in position, horizontally, on the ground. Then the sides, with the molding for the corner chamfers attached, are set to the required taper and held there by means of an occasional clamp on the outside. The top of the mold is left open and the concrete is given a smooth finish by troweling. The reinforcing rods are placed in when the mold is complete and are held in position, temporarily, while the concrete is being placed. They are not connected in any way at the top or bottom.

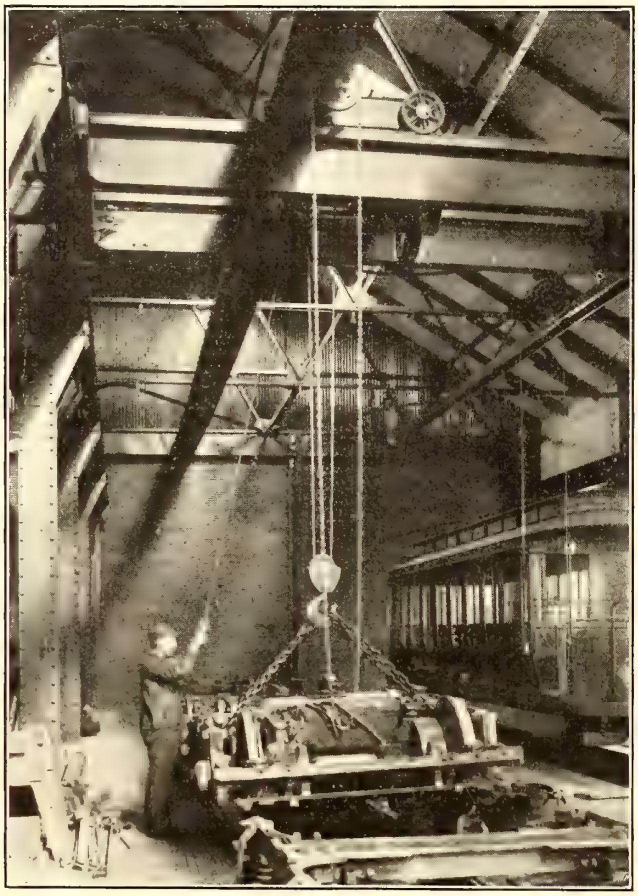
The best results are obtained from concrete compounded of one part of cement to four or five parts of clean lake or washed gravel, although good results are obtained with the use of broken stone. The concrete is put in throughout the entire length of the pole at once, and is well tamped in place.

The cost of the concrete pole varies with the location; but, generally speaking, it is about one-third less than that of steel. As compared with wood, the concrete pole is initially more expensive, but a fewer number of poles are required and there is no maintenance expense. There is also an increased safety from wind pressure. The concrete structure has carried lines during a 60-mile gale under which a wooden line would have been demoralized.

The accompanying illustration shows a 30-ft. span pole in St. Catharines, and is one of some eighty poles of that size that have been in use for some time. They have proved so successful that the local company has placed an order for additional concrete poles. The city of Toronto has also some ten concrete poles which have been in use for three years, as an experiment. The Windsor, Essex & Lake Shore road, of Windsor, Ont., has ordered one hundred concrete poles for use this coming season.

ELECTRIC TRAVELING CRANES AT COLD SPRINGS CAR HOUSE, BUFFALO

The installation of electric traveling cranes for lifting car bodies, trucks, etc., in the shops of the International Railway Company in the car houses at Cold Springs, near Buffalo, N. Y., consists of four 10-ton, 3-motor electric "Northern" cranes, controlled from the floor, each crane being equipped with a 5-ton low type Northern crane trolley. The span of each crane is approximately 30 ft. By using two trolleys and the lifting beam the car body is lifted off the trucks, as shown in the accompanying illustration, and new trucks rolled into place. With two cranes together the entire car body can be lifted and moved to any portion of the shop. Trucks or motors, etc., are lifted by one trolley, as shown in the engraving. The crane ridges are traveled by an electric motor, and each hoist is operated by an independent electric motor. The travel of the trolleys across the bridge is accomplished by hand power.



SINGLE CRANE AS USED TO LIFT TRUCK

The conditions at Cold Spring were such that a low type trolley was necessary, and for this reason the Northern low type electric crane was selected, as it occupies but little head room. The hoisting speed is 10 ft. to 25 ft. per minute, the bridge travel speed 200 ft. to 250 ft. per minute.

A pit, approximately 5 ft. deep, extends between the rails of each track. The height above the rails to the ceiling is approximately 19 ft., and the space occupied by the cranes is approximately 3 ft. above the runway rail. The cranes take current from the regular overhead track wires above the pit, these wires being supplemented by a ground wire for the crane. Thomas Pumfrey planned the installation for the International Railway Company, and the equipment was installed by the Northern Engineering Works, of Detroit, Mich.

TWO TROLLEYS FOR LIFTING CAR BODY

MORE SEMI-CONVERTIBLE CARS FOR FITCHBURG & LEOMINSTER RAILWAY

The Fitchburg & Leominster Street Railway Company has lately added to its rolling stock four Brill grooveless post, semi-convertible cars to be used for general traffic between Ayer and Fitchburg. It was in the fall of 1902 that this road purchased its first Brill semi-convertible; in fact, the car was the first of the type to come into the State, and the chief reasons for its continued use, as set forth by W. W. Sargent, superintendent of the road, are its popularity and the ease with which it can be changed over.

SEMI-CONVERTIBLE CAR FOR FITCHBURG & LEOMINSTER STREET RAILWAY

The chief dimensions and features of the new cars follow: Length over end panels, 33 ft. 4 ins.; over vestibules, 42 ft. 9 ins.; width over sills, including sheathing, 8 ft. 2½ ins.; over posts at belt, 8 ft. 6 ins.; size of side sills, 4 ins. x 7¾ ins.; end sills, 5¼ ins. x 6⅞ ins.; sill plates, 15 ins. x ⅜ in. The cars are mounted on 27-E1 trucks, with a wheel base of 6 ft. Four motors, of 40-hp capacity each, are used on each car. The interiors are of cherry, with ceilings of birch veneer. This type of construction permits a 37-in. seat with aisle space of 24 ins.

FINANCIAL INTELLIGENCE

Wall Street, May 8, 1907.

The Money Market

There has been no material change in the monetary situation during the past week. The demand for money from all sources has been comparatively light, resulting in somewhat lower quotations for all classes of accommodations. Early in the week preparations for the May 1 interest and dividend disbursements caused an advance in the call loan rates to 4 per cent, but this was followed by a drop to 2 per cent at the close. In the time loan department business was practically at a standstill, and notwithstanding further concessions on the part of lenders of about 1/4 per cent in the asking rate, they experienced considerable difficulty in placing their funds. Corporate borrowing continues. The most important development in this connection during the week was the decision of the Atchison directors to issue about $26,000,000 ten-year 5 per cent convertible bonds. The subscription price of the bonds has been fixed at par and accrued interest, payable 30 per cent at the time of subscription, 35 per cent between Jan. 5 and Jan. 10, 1908, and 35 per cent between June 5 and June 10, 1908. The payment of these bonds covers such a wide period that little or no disturbance will be caused to the local money market. Reports that the Secretary of the Treasury will withdraw part of the $35,000,000 special deposits made with the national banks at the close of last year, were revived, but up to this time no official announcement has been made from Washington regarding the Secretary's intentions in this matter. The sharp advance in foreign exchange to the highest rate of the year caused more or less talk of gold exports to Paris, but according to leading authorities such transactions are out of the question at this time. The European situation remains practically unchanged. Open market discount rates are materially below the official figures, but no change in the latter is expected for the present. The Bank of France continues to draw gold from London, and until the former institution recovers all of the gold sent to London earlier in the year, it is not likely that there will be any change in the Bank of England discount rate or in that of the Bank of France.

The bank statement published last Saturday was very disappointing. Loans showed a further expansion of $16,902,700, making a total increase in that item of $85,000,000 during the past four weeks. Cash decreased $1,918,000. Deposits increased $14,416,600, which resulted in an increase in the reserve required of $3,604,150 over the preceding week. The surplus reserve therefore was reduced by $5,522,150, leaving the total surplus at $6,824,625, as compared with $5,899,525 last year and $18,729,425 in the corresponding week of 1905.

The Stock Market

Trading on the Stock Exchange was comparatively quiet during the past week, and was accompanied by an irregular price movement. At the beginning of the week the market displayed pronounced strength, but in the subsequent dealings the early gains were in many instances wiped out. The speculation was entirely professional, there being nothing in the commission house business to indicate an active interest in the market on the part of the so-called outside public. The principal factors working for the decline during the last half of the week were the crop damage reports and the probable course of the money market in the immediate future. Reports from the winter and spring wheat districts were decidedly unfavorable, and while these reports caused considerable selling of stocks by professionals there was a general disposition on the part of the more conservative element to await the Government crop report to be made public at the close of the week. So far as the money market is concerned there is nothing in the situation calculated to cause any material change in rates for money in the near future. Funds are now in ample supply and rates for time loans are lower than those prevailing at the close of a week ago. The sharp advance in sterling exchange to the highest rates of the year suggested exports of gold to Paris, but it may be said upon competent authority that such operations are entirely out of the question at this time. Rates are nearly a full cent below the point at which shipments of the yellow metal can be made profitably, and even should the Bank of France allow interest on the gold while in transit, which is unlikely, it is doubtful if such transactions could be made without a loss to the shipper. The strike of the freight handlers of the Trans-Atlantic and the coastwise lines and the fears that the struggle may extend to the railroads, also had a depressing influence. Monetary conditions abroad are highly satisfactory. The general business situation remains practically unchanged. The activity in iron and steel continues, while the position of copper metal is very strong.

Philadelphia

Although the trading in the local traction issues was upon a comparatively small scale during the past week, prices generally showed strength, and in some instances substantial gains were recorded. Philadelphia Rapid Transit was the active feature of the group. Opening at 21 5/8, it eased off to 20 3/4, and later rallied to 21 1/4. On May 6 the assessment of $5.00 was paid, making the stock $35 paid in, and sales on the new basis were made at from 26 1/8 to 25 7/8. About 12,000 shares were traded in. Union Traction was decidedly firm, with transactions at 59 7/8 and 60. Philadelphia Company common sold at 44 1/4 and 44, and preferred sold at 45 1/2 and 45. Philadelphia Traction was firm at 94. Other sales included American Railways at 49 3/4 and 50; United Traction of Pittsburg preferred at 47, and Lehigh Valley Transportation at 12 3/4.

Chicago

There were no important developments in the local traction situation during the past week. Deposits of the stocks under the plan have been fairly large and fully up to expectations. Trading in the street railway issues was extremely light and prices remained practically unchanged. Union Traction common advanced from 4 1/4 to 4 5/8, and the preferred sold at 15 1/2. Metropolitan Elevated preferred was dealt in at 65, and Chicago & Oak Park common sold at 4.

Other Traction Securities

The market for traction issues at Baltimore was exceedingly quiet but strong. United Railway incomes furnished the active feature of the trading, upwards of $30,000 selling at 55 and 55 1/4. The 4 per cent bonds sold in small amounts at 87 1/4 and 87 1/2, and the new refunding 5s changed hands at 84 1/2. The free stock declined from 13 1/4 to 13. Other transactions included Norfolk Railway & Light 5s at 97 1/4, Macon Railway & Light 5s at 96 1/2, and Washington City & Suburban 5s at 101 1/2. The feature of the Boston market was a decline of 2 points in Boston Elevated to 139 on light transactions. Massachusetts Electric common, after an early advance to 17, lost nearly all of the improvement. Boston & Worcester was active at 26 1/2 and 26, and sales of the preferred were reported at 71. West End common sold at 88 and 88 1/2 and the preferred at 105.

Owing to recent decision of the local courts in favor of the Cleveland Electric within the past week its stock has advanced several points from the low level it reached a few days before, when seemingly a raid was made on it, following the granting of franchises to the opposition companies over the two routes on which it is now taking up its tracks. Moreover, there has been considerable trading in its securities and confidence is expressed in its future, although any settlement must result in reduction of fares. On Saturday the Forest City showed a decline of 3/4, and this continued on Monday. Northern Ohio sold at 27 1/2, several fair sized blocks of stock going at that. In all, the week was rather more active than usual in traction securities.

The traction shares moved in sympathy with the general market. The announcement from Albany that the Republican Senators had decided to accept the Governor's utilities bill had very little influence on prices.

Security Quotations

The following table shows the present bid quotations for the leading traction stocks, and the active bonds, as compared with last week:

	May 1	May 8
American Railways	49¾	49¼
Boston Elevated	a140	a138
Brooklyn Rapid Transit	58⅞	60⅜
Chicago City	180	180
Chicago Union Traction (common)	4¼	4½
Chicago Union Traction (preferred)	15¼	14½
Cleveland Electric	—	51½
Consolidated Traction of New Jersey	73	74
Detroit United	70	70
Interborough-Metropolitan	25	24½
Interborough-Metropolitan (preferred)	59½	58½
International Traction (common)	—	—
International Traction (preferred), 4s	—	—
Manhattan Railway	139¾	138½
Massachusetts Elec. Cos. (common)	16	16
Massachusetts Elec. Cos. (preferred)	57	57
Metropolitan Elevated, Chicago (common)	24	a26
Metropolitan Elevated, Chicago (preferred)	a65	a65
Metropolitan Street	94	92½
North American	75⅜	72½
North Jersey Street Railway	40	40
Philadelphia Company (common)	44	44
Philadelphia Rapid Transit	21¼	†25¼
Philadelphia Traction	94	94
Public Service Corporation certificates	62	61
Public Service Corporation 5 per cent notes	92	92
South Side Elevated (Chicago)	80	81
Third Avenue	115	108
Twin City, Minneapolis (common)	95½	94
Union Traction (Philadelphia)	59½	59¾

a Asked. † Assessment paid.

Metals

The "Iron Age" says the foundry iron markets are firmer throughout the country. There has been some movement of basic iron in the East, sales for the week being 35,000 to 40,000 tons. The railroads do not seem to be taking hold very vigorously in their purchases for delivery in 1908. Structural shops have taken comparatively little business.

Copper metal continues strong. The large selling companies quote 25½ cents for Lake and 25¼ cents for electrolytic.

Owing to continued advance in the prices of raw materials, particularly of pig iron, and evidence that these higher values will rule for some time, a prominent manufacturer of engines predicts a very sharp advance in prices to take care of the increased cost of materials.

RAILWAY MEETING OF THE A. I. E. E.—PAPERS ON RAILWAY AND OTHER TOPICS FOR ANNUAL MEETING

A railway meeting of the American Institute of Electrical Engineers is scheduled for May 21, when Frank J. Sprague is to present a paper on "Facts and Problems Relating to Electric Trunk Line Operation."

A number of papers on railway and allied topics have also been announced for the Niagara Falls meeting, which occurs June 25-28. Among them are:

"Some Power Transmission Economies," by F. G. Baum.

"One-Phase, High-Tension Power Transmission," by E. J. Young.

"Attitude of Technical Schools Toward the Profession of Electrical Engineering," by H. H. Norris.

"Track-Circuit Signaling on Electrified Roads," by L. F. Howard.

"Engineering Specifications," by C. W. Ricker.

"Vector Diagrams of Single-Phase Commutating Motor," by W. I. Slichter.

"Regeneration of Power from Electric Railway Motors," by William Cooper.

"Switchboard Practice for Voltages of 60,000 and Upward," by S. Q. Hayes.

There are also to be two topical discussions at the Niagara Falls convention, they are on "Single-Phase vs. Multi-Phase Generators for Alternating-Current Roads," and "Standardizing the Frequency for Alternating-Current Roads," and are to be led by A. H. Armstrong, railway engineering department of the General Electric Company, and N. W. Storer, of the Westinghouse Electric & Manufacturing Company.

SOUTHERN PACIFIC RUSHING WORK ON ELECTRIC LINES

The Southern Pacific Railroad has announced, through General Manager Calvin, that it will soon have the narrow-gage line to the Alameda mole in complete running order as an electric railway, and that it is proposed to give a fast electric train service on that line. All of the equipment has been ordered and is being moved forward as rapidly as possible, and during the summer a large force of men will be kept at work making the necessary changes for the conversion from steam to electric power. One of the features which will be then introduced will be a fast electric train service between Oakland and Alameda, with the Oakland terminus at Fourteenth Street. As soon as the narrow-gage road has been changed the force of men will be immediately put at work making the same change on the Seventh Street line to cover the service to the Oakland mole. On Sept. 1 a new ferryboat will be added to the service between San Francisco and Oakland, and it is proposed to change the engines on the existing boats with a view to increasing materially their speed, so that a 20-minute service may be maintained between both sides of the bay.

ANNUAL REPORT OF THE PITTSBURG RAILWAYS COMPANY

The fifth annual report of the Pittsburg Railways Company for the year ended March 31, 1907, as just made public, shows earnings as follows:

INCOME ACCOUNT

Gross earnings from operations			$10,232,619
Operating Expenses:			
General expenses		$851,909	
Conducting transportation		3,243,327	
Maintenance of way and structures		511,057	
Maintenance of equipment		632,982	
Park expenses		132,238	
Total operating expenses		$5,371,514	
Bridge Tolls		108,733	
Taxes		291,711	
Total operating expenses and taxes			5,771,957
Net earnings			$4,460,662
Other Income:			
Rent of buildings and real estate		$47,876	
Interest and discount		5,014	
Miscellaneous		31,013	
Total other income			83,903
Total income			$4,544,565
Deductions from Income:			
Rentals of leased properties:			
Pgh. & Castle Shannon R. R. Co.	$15,000		
United Traction Co. of Pittsburg	552,485		
Consolidated Traction Company	1,550,598		
Brunot Island power station	60,169		
		2,178,252	
Miscellaneous interest and discount		278,515	
Tenement expenses		2,693	
Total deductions from income			2,459,460
Net income before deducting fixed charges and extraordinary maintenance expenses			$2,085,104
Fixed Charges:			
Interest on funded debt of Pittsburg Railways Company and leased companies			1,734,200
Net income after deducting fixed charges			$350,904
Extraordinary maintenance expenditures		$300,131	
Car Trust notes issued Dec. 1, 1905, retired during year		40,000	
			340,131
Net income, surplus for the year			$10,773

Passengers carried	203,411,809
Car mileage, miles	36,125,014
Earnings per car-mile	$.2791
Expenses per car-mile (including taxes)	.1552
Net earnings per car-mile	.1239

REPORT ON MUNICIPAL OWNERSHIP

The report of the committee of the American Street and Interurban Railway Association, rendered at the Columbus convention, has just been made public. It was presented by Charles D. Wyman (chairman), H. M. Sloan, J. J. Stanley, John A. Beeler and George F. Chapman. The report, slightly abstracted, follows:

Out of 164 companies received from our circular letter to members of the association we find that the franchises under which they are operating are derived as follows:

State	9
United States Government	1
City	44
City and State	36
Government and City	1
City and County	44
State, City and County	23
Total	158

The bearing of this mixed parentage with reference to a possible attempt on the part of cities to take over the business of the companies is obvious.

In answer to the question, "What municipality-owned utilities are now in operation in your city or field or operation?" 158 replies were received as follows:

None	58
Water Works	51
Electric Lighting	14
Water Works and Electric Lighting	21
Electric Lighting and Gas	1
Water Works and Gas	1
Water Works and Sewer	2
Water Works, Electric Lighting and Gas	4
Water Works, Electric Lighting, Gas, Sewer and Electric Railway	1
Water Works, Electric Lighting and Electric Railway	1
Water Works, Electric Lighting and Sewer	1
Ferry	1
Bath Houses	1
Water Works, Ferry, Subways and Tunnel	1
Total	158

The municipal electric street railways reported in the above list are one in West Seattle, Wash., 1½ miles long with two cars, and the other in Guelph, Ont., with 7½ miles of track and operating eleven cars. Within the last month the electric railway at West Seattle has been sold to the Seattle Electric Company, a privately owned corporation.

One hundred and fifty-nine answers were received to the question, "Has there been any agitation in your locality for the municipal ownership of street railroad properties?" as follows:

No	132
Yes	6
Slight	21
Total	159

To the question, "What have been the causes of such agitation?" the companies apparently found difficulty in replying, since out of 164 only fifty-eight responded. Of these thirty-three asserted that there was no definite cause, and the others assigned as reasons, socialistic movements, the general municipal ownership wave in the country, political and newspaper agitation, and disagreements growing out of attempts at franchise renewal. One answer is worthy of attention, that received from the Guelph Company, in Ontario, Can., namely, "Public demand and failure of private corporation to make a success." It would be interesting to know whether the municipality was attaining any better financial results than those which led the private corporation to abandon the field.

In answer "To what extent does this movement prevail today?" seventy-five companies replied as follows:

No agitation at present	54
Slight	15
Growing	3
Active	3
Total	75

It is to be noted that of the three companies reporting active agitation, one is located in a city where municipal ownership was made a political issue in a recent municipal election; in another, the movement grew out of a question as to the legality of the franchises under which the company was operating and the attempts on the part of the corporation to legalize and extend same, and the third is that of the municipally-owned plant at Guelph.

To the question as to the sentiment of the local press in regard to the movement, 116 companies answered that the movement was not receiving support by the newspapers, ten that it was advocated to some slight extent, and eight that the press in their vicinity was pronouncedly in favor of the doctrine.

One hundred and fourteen companies stated that the municipal ownership movement was not a feature in the politics of their city or town; two, that it entered into politics to some slight extent, while by six it was pronounced a prominent factor in the work of political organizations.

One hundred and thirty-one replies were received to the effect that there had been no expression regarding the doctrine by the voters or taxpayers of the city or county, one that it had been quite openly advocated and three that it had been made a subject of referendum.

To the question as to whether the city charters or any legislative enactment required a referendum of the question of the municipalities acquiring or owning and constructing street railways, out of 103 answers it appeared that about one-half of the municipalities or towns are required to refer such a question to the voters, and the others are free to take action as the civil authorities may desire, subject, of course, to general restrictions with reference to the issue of securities for municipal undertakings.

One hundred and thirty-two of the companies stated that there had at no time been any very complete discussion of the question of municipal ownership in their locality, and that no presentation of the arguments for or against the proposition had been made in the local press by any civic body or in any public assembly; while eight replied that the matter had been the subject of popular discussion. From Halifax, N. S., it was reported that the conclusion of a general and public consideration of the subject in that city had resulted adversely to its trial.

To the question, "Has your company made any public statements of its position, either in the papers or otherwise in regard to the question?" 132 companies replied "No" and three "Yes."

It will be interesting to note carefully the answers received to the following question: "What, in your opinion, is the best method of meeting and controverting the sentiment for municipal ownership?" Of the 110 replies, five methods were especially emphasized:

First—Education.

Second—Good service.

Third—Publicity as to facts of company's operation and position.

Fourth—A liberal policy in the matter of extensions, rates, etc.

Fifth—Square treatment of everybody.

From the above replies it is evident that as regards the electric street railroads in this country the movement for their municipalization has not as yet assumed any very grave proportions, but we cannot be blind to the fact that a strong sentiment in that direction has developed which will sooner or later threaten our investments and as well our rights as citizens and taxpayers, as we hold them. If we concede that this condition exists, the most important answer to the questions submitted to the companies would seem to be that last cited, namely, "What is the best method of meeting and opposing this sentiment of municipal ownership?" and we cannot do better than to take for discussion in this report the suggestion embodied in the replies received from the members of the association, which, in brief, is covered by the term "education" or the phrase "public enlightment upon the subject."

We may utter only a truism when we say that he who would ascertain the truth or falsity of a proposition must needs as a precedent to any permanent and safe result be furnished with an open mind, an honest purpose and a courageous resolve. But such an attitude on our part is absolutely essential in the present instance, for if we believe that the discoverable truth as to this question of the municipal ownership of public and quasi-public utilities such as transportation, both as to facts, methods and results, will lead to the safeguarding of the business interests we represent and our own, as citizens and taxpayers, we ought heartily to urge our fellow citizens to join with us in a patient, comprehensive and honest study of the question and

the conditions which have given it life and force. Invective and violent declamation will not prevail to stop its progress; its promoters cannot be frightened from their purpose by superficial criticism or political strategy. We must meet them in the field of open discussion and argument, prepared to reason together honestly and fairly as to the merits of the proposition. "Will State or municipal socialism or ownership make for the greatest growth of the country, the municipality or the individual?" "Will it, under the conditions that prevail in this free land, contribute to the best profit of the community, both taxpayers and non-taxpayers?" "Is it right?" "Will it pay?" If in a proper spirit we can promote and join in discussion along such lines as these, we believe we will secure a most advantageous result to our interests as business men and citizens.

Your committee feel that to urge such action will be unavailing unless the members of this association are convinced of the necessity of the adoption of this or some kindred policy to avert positive danger to our interests. In the absence of any immediate attack upon our own domains we may be inclined to view the progress of municipal socialism with nothing more than dilettante curiosity and relegate its phenomena to the halls of academic discussion. While municipal socialism, which, as an important part of its creed advocates the ownership and operation of public utilities of the character our association represents, has not as yet made any very general or determined attack upon our business, it has nevertheless reached a status abroad and seeks a like one here both as a political dogma and a social theory which cannot in safety be ignored. However much we may be inclined to be indifferent to ideals, theories and captions, and refuse to be frightened by this bogy of socialism, we cannot shut our eyes to the fact that from Germany, France, Italy, Belgium and England it has come to America, has passed the inspection of many American scholars of civil policy and social economy who might be presumed to guard our intellectual and social gateway, and has found a lodgment in our country for the propogation and practice of its theories. It must be remembered that the theories of one age may become the facts of the next, and in this day of rapid movement in thought and action the ideals of one decade are incarnated in the political and social life of the next.

When equilibrium is delicately poised a minute and perhaps an unobserved change of a few ounces of weight may precipitate an avalanche, so in a society like ours, moving with unprecedented rapidity, unintelligent conservatism is dangerous, and in these days we cannot afford to be superficial observers of the progress of this socialistic question pregnant as it is for good or evil.

When from the platform of a great hall in the metropolis of this country, in the presence of 20,000 people gathered to do him honor and surrounded by men who rank as leaders in the field of politics and patriotic citizenship—men of high intelligence and noble purpose—the man whom a great political party hastens with almost universal accord to select as its candidate for the office of President of the United States, dares to declare as one of the principal features of his creed, "the ownership of the railroads by the Government," can we doubt that State socialism and with it that of municipalities is an active and progressive factor in American politics and life.

As a learned and accurate observer of the trend of modern events has said, "That man is living in a fool's paradise who does not see that we are drifting rapidly into socialism." Your committee conceive it, therefore, to be an essential part of this report to sound a note of warning to our fraternity that we are confronting an active and resourceful enemy and to urge that each of our members actively engage in a vigorous and determined campaign of opposition to this socialistic advance. We cannot refrain from expressing our belief that it is unfortunate to have this theory of State socialism adopted as a part of the creed of one of our great political parties, for this will insure for it a wider and more popular field for discussion than it has hitherto found in this country.

The more popular and usual reasons, aside from the general statement that corporations are acquiring too great control and political power, given by political orators and socialistic propagandists in support of the extension of municipal functions to cover water, light and transportation, are that these public utilities are natural monopolies, and as such belong to all the people for their use and convenience. The sanest and clearest statement made on this point we have seen is that of Samuel Chisholm, Lord Provost of Glasgow. He says: "In my opinion there are three conditions which should meet, or at least two of which should meet, before a municipal corporation should be authorized to take over any public enterprise:

"(1) That it is more or less practically a necessity.

"(2) That it is practically a monopoly.

"(3) That it requires the use of the streets."

The more radical promoters of the municipal movement refuse to be limited by the above conditions, and as one of these has said, insists there is no "finality to municipal enterprise." In this country thus far, however, the Lord Provost's definition covers some, at least, of the stock reasons given by the proponents of the doctrine.

But are these reasons well grounded? As to the element of necessity, is light or transportation any more a necessity to the people of a city than bread, clothes or boots? Why should the supplying of the latter be given over to private enterprise and the former be taken in hand by the city? As a learned jurist had said on this point, "These latter prime necessities of life are left to the ordinary law of supply and demand, and it is evident that the more imperious the demand the more certain will be the supply. That a thing is a necessity, so far from being a reason for its being supplied by the community, is a reason why it may safely be left to be supplied by private enterprise."

But these public utilities are natural monopolies and use the public streets. Is it true that our rights under charter in the cities of this country have protected us from competition? Do not the major portion of our franchises distinctly state they are not exclusive? Appeals to courts on the question of exclusive franchises have resulted in decisions to the effect that it is *ultra vires* for a Common Council to grant an exclusive privilege in a public street. Our critics argue, however, that our occupancy of a city street with our tracks prevents of necessity the incoming of a competing line. If one consults the maps of the cities of the United States, he will find that there are but few in which a competing line of street railroad could not find unoccupied streets upon which, from the centers of the business section to the residential quarters, a line might be laid with some fair degree of prospective profit. But a few years have elapsed since the present apostle of municipal ownership, his honor, Mayor of Cleveland, Tom Johnson, was granted a franchise in the streets of Buffalo for approximately 100 miles of track, and was only prevented from construction by the Railroad Commissioners of the State, who, after a careful investigation of the matter refused Mr. Johnson such a right on the ground the new road was uncalled for, as the local company was already giving all the service and facilities the city's needs required. Evidence of the presence of competition is to be seen in not a few of our cities to-day where applications are before the Councils for new and competing lines.

But if we are monopolizing the surface of the streets we cannot lay claim to the space above or below such streets, and neither in New York nor Chicago did the averred occupancy of the streets prevent the competition of elevated or subway lines, a kind of competition that is not far distant in many other cities.

Last of all we are exposed to the threatening competition of the cities themselves engaging in the business by the building of municipal lines, and with the strong arm of legislation compelling "joint user" clauses in any new extensions granted, giving them the right to run their cars over parts, at least, of our lines already built. Monopoly as defined by jurists exists when the law confers upon some object which is a matter of necessity or even of desire to others. In the light of this essential or certainly important feature of monopoly, the privileges, of which we have been made the grantees, cannot be dangerous, since the State or city has fixed the price at which we may sell our commodity, and further has reserved in almost all of our charters the right to regulate fares. We must operate whether the business is profitable or not, when general business conditions are favorable or the reverse, our sole privilege being that we may reduce fares by extending the length of the ride for a single fare, the enlargement of the transfer privileges and the carrying of an increasing number of city, county or State officials free.

But distrust of so-called exclusive proprietorship of public utilities lies, we are often told, in the belief that they are immensely profitable, and, therefore, that the State or municipality in granting charters for the private ownership and conduct of public utilities, have improperly parted with a valuable asset which they should in some way recover. This statement is notably the favorite allegation of agitators and demagogues, but it is as well a part of the faith of many people who have never

taken the time to study the matter with any degree of care or accuracy.

From the United States Census Bureau's special report on street and electric railways for 1902, some interesting and instructive statistics bearing on this matter of the value of our franchises may be obtained. By the report in question it appears that the total amount of dividends and interest actually going to stockholders and bondholders of the street and electric railways in the country, as a whole represents less than the current rate of interest on an amount equal to the face value of their outstanding securities. Of 817 operating companies in 1902 with 22,576 miles of track, and 60,290 cars carrying 4,774,211,904 fare passengers, but 286 paid any dividend on any or all classes of stock securities. The total ratio of dividends paid to total capital stock was 2.6 per cent; the ratio of total dividends to total dividend bearing stock was 5.1 per cent. The full amount of dividends paid during the year was $33,039,171, and the same year the companies distributed in interest to bondholders and creditors $46,462,470, paid to wage earners $80,770,449, and to the Commonwealths in taxes $13,366,335. If to this latter item be added the personal taxes assessed against the individual holders of street railway securities, on the low basis of three-quarters of 1 per cent on the face value of their securities, the item of taxes turned into the State and municipal treasury during the year amounts to approximately $20,562,516. The rate of net return to stockholders would not indicate any especially great profit at present being derived from the chartered rights the companies possess, and the rate of return, considering the menaces and hazards of the business, surely cannot be regarded as excessive. It is notable as indicating the estimate of value placed upon street railroad securities that the stock issues of a comparatively few of the companies represented in this association sell at par. The bonds of our companies are not permitted as investments by savings banks, and in the list of investments by banks, trust companies and insurance companies, few, if any, street railroad securities are to be found.

To a statement of our dividend paying results, our municipal ownership friends may reply that our security issue is inflated, and thus good, divisible earnings are precluded. Meeting this allegation, we point to the facts as they appear in Massachusetts, an old and populous Commonwealth and one in which, by law, the security issue of a company must not exceed the actual cash invested. Everett W. Burdett, in his admirable recent address on municipal ownership, points out that "The State of Massachusetts has 98 electric railways, operating 2688 miles of track, transporting over 500,000,000 passengers by the use of 7341 cars, and that only about one-third of them paid a dividend in 1905. Sixty-three paid no dividends at all, while the other 35 paid from 2 to 10 per cent with an average dividend of 4½ per cent, which, if applied to the capital of all the companies in operation, would have yielded an average dividend of less than 2½ per cent. At the same time these companies paid into the public treasury in the form of taxes nearly $2,000,000. It thus appears the tax gatherer, the employee and the general public have each and all reaped rewards much greater than have been realized by the stockholders in these enterprises." Verily the monopoly we enjoy is neither to be feared nor greatly to be envied.

Giving further consideration of this monopoly cry, we may point out that the great danger of monopoly is the absence of the stimulating and controlling power of competition. In the granting of our franchises, both the State and city authorities seemed to have this fear, for not only in these charters, but by ordinances of constant and regular sequence we are required to do this or that, or refrain from sundry and imaginary actions, with elaborate legal refinement. We are directed as to opening the streets, the kind of rails and crossings which shall be employed, the style of overhead construction we shall use, the kind of cars we may provide and how they shall be run, the signals to be used, the time to put on vestibules, when to take them off, where we shall stop to take on or let off passengers, the fare we may charge and the transfers we must give, how we must adapt our business to other users of the street; these and a hundred other regulations are duly set forth for our guidance. No other public utility is regulated and controlled to a similar extent. Nor do we complain of this careful and watchful supervision—a supervision the penal clause of which reads nullification of privileges or severe fines.

To turn over such a regulated and controlled monopoly to an uncontrolled one as would be the case were the city to assume the ownership and operation of its street railroads would, to put it mildly, be open to great question. All the evils laid at the doors of monopoly of indifference to public wishes and comfort and the like, would surely be heightened and aggravated by such a transfer, and a little study of the usual conduct of public and municipal affairs would, we think, evoke a decided negative to the proposition, unless, we are sometimes promised, vital changes are made in the usual make up of municipal responsibility.

As to the point that as our roads in using the public streets thus trench on the proper sphere of municipal functions, we answer that as we construct our lines and operate them in accordance with and under the rule of the city's agents, the municipality could do no better.

We have thus briefly indicated a line of reply we believe can profitably be followed in our discussion of this question with those who take their cue from the socialistic utterances of public speakers and newspapers, whose stock in trade is the wholesale denunciation of monopoly and wealth.

We may now turn to those who advocate the municipalization of the street railroads for economic reasons or urge such an ownership will aid the laboring classes.

In the evidence given before a joint committee of the Houses of Lords and Commons appointed "to consider and report as to the principles which should govern powers given by bills to municipal authorities for industrial enterprises," Sir Thomas Hughes stated briefly what may be called the stock economic arguments for municipal ownership: (1) The obtaining of capital at a cheaper rate than can a private corporation. (2) The people become partners in the enterprise. (3) There are no dividends to pay. (4) Cheaper management. As a learned writer has said, advantages like these might be urged in the advocacy of all forms of municipal trading. If municipal trading has all these advantages over private enterprise and is, therefore, more efficient and productive, why should not these advantages be made use of for the better and cheaper supply of every article which the community needs? If of light and locomotion, why not bread and clothes? If the community as such possesses all these enormous advantages in cheapness and efficiency of production over the private trades, the logical result would seem to be that the community should possess itself of all the instruments and agencies of production and become the sole caterer for the wants of the citizen.

Evidently back of a program of municipal activity stands the question of taxes and their equalization in such way as that they shall bear justly upon the rich and the poor, the capitalist and the laborer, the professional man and the tradesman, with such equal weight that none may complain of his apportionment.

If the city, therefore, engages in a business for the service of which charge is to be made to users, and further, if this city business is instituted in the face of offers on the part of private corporations to assume all risk and under regulations by the proper authorities to give the service for a specific charge, justice to taxpayers and respect for fair business conditions demand that from the income of said business all charges should be paid. In other words, such business should be self-supporting, and this is manifestly true in consideration of the advantage which is claimed by the proponents of municipal ownership, that no dividends should be distributed by a municipally owned enterprise of any sort.

That such should be the basis of the financiering of a city's remunerative public utilities is becoming generally recognized, and has been adopted in the case of municipal water works. The Mayor of Chicago, in his scheme for the municipal ownership of the street railroads of that city, proposes to issue bonds or certificates of indebtedness against the properties and their earnings and against these alone. The citizens of Seattle, Wash., were recently called upon to vote upon a scheme for the construction of a system of municipal street roads in that city. The financial basis of the proposition is set forth in the ordinance authorizing the same as follows: "To ratify or reject the proposition of incurring a general bond indebtedness bearing interest not exceeding 4 per cent per annum in the sum of $1,272,000, together with the proposition of incurring a special bond indebtedness bearing interest not exceeding 5 per cent per annum in the sum of $3,000,000, to be an obligation against not to exceed 20 per cent of the gross revenue or proceeds to be derived from the plan or system." This rather unique financial scheme, while it smacks very strongly of a municipality trading on margins, evidently recognizes the injustice, in part at least, of loading the general taxpayer of a city with the burden of a municipal public utility.

A city, therefore, establishing a business on such a basis has no

advantage over that of a private corporation in the matter of securing capital, and public service utility bonds and certificates of indebtedness secured by mortgage on the property and its revenues will not sell in the open market at any higher prices than those of a private corporation. In fact, we believe it can be demonstrated that capitalists, by reason of having less confidence in the progressiveness, accurate accounting and the skill of municipal management would regard less favorably such a security of a city road than they would that of a corporation.

As to the partnership of the people in the enterprise, it is but fair to say that the average man desires the liberty to choose for himself as to the investment of his money and business associates, and for every taxpayer in the city, whether he will or no, to be compelled to take shares in a business over which he has no control, and especially managed by men of whose capacity he has no proof, is a proposition which, while it may from a sentimental point of view have some force, surely from a business one is of no weight.

As it is a notorious fact that private enterprise is ambitious and progressive, ever seeking extension for its efforts and multiplying its activities, while business interests in the hands of the Government are quite the reverse in their policy, the suggestion that the municipalization of our street railroad systems would in the long run increase the opportunities for the working classes, is evidently untrue.

It is hardly necessary for us to take time to discuss the claim of the municipal ownership promoters that the city-owned road could be managed cheaper than is that of the private corporation; so universally is it acknowledged that public work of all kinds is less economically handled than that of corporations where responsibility is directly traceable and the directors or managers of which can be readily brought to book for negligence or incapacity.

As we have before stated in this report a considerable number of those advocating the municipal ownership of public utilities have been led to do so by their distrust and disgust at the relations which have existed between legislators having in their power the granting of public franchises, and the officials and promoters, or political bosses, who have acted as the henchmen of public service corporations. Your committee hold no brief for the defense of corporations who have debauched Councils, and by the use of bribes in the shape of securities or of cash have secured privileges, even though the request for such privileges in and of itself was often entirely proper. But we aver that graft is confined to no department, no locality, no party, no corporation or no individual. In the public revelations which have been made of late of the existence of this evil in this country, it appears in the Federal government, in the city governments, in the post office department at home and in the consular service abroad, in public and private business circles; and wherever it is seen it is revolting to honest business enterprise, and injurious in the extreme to all our interests and desires. It is an evil which must be extirpated, or reduced at least to its lowest terms, and we believe we may say that no class of business men or business interests would be more pleased to see this evil uprooted than would the street railroad companies, their managers and directors. If the inner history of the companies represented by this association could be accurately written and spread in full upon the public books, it would cover a list of refusals to purchase privileges, or rather, in many instances, permission to do that which was altogether advantageous to the city in which the company operated and to the people whom it desired to serve, even at the risk of attack, misunderstanding and unpopularity, that would be surprising in number, and well nigh continuous. We go farther and aver that the street railroad companies of the country, as a body, are honestly conducting their enterprises. They have no reason to be ashamed of the business in which they are engaged, or of the service which they give. They have played no unimportant part in the wonderful growth of urban life and opportunities in this country during the past twenty-five years, and what they have accomplished in the introduction of electricity and its uses for public transportation is a source of pride and of self-congratulation. The use of improper or underhanded methods in the securing of rights or the enforcement of privileges already granted is as distasteful to the street railroad manager as it is to any citizen or business man; and we are sure that we will join hands most gladly in every movement looking toward the extirpation of such a practice of evil.

But it has been done no more by the street railroads in proportion to opportunities offered, than by the private individual who pays the policeman on his beat for protection, or the laborer who contributes to the political boss to obtain work.

Since this graft practice seems to have infiltrated itself through all departments of political and private business life, we respectfully submit that the municipalizing of public utilities in a city presents a most inadequate method of reformation. There is no way to make the community honest except by individual honesty, and the American conscience is not dead, if it does sometimes seem to nod. A general appeal to the common honesty of the country, which has been made so effectively by men like Folk in Missouri, Taft in Ohio, Weaver in Philadelphia, and Jerome in New York, will have far greater effect than to place in the hands of public officials of cities, who have already shown a weakened sense of right, truth and honor, the management and control of great public utilities. It certainly would be a sad reversal of the commendation addressed so long ago to the faithful steward, "Thou hast been faithful over a few things, I will make thee ruler over many things," to adopt such a policy with officials in our cities until at least a very great change in the political makeup of Councils and legislative bodies had been brought about.

We cannot in this connection refrain from asserting that into the ambitions of public corporations there enters an element which we might call "the passion to serve," a strongly moving desire to secure honor and reputation in the eyes of our fellow citizens to a far greater extent than our critics will generally admit. The corporation and its managers are described as without soul, wholly sordid and greedy, the scope of whose work is limited by the goal of wealth and the distribution of large dividends. Is it entirely true that the financial leaders in the country, or the captains of industry, have no care for their duties as citizens, or no other object in their work than that of accumulation? We believe that with as much truth it might be asserted that the college professor cares nothing for his teaching other than that he receives his salary, or that the inventor is spurred to his task solely by the prospect of gain, or that the soldier fights in defense of his country under the impulse only of possible booty. In times of sore financial distress, in the face of great calamities occurring in any part of the country, or in any great political crisis, is it true that the corporate wealth or the individually prosperous exhibit a want of participation in the popular humanitarianism of their fellows? When the earthquake and fire recently overwhelmed San Francisco, were we not all, rich and poor, included in the common feeling of sympathy and of substantial help to the suffering and the needy? If individual effort contributes to the development of a man industrially, and to the strengthening of his mental powers, we refuse to believe that it shrivels his soul or narrows his conception of righteousness and truth.

As we have said, in the effort to reach a higher standard of industrial and civic honesty, our companies will most gladly join. Perhaps it may be presumptuous in us to point out to publicists methods to this end, but we cannot refrain from expressing, from our point of view, our satisfaction with the plan which has been during the last two or three years adopted by the cities of Houston and Galveston. The chief feature of this is the concentration of municipal power in the hands of the Mayor and four commissioners, who act as his assistants and who combinedly have a certain degree of checking power on the Mayor's action, but only in a few specified matters, mainly relating to expenditures. This new form of government, as you will remember, was established by a charter granted by the Legislature, and the idea was in part inspired by the effective methods of the commission under which the city of Galveston had spent millions for improvements and the re-establishment of all that had been destroyed by the great flood. Only four city officials are chosen by popular vote—the Mayor and four aldermen-at-large—who are at once appointed by the Mayor commissioners respectively of taxes and finance; police, fire and electricity; streets and bridges; sewers, parks, water and public health. Mark you, these aldermen come not from any individual ward; they represent presumably the interests of the city at large. The Mayor has the removal of all non-elected officials and employees, including the tax collector, the chief of police, the judge of the corporation court, the city attorney and the city comptroller. A referendum upon the granting of a franchise may be had whenever 500 qualified voters ask for it. Thus the municipal government exhibits a combination of home rule and direct responsibility.

Without dwelling upon this experiment, it suffices to say that

its working has been excellent. The street railroad corporations in both cities report that under such rule their requests are respectfully considered, and they feel that the decision in respect to same is one dictated by an independent and civic study of the situation, viewed in its entirety.

We may refer also to the fact that in the District of Columbia, where commissioners have charge of public affairs, no suggestion of municipal ownership of street railroads has ever been made.

The assertion that municipalities already provided with a corps of officials in the various departments can take over the construction and management of such public utilities as water, light and transportation, and distribute the official duties involved in the care and direction of same in such a way as to cheapen the costs of management as compared with those of private control, is one that can best be refuted by a comparison of the costs of work done by city employees along almost any line, as compared with that of individuals or private corporations. Apart from the question of the quality of the city accomplishment and that of the individual constructor or manager, it can be easily demonstrated that the element of political influence entering into the choice of municipal officials and employees, the pressure exerted by political leaders for places for their partisans, the conduct of business by committees and boards without any accurate line of responsibility and without the presence of personal ambition in the officials to do business on a business basis, always makes against economy and efficiency. One has but to read the public records of Common Councils to be struck with the constant appeals from the various departments of any city for more help, and the usual answer made to a complaining citizen of some lack of attention to prescribed duties by city employees, is that there is lacking sufficient force to secure a proper compliance with public requirements. The truth is that a high grade of specialized intelligence is not to be found in our municipal governments, shifting and uncertain as their makeup is, and no civil service legislation can cure this evil. It inevitably follows from such a condition that work done by a city is always at a higher unit cost than that performed by private corporations or individuals.

There are still other good and substantial reasons which may be effectively advanced in support of the private installation and conduct, under proper control, of quasi-public utilities.

Can it be doubted that where a city has invested the money of taxpayers in a municipal plant like a lighting or street railroad enterprise, that part of its functions assumes the character of a guarded monopoly that jealously resents any invasion of its field of competition or new methods or improvements.

In the light of this inevitable result it may be interesting to conjecture what would have been the effect upon the urban transportation problem in the United States, if, when electricity knocked at our cities' gates twenty-five years ago and offered itself as a substitute for horse power in the moving of tram cars, our municipalities had been the investing owners in the then operating roads. It has been estimated by statisticians that the electrification of the horse railroad systems of this country has involved the sacrifice of above $250,000,000 worth of property and the expenditure of a much larger sum for new construction and equipment. Is it presumable for a moment that such a loss and such a new investment would have been entered upon with anything like alacrity and courage? Would not that venturesome spirit which always inspires and accompanies the initiation and permanent introduction of any such great industrial improvement have been conspicuously absent? Secure against competitors, it seems to us certain that the municipal monopolists, after long public discussion and delay had been had, would have thrown the question into the arena of politics to be wrangled over by radicals and conservatives, holding in check thereby the growth and development of the cities to a most harmful extent. The history of electrical enterprises in England bears out such a conclusion. It appears from abundant evidence presented to the commission of the British Parliament appointed to investigate municipal trading, that city after city had successfully opposed the introduction of electric lighting or electric traction, either because they were themselves interested in gas or horse tramways, or because they intended at some time or other to become suppliers of electric power themselves and wished to keep the field clear.

The private company is urged constantly to better service, to improved apparatus, not only by its desire to please its patrons, upon whom its revenues depend, but by threatened invasion of its territory by others who will offer greater inducements to users of its commodities. No such stimulating motive can be present in a municipal monopoly. Such a kind of monopoly encourages slackness in management, persistence in obsolete methods and resistance to new inventions. In the very nature of the case, unwillingness to admit mistakes, the danger of criticism on the part of the special party promoting the municipal enterprise, the endeavor to avoid public investigation —all these follow most naturally in the train of municipal monopoly. But a few days ago a turbine in a municipal lighting plant in one of our large cities burned out. The officials hastened to the private company also operating in the city for help, and this was most willingly granted, but not a single paper in the city published a word of the accident in the municipal plant. No investigation was held, at least no public statement was made, and it is believed that few, if any, of the citizens were aware of the fact of the destruction of this costly machine and the added expense thereby entailed upon the taxpayers. It is needless for us to point out that under such a condition the accounting statements of many of the municipal light and water plants in this country are looked upon with suspicion, and one of the questions discussed by the municipal league of cities in this country has been the obvious necessity of a better system of accounting, so that the costs should be accurately apportioned and ascertained against any municipal function.

Another very pertinent objection to municipal ownership lies in the fact that a municipality necessarily moves slowly and is unwieldy. These are the days of hot-foot progression, decisions must be made with rapidity and promptness. A municipal monopoly which must in advance secure the judgment of its stockholders and directors as to the wisdom of adopting any proposed invention or the selection of some new course, would find itself hampered in the matter of speed and would, without doubt, be very timid and nervous in entering upon any new policy. The honest official, knowing that he is the trustee of the public funds, would feel that he had no right to enter upon speculative undertakings, and as the incorporating in our work of many of the inventions applicable to our special industry is necessarily experimental, and therefore speculative, the public administrator, facing the responsibility of this trusteeship and fearful as to the security of his position, would hesitate to recommend the scrapping of old and the purchase of new and up-to-date apparatus, often to a degree which would necessarily impede the efficiency and progress of the municipal plant. It is fair to say that, so far as we know, either abroad or in this country, in cases where municipalities have engaged in lighting or tramway work, there is no record of a new invention having been taken up and carried to a success through city initiative or practice.

The general effect of the taking over by the State or by the city of public utilities would, it cannot be doubted, most seriously injure and discourage private enterprise; and if no other objection were raised against municipal trading, this should be in this day and age of the world a well nigh conclusive one. Join to this the question of cost to the cities and of the doubtful profit resulting therefrom, and we have a presentment against the scheme of the strongest character. As we have said, the question of taxes lies at the base of all municipal activity, and one has but to read of the increasing debt of most of our cities and the upward tendency of taxation in the majority of our municipalities, to be convinced that it certainly is unwise for the urban centers, with the rapid extension of their municipal needs, to undertake any increased financial burdens unless absolutely necessary. As it can be shown that the majority of electric railway companies, in the shape of taxes in some form and in the returns made by individual stockholders, are paying into the treasuries of State, county and city a sum practically equal to, or greater than, that distributed to their own stockholders, the argument against municipal investment in public utility enterprises is very plain.

We may with very great benefit turn to the condition in England in this matter of taxes as bearing on the point we are discussing. In the month of August the special correspondent of one of our American newspapers writes regarding this subject as follows: "It is of this burden that we hear little in America. The student of municipal trading writes of the efficiency of the British street cars, lighting plants and the rest. He speaks truly of the honesty with which these enterprises are conducted. The philanthropist speaks warmly of the extent and liberality of the British system of poor relief, and the altruists applaud the measures of social reform. But to hear the other side, the in-

quirer must know, not city councilors displaying their city to the admiring stranger, not ardent philanthropists, and not those who study social reforms that benefit one class in the community above the cost it lays upon others. We must go to the houses and life of the taxpayers that meet the expenses of these things. The very rich may well bear the increasing charge that steadily-rising taxation lays upon them; not upon them, but upon the middle class from the well-to-do professional man who works with his brain harder and longer than the laborer, down to the small tradesman struggling to keep his independence, does the real burden fall. Seven years ago taxation in England stood at little more than $6 per head; four years ago it had risen nearly to $7. There are no statistics for later years, but there is every apparent reason to believe that the amount of taxation has continued to rise. Local associations for taxpayers' defense are springing into existence in many cities and towns. The class that must pay for municipal experiments and altruistic ventures in general is beginning to stir from its indifference to local administration and local elections. Our burden of taxation increases until it is becoming intolerable."

A reaction in the matter of municipal enterprise is taking place in England, and in our own country taxpayers are beginning to inquire in an emphatic way as to the actual results of our own municipal enterprises. Bad bookkeeping and inadequate reports are too often the rule in the case of city plants, but expert examinations of these business ventures are now more frequently demanded, and they are summoned to the bar of public opinion to give testimony as to their profitableness and efficiency. The verdict most frequently rendered against them is that they are uneconomical and antiquated in apparatus and method.

From New York City, Brooklyn, Cincinnati, Chicago and Seattle, waste in output, inadequate supply and laxity of management is alleged by users against the municipal water systems, and the expert investigation of city gas and electric installations by competent commissions and experts on behalf of many of our cities, are resulting in like conclusions. We may cite two typical cases:

A special commission of the Council of Richmond, Va., after a thorough examination of the municipal gas plant of that city, recently reported that the capacity of the works was insufficient, the apparatus worn out and obsolete, the labor paid more than the market price and the care and conduct of the plant unskillful, and finally recommended the operation of the work be transferred to a private corporation. "The Richmond Despatch," commenting on the service given by the city plant, says: "Municipal monopoly is more autocratic and overbearing than any private corporation would dare to be."

Hamilton, Ohio, has often been referred to by municipal ownership advocates as an example of their theory worthy of imitation. It is the only city in the United States of above 25,000 population that has built and operated its own water works, gas and electric light plants. These plants have been in operation twenty-two, sixteen and ten years, respectively, and thus offer a fair basis for gaging the efficiency of municipal operation. On March 9 last, a report on the financial condition of these plants was filed by a special examiner of the State Bureau of Inspection and Supervision of Public Offices, from which it appears that, considering operating expenses alone, the gas and electric light works incurred losses for the three years ending December 31, 1905, of $16,689 and $4,426, while the water works showed a profit on paper of $12,797, with a proper allowance for interest, insurance, depreciation and lost taxes, the aggregate loss of the three years exceeds $230,000. It is to be added that the municipal gas plant of Hamilton has been shut down.

Such illustrations of the real results of municipal ownership and operation cannot but be effective with the thoughtful and unprejudiced in our cities, upon whom must fall the burden of paying for these business enterprises, and as has been said, "With the facts in their possession the common sense of the American people will not permit such a movement to overwhelm our cities with debt, as is the case in England."

As the exploitation of municipal tramways in this country is confined to two or three comparatively small ventures, and these moreover have been operating too short a time as to give little value to results obtained, we have at hand little or no actual data of use in determining what the financial results or general value of such sort of enterprises would be under our municipal conditions. It is customary for the advocates of the movement to point to municipal trading as practiced abroad, especially in Great Britain, as illustrative of the benefits they assure the people of this country would accrue to them if our cities would become the owners and operators of urban transit. Until recently the facts of municipal trading abroad have excited but little interest in the general public here, and to take the time to find out the real truth as to the results across the water, of municipal street railroad enterprises or other municipal ventures, has apparently been deemed unnecessary. As Mr. Burdett, in his recent admirable address before the National Electric Light Association, said: "There have been few serious efforts made to counteract the assertions of partisans of municipal ownership, misrepresentation of facts and statements of false conclusions from insufficient or inaccurate data have gone without challenge."

Happily we are no longer in doubt as to the truth of municipal results abroad, and can measure these by practical standards. We are not obliged to confine ourselves in our discussion of the subject to theories or ideals, for we have before us the results of the investigation of foreign municipal ventures by students of practical conditions whose conclusions cannot be gainsaid.

Principal among these, we find ourselves specially indebted to Everett W. Burdett, of Boston, whose intimate knowledge of the work of public service corporations in this country has made him familiar with the character of service here demanded, and whose legally trained mind gives him a peculiar aptness for the analysis and judicial balancing of arguments and practical results. Mr. Burdett, after spending some time in England in careful study of the object, has given us the best brief presentment in the matter which has yet appeared, bristling as it is with cold, hard facts. We commend to your careful reading his article recently appearing in the "Journal of Political Economy" on "Municipal Ownership in England."

Prof. Hugo Richard Meyer's volume on "Municipal Ownership in Great Britain," published this year, might well be used by us as a text book, for in its pages full of statistics and data of all kinds, the theory, development and actual results of municipal ownership and operation, with especial reference to tramways, are set forth in a masterly and convincing manner. The literature upon this subject is fast multiplying in answer to the public demand for the facts, and we urge upon our members a careful reading of these various publications.

The report of James Dalrymple, head of the municipal tramway system of Glasgow, who recently visited this country in the capacity of a municipal ownership expert, to advise his honor, Mayor Dunne, of Chicago, as to the establishment of that kind of a street railroad system in that city, is the utterance of an experienced street railroad manager, and one whose conclusions can certainly be regarded as unbiased by any leaning toward the private ownership of street railroad systems When such an expert, after a study of the conditions surrounding urban transit work in Chicago and other cities, reports adversely to the municipality taking over the transportation business, we may accept his conclusion as far better founded than that of the political demagogue or the idealistic doctrinaire.

The limits of this report will not permit its inclusion of the facts and figures the students of results abroad have presented in the publications to which we have called your attention. We have already alluded to some of them, and their meaning to us as against the movement for municipal ownership.

In brief, their findings are that the development of street transportation facilities abroad has been static and miserably slow as compared with that in our country. That the extent and quality of service given is much behind that given by our private companies. That in actual return to the public treasuries the amount per capita of population is less on the part of the municipal tramways than that rendered here by private corporations in taxes, interest and other contributions; and, finally, that the political combination of a mass of municipal employees might be destructive to the best government of a city.

To the political aspect of this question we need hardly call your attention. Our cities have during the last few years arisen in revolt against the political boss, and the dethronement of such a ruler has been gladly applauded by all right-minded citizens. Could any surer method of returning such a one to dangerous power be devised than to bind together in one federation of selfish interest the number of employees which are of necessity required to operate a city street railroad system, and who, if under municipal rule, would look to the political control of the municipality for place and pay?

The conclusions evoked by a careful study of municipal owner-

ship abroad and which we have very briefly adverted to above, may well be carefully studied and verified by the membership of this association, and in our efforts to bring to pass a more general enlightenment upon the essential facts and results of this subject, we will do well to invite discussion on these points.

A word or two regarding our legal status. Having received grants from State, county or city, many of our companies are inclined to feel that their strongest bulwark against the encroachments of municipal or State competition lies in what they are pleased to term their vested rights. It is true that the equity of the case is with us, and that an attempted confiscation of our property and privileges by legislative assemblies or municipal councils might be successfully resisted on moral and equitable grounds. But we must remember that the source of our legal rights lies largely in legislative action, and that within the limits of the constitution absolute confiscation of our property is possible. As a legal authority has said, "In theory we deny that confiscation occurs under our laws, but in fact confiscation forms a regular branch of our jurisprudence which the court undertakes to supervise. The most superficial acquaintance with history suffices to convince the reader that property which is obnoxious and ill defended is generally confiscated, and if such property escapes confiscation it is because of the vigor with which attack is repelled. Private property is rarely respected when the property is for some reason unpopular, and the possessors thereof feeble relatively to the prejudice against them."

If the actual confiscation of our property can be resisted through legal means, its taxation to such an extent as to make it valueless is largely in the control of the public.

It remains to add that not alone by argument and discussion may we defend our property interests from municipal ownership encroachment, but as well it is of imperative necessity that in the general policy of our management we gain the good will of those we serve. The motto of a merchant prince, "The customer in this store is always right," might well be ours in the daily conduct of our business. "He who serves the public best serves his company best," speaks a sentiment which must be an animating principle of our management.

Insisting upon our rights as property owners and taxpayers, conducting, under control and with a due sense of responsibility, an honorable business, and claiming the rewards which individual initiative effort and ambition fairly bestow upon us, we must at the same time have a clear preception of and respect for the rights of others, and in all our dealings with the public remember we are its servants and not its masters.

THE CLEVELAND SITUATION

The Cleveland Electric Railway Company has spent the week in tearing up its track on Quincy Street, one of the two from which it was barred by the United States Supreme Court injunction, and the paving is being replaced just as it was before the street was used. In all, there are about 10 miles of track in Central Avenue and Quincy Street, and it is said that the property is worth, upon the basis of valuation given during the leasing negotiations, $750,000, after the salvage has been deducted. This is the property for which the low-fare companies offered $150,000. Judge Phillips heard the original injunction suit to prevent the Forest City Railway Company from building lines on Central Avenue and Quincy Street, and to prevent the Low Fare Railway Company from using or interfering with the Cleveland Electric's tracks. The decision will be rendered later. In the meantime, however, the Low Fare Railway Company, operating under the franchise rushed through a week ago and the special permit granted by the Board of Public Service, undertook to lay track on Central Avenue and Quincy Street, where the old company had cleared the way by removal of its tracks. On Thursday, Charles S. Isom, a property owner, applied for an injunction against the company to prevent further construction, on the ground that the ordinance had not been published and that the company had not the consents of property owners when the ordinance was rushed through the Council. The Cleveland Electric had secured the revocation of the consents of a large number of property owners, but the legislative body of the city paid little attention to that. Squire, Sanders & Dempsey, attorneys for the Cleveland Electric, gave notice that this suit would be brought and they secured a continuance of the temporary restraining order until this week. The attorneys for the Low Fare Company endeavored to have it dismissed, pending a hearing on the application for a permanent injunction, on the excuse that they could save the old company the expense of replacing the pavement by laying track along close behind the wrecking force. The court could not see it in that way.

Under the permit given by the City Council and the Board of Public Service the Low Fare Company also endeavored to connect its track at East Fourteenth Street with the Cleveland Electric tracks on Euclid Avenue, against which action an injunction is pending. Judge Chapman, who is hearing the other injunction cases, ordered the work stopped at once and rebuked City Solicitor Baker for advising such action. He also said that he would take up the question of contempt later on.

The new companies are now endeavoring to obtain consents of property owners on streets connecting Central Avenue and Quincy Street east of Fifty-Fifth Street. It is said that the companies are planning to use the tracks of the Cleveland Electric on Fifty-Fifth Street, under condemnation proceedings, but that failing they desire to have a clear way through on some other street. The Cleveland Electric, however, hopes to prevent the granting of consents until the people are thoroughly acquainted with the situation.

The Cleveland Electric Railway Company has refused to pave between tracks on Detroit Street, between West Fifty-Eighth Street and West 117th Street, as had been planned, since the administration has declared that its franchise on that street expires next February. The cost would be something like $70,000, and the company does not care to throw that amount away.

The Cleveland Electric Railway Company is carrying about 120,000,000 passengers a year. At the present rate of fare it gets 4.7 cents per passenger. The expense per passenger is 2.82 cents. With the proposed reduction to seven tickets for a quarter, the rate would be 3.6 cents, or a loss of 1.1. Computed in this way the direct loss would be $1,320,000 per year. The net profit per passenger is .78, and on the basis of 120,000,000 passengers a year, the net income of the company would be $936,000. The bonded debt of the company is $10,000,000, and 5 per cent on this would be $500,000, leaving $436,000 to pay dividends on the stock, which is 2 per cent or less.

Judge Chapman on Saturday issued an injunction against the Forest City Railway Company, to restrain it from building a street railway system on Central Avenue and Quincy Street. He held that the financial interest of the Mayor in the company nullified its right to franchises on those streets. The Low Fare Railway Company was also enjoined from using the tracks of the Cleveland Electric. The court said that the defense that the public would be inconvenienced by the fact that there are street car lines on those streets is not sufficient to debar the company retaining possession of its own tracks and other property, nor is it sufficient to allow another company to take possession of property that does not belong to it and opreate the property because people are inconvenienced. In other words, the private property rights of the Cleveland Electric must not be violated.

Monday evening the City Council passed franchise extension ordinances giving the Low Fare Company grants on the following streets, now occupied by the Cleveland Electric Railway Company, whose rights are claimed to expire next February: Woodland Avenue S. E., Kinsman Road S. E., Detroit Avenue N. W., Lorain Avenue, Bridge Avenue N. W., West Sixty-Fifth Street, Clark Avenue S. W., West Seventy-Third Street, Madison Avenue N. W., West Ninety-Eighth Street, Woodbine Avenue N. W., and John Avenue N. W. These routes are all on the West Side. Fifteen ordinances were introduced granting the Low Fare Railway Company franchises on as many streets between Central Avenue and Quincy Street east of Fifty-Fifth Street. It is said this was done in order to keep the Cleveland Electric in ignorance of the street that would be used.

Councilman Felton introduced another ordinance granting the Cleveland Electric a franchise on Central Avenue and Quincy Street, at 5 cents cash fare and seven tickets for a quarter, but the matter was tabled in spite of his efforts to have it advanced to a second reading, as has been done with the low-fare ordinances. Councilmen do not want to put themselves on record with their votes.

This week the suits against the Low Fare Railway Company will be taken up. The allegation is that the franchise granted it is illegal, because it did not have the consents of property owners along the streets. The Cleveland Electric had obtained the revocation of a large number of consents, sufficient to prevent the company from securing a valid franchise it is claimed.

FIFTH ANNUAL REPORT OF THE UNITED RAILWAYS INVESTMENT COMPANY

The fifth annual report of the United Railways Investment Company, which was presented to the stockholders at their meeting last month, as referred to before in the STREET RAILWAY JOURNAL, gives the separate earnings of the United Railways of San Francisco, the Philadelphia Company and affiliated corporations and the combined earnings. The operating figures and balance sheet, together with the remarks of President Thalmann, abstracted, follow:

During the year 1906 your company acquired $24,200,000 (par value) of the common capital stock of the Philadelphia Company, an amount which is approximately 72.8 of the outstanding common capital stock of that company.

Of the stock so acquired $21,000,000 (par value) was deposited by stockholders of the common stock of the Philadelphia Company under the plan and proposition ratified at a meeting of stockholders of your company, held April 5, 1906, and the purchase price therefor was duly paid by your company at the times and in the manner provided for in said plan and proposition, and the shares so acquired were duly pledged and deposited under the collateral trust agreement securing 5 per cent prior lien collateral trust bonds of your company, as required by said plan and proposition.

The residue of such common capital stock, amounting to $3,200,000 (par value), was acquired later in the year, and of that amount $2,690,000 had been delivered to your company and paid for by it prior to Dec. 31, 1906, and the balance, amounting to $510,000, was delivered to your company and paid for by it in January, 1907.

COMBINED INCOME ACCOUNT OF UNITED RAILROADS OF SAN FRANCISCO AND PHILADELPHIA COMPANY AND AFFILIATED CORPORATIONS, FOR THE YEAR ENDED DEC. 31, 1906

	Total	United Railroads of San Francisco	Philadelphia Company and Affiliated Corporations
Gross earnings	$23,785,596.39	$5,955,786.32	$17,829,810.07
Operating expenses and taxes	12,381,067.22	3,114,590.09	9,266,477.13
Net earnings	$11,404,529.17	$2,841,196.23	$8,563,332.94
Other income	289,429.80	89,360.84	200,068.96
Gross income	$11,693,958.97	$2,930,557.07	$8,763,401.90
Deductions from income (not including fixed charges)	1,333,944.14	37,231.13	1,296,713.01
Income applicable to fixed charges, etc.	$10,360,014.83	$2,893,325.94	$7,466,688.89
Fixed charges	4,880,456.12	1,580,702.14	3,299,753.98
Net income	$5,479,558.71	$1,312,623.80	$4,166,934.91
Improvements, betterments, extensions, sinking funds, etc.	1,595,627.78	435,477.82	1,160,149.96
Net income after deducting improvements, betterments, etc.	$3,883,930.93	$877,145.98	$3,006,784.95
Dividends on preferred stock:			
Philadelphia Company	$299,997.50	......	$299,997.50
Equitable Gas Company	3,201.00	......	3,201.00
Consolidated Gas Company	28,333.33	......	28,333.33
Total	$331,531.83	......	$331,531.83
Surplus for the year applicable to dividends on common stock, etc.	$3,552,399.10	$877,145.98	$2,675,253.12
Proportion applicable to other owners of common stock of affiliated corporations	3,783.65	......	3,783.65
Balance	$3,548,615.45	$877,145.98	$2,671,469.47
Proportion applicable to United Railways Investment Company, based on its present stock holdings	$2,821,975.75	$877,145.98	$1,944,829.77
		100%	72.80%

New York, April 16, 1907.

During the current year the Philadelphia Company has paid the regular dividend on its preferred stock and the usual dividend of 6 per cent on its common stock, and all the surplus earnings of that company, above the amount of dividends, has been retained by that company for its corporate purposes.

Both the gross and net earnings of the United Railroads of San Francisco had shown excellent results up to April 18, 1906. On that date the earthquake occurred, which resulted in a disastrous fire and involved the company in great loss, which included the destruction of the cable power houses and severe injury to the cable conduits.

That company reports that it has now installed the overhead trolley system on practically all the important roads formerly operated by cable, and that over 91 per cent of the mileage of the company is now in operation.

In connection with plans intended to provide the United Railroads of San Francisco with moneys to be required by it in the future for construction and improvements, authority has been given by the directors of your company to vote the stock holdings of this company in the United Railroads of San Francisco in favor of a proposal to increase the capital stock of that company by the creation of an issue of $5,000,000 of first preferred stock, the same to bear interest at the rate of not less than 6 per cent per annum, and to be cumulative. Of this issue of first preferred stock $1,500,000 is presently issuable, and your directors have authorized a subscription thereto by your company, at par, for cash.

The audit of the accounts of the United Railroads of San Francisco for its fiscal year ended Dec. 31, 1906, and of the Philadelphia Company for its fiscal year ended March 31, 1907, have not been completed. Messrs. Haskins & Sells, however, have prepared a tabulated statement of the consolidated gross earnings, operating expenses, taxes, interest charges, net income, dividends and surplus of the Philadelphia Company and the United Railroads of San Francisco, for the calendar year 1906. For the reasons stated, with respect to the annual reports of the two companies, the figures for the year 1906 are in part based on the provisional figures of the accountants.

No cash dividends were paid during the year 1906 by the United Railroads of San Francisco, all its receipts over and above fixed charges and taxes and all the surplus earnings of the Philadelphia Company, above the amount of dividends paid by it, having been retained by the respective companies for their respective corporate purposes.

UNITED RAILWAYS INVESTMENT COMPANY GENERAL BALANCE SHEET—DEC. 31, 1906

ASSETS

Investments:		
United Railroads of San Francisco stock:		
200,000 shares preferred, $100 par value each, 199,989 shares common, $100 par value each.		
Philadelphia Company stock:		
473,800 shares common, $50 par value each.	$53,052,818.40	
Other investments	73,663.21	
Total investments		$53,126,481.71
Cash:		
New York bankers	$2,665.74	
Philadelphia bankers	5,000.00	
On deposit to pay bond interest	4,616.90	
Total cash		12,282.64
Demand loans		276,725.00
United Railroads of San Francisco dividend certificates:		
Bearing interest at 6 per cent	$150,000.00	
Bearing interest at 5 per cent	400,000.00	
Total United Railroads of San Francisco dividend certificates		550,000.00
Interest accrued:		
On demand loans	$1,921.56	
On United Railroads of San Francisco dividend certificates	3,758.33	
Total interest accrued		5,679.89
Two months' proportion of dividend of 1½ per cent on capital stock of Philadelphia Company, declared Nov. 23, 1906, and payable Feb. 1, 1907		236,900.00
Furniture and fixtures		624.25
Contingent asset—amount due from United Railroads of San Francisco and Philadelphia Company—subject to adjustment		103,471.97
Total assets		$54,312,165.46

Note.—At Dec. 31, 1906, the United Railways Investment Company had a contingent liability to an amount not exceeding $500,000, for accounts of the United Railroads of San Francisco, which it has guaranteed.

The dividends on the $20,000,000 preferred stock of the United Railroads of San Francisco are cumulative, and are in arrears as from March 31, 1906.

UNITED RAILWAYS INVESTMENT COMPANY GENERAL BALANCE SHEET—DEC. 31, 1906

Liabilities

Preferred capital stock—150,000 shares, par value $100 each...		$15,000,000.00
Common capital stock—194,000 shares, par value $100 each...		19,400,000.00
Collateral Trust, sinking fund, 5 per cent gold bonds.......		15,750,000.00
Preferred stock dividend certificates:		
Bearing interest at 6 per cent..................	$712,500.00	
Bearing interest at 5 per cent................	375,000.00	
Total preferred stock dividend certificates..............		1,087,500.00
Preferred stock dividend, payable Jan. 2, 1907, in 5 per cent scrip		375,000.00
Cash overdraft—New York bankers............	$487,027.38	
Notes payable	1,000,000.00	
Drawn under European credits.................	603,875.00	
		*2,090,902.38
United Railroads of San Francisco—current account........		48,103.77
Vouchers payable		42.35
Bond coupons due—not presented...........................		4,616.90
Interest accrued:		
On bonds	$131,250.00	
On dividend certificates.......................	16,501.21	
On notes payable..............................	8,916.68	
On European credits..........................	2,549.67	
Total interest accrued..................................		159,217.56
Profit and loss—surplus..		396,782.50
Total liabilities		$54,312,165.46

* This indebtedness had, prior to April 16, 1907, been reduced to approximately $135,000.

UNITED RAILWAYS INVESTMENT COMPANY, STATEMENT OF INCOME AND PROFIT AND LOSS, AS CERTIFIED BY HASKINS & SELLS, FOR THE YEAR ENDED DEC. 31, 1906

Income:		
Dividends on stocks owned..................	$1,295,397.83	
Interest on loans, dividend certificates, etc..	38,824.80	
Total		$1,334,222.63
General Expenses:		
Directors' and auditors' fees, taxes, salaries, printing, postage, etc.	$28,897.24	
Other Income Charges:		
Interest on bonds............................	$525,000.00	
Interest on dividend certificates..............	37,877.23	
Interest on loans	19,233.08	
Total	$582,110.31	
Total		611,007.55
Net income for the year....................................		$723,215.08
Profit and Loss Credits:		
Surplus at beginning of year..................	$433,567.42	
Adjustment of book value of Philadelphia Company stock, being the amount of underwriting commission received........	40,000.00	
Total		473,567.42
Profit and loss—gross surplus................................		$1,196,782.50
Profit and Loss Charges:		
Donation to San Francisco relief fund.........	$50,000.00	
Dividends	750,000.00	
Total		800,000.00
Profit and loss—surplus, Dec. 31, 1906.........................		$396,782.50

THE RAILROAD COMMISSIONERS ON THE WOODLAWN WRECK

The report of the State Board of Railroad Commissioners of its inquiry into the causes of the wreck of the Brewster express on the Harlem division of the New York Central Railroad, on Feb. 16, was published Tuesday, May 7, and makes ten recommendations for reforms in conditions on the New York Central lines in the "electric zone," which range from better methods of spiking down the rails and the super-elevation of curves to changes in the administrative officers which will place responsibility more directly where it belongs.

The cause of the accident itself the board finds to have been in the weak track, which was reported by the engineer of a train which went over the Woodlawn curve some hours before the disaster.

"The accident, therefore," says the report, "was the result of a track condition, plus speed, plus again the neglect to locate and remedy conditions that had been reported on the morning of the accident."

Much stress is laid in the findings of the board on the failure of the officials of the road to take proper warning from the report of the engineer who telegraphed his finding of "rough track" at the Woodlawn curve. It blames the superintendent of the Harlem division for not having warned the engineer and motormen of each succeeding train of the reported condition of the track, and expresses the further opinion that no trains should have been allowed to run over that stretch of track even at schedule time until the track supervisor of that division had reported that everything was right.

No evidence was produced, the board thinks, which would justify the laying of the blame for the accident on anything but a defect in the track, "and the board assumes," says the report, "that there is no such evidence in existence, as the company stated at the opening of the inquiry that it would render all the assistance it could through its employees in coming to a conclusion as to the cause of the wreck."

As to the responsibility of those who had charge of the adjustment of conditions to the electrification requirements, the report has no fault to find, except for the failure of the operating officials to run dummy trains for a sufficient period over all parts of the road to determine the actual working conditions of the new equipment.

PLAN FOR REMOVAL OF CHICAGO STEAM RAILROAD TERMINALS TO THE OUTSKIRTS OF THE BUSINESS DISTRICT

Representatives of the traction companies of Chicago met the railroad terminal committee of the Commercial Club May 1, and reached an agreement to work out a down-town transportation system that will induce the steam railroads to remove their terminal to the outskirts of the business district. The plan under consideration contemplates the establishment of railroad terminals outside of the district bounded by Twelfth Street on the south, Halsted Street on the west, and Chicago Avenue on the north. A double-decked subway system will furnish a means of rapid transportation to and from the railway stations. At the meeting, Bion J. Arnold explained the double-decked subway system he has worked out for the down-town district, and showed how extensions could be made to the system to reach railroad stations north and west of the river. He informed the committee that it was his intention to urge the city and the traction companies to construct immediately the smaller of the subway systems contemplated by the traction ordinances. The railroad men expressed themselves as not believing that this small system would relieve the congestion sufficiently to justify the removal of the terminal. They are, however, satisfied that with a proper subway system it would be more convenient for passengers to reach outlying depots than to reach them under the present conditions.

Harvey B. Fleming, chief engineer of the Chicago City Railway, has been selected by the railway company as its representative on the supervising Board of Engineers, which is to have charge of the reconstruction of the Chicago City Railway under the terms of the traction settlement ordinance. The board will be composed of three members, Bion J. Arnold as chairman, Mr. Fleming and an engineer to represent the city. The city is to appoint its representative within thirty days.

According to President F. H. Rawson, of the Union Trust Company, stock of the underlying companies of the Union Traction Company is being deposited with the trust committee at the rate of 1000 to 3000 shares a day, in response to the call.

A committee composed of Controller Wilson, Corporation Counsel Brundage, Engineer Arnold, Special Counsel Walter Fisher and Chairman Foreman, of the local transportation committee, is working over a system of accounting for the division of the net profits between the city and the traction companies, as provided by the traction ordinances.

At a mass-meeting of traction employees, held April 29, it was voted to demand from the Union Traction and the Consolidated Traction Companies an increase in wages amounting to about 30 per cent and an 8-hour day.

NEW HAVEN CONSOLIDATED MEETING

A special meeting of the stockholders of the New York, New Haven & Hartford Railroad Company will be held in New Haven May 31, to amend the charter and consider and act upon the proposition to merge the company with the Consolidated Railway Company, a majority of whose stock is owned by the New Haven Company. The following details of the plan are sent out, but not officially, from New Haven:

Instead of the stockholders of the New Haven road voting at the special meeting to be held this month on a proposition which would make the Consolidated Railway, composed of the electric lines in this State owned by the New Haven, a part of the corporation, they will take action on a proposal to make the New Haven a part of the Consolidated. The New Haven road, if the stockholders approve, will be operated under the charter of the Consolidated Railway Company, which has a liberal charter and one that would, on the whole, work to the benefit of the New Haven Company.

PLANS FOR THE TOLEDO, WABASH & ST. LOUIS

Plans announced by President C. D. Whitney, of the Toledo, Wabash & St. Louis Electric Railway Company, indicate that construction work will be begun not later than July 1, and that the first 13 miles will be in operation by the end of the year. The company has most of its franchises between Toledo and Defiance, and now controls the old Maumee power house at Miami, the largest water power house on the Maumee River and of sufficient capacity, it is thought, to furnish power for the section between Toledo and Defiance. The construction work will be pushed along as rapidly as possible, but Defiance will probably not be reached before next spring or summer, if the plans are carried out as now arranged. Mr. Whitney says that the grading will be so light between Toledo and Neopolis that not more than 70,000 sq. yds. of earth will have to be moved. The track will be rock ballasted, control of quarry No. 2 at Waterville having been secured, and will be laid with 70-lb. steel rails. Catenary construction will be used. This will be the first road in Ohio to use this construction to any extent.

INSPECTION OF CAR EQUIPMENT AND ACCIDENT REPORTS

The Indiana Railroad Commission has notified steam and electric railway companies operating in Indiana that by authority of a recently-enacted law the Commission would soon send out inspectors to examine the car equipment, the track, the rolling stock, etc., and would also furnish the companies with blanks for accident reports. The new law requires said companies to make two reports of every accident to the Commission—one, a preliminary report, is to be made within five days after the accident, giving place and date of the accident, the probable cause, the number of persons killed and injured; a blank for a second report, to be made within twenty days after the accident, is also furnished. This second report is much more complete, and shows whether the accident was due to a collision, derailment or other cause; at or near what station, on what division, the number of train or trains, the names of the engineer, fireman, motorman or motormen and conductors, the exact time of the accident, and an explanation of the cause of the accident. The report must also show the age, residence and occupation of each passenger, employee or other person killed or injured, also the extent of the injury as near as can be ascertained. Lastly, the amount of the property damage is to be enumerated.

ELECTRIC RAILWAY ENGINEERING AT CORNELL

The seniors in electrical engineering and in mechanical engineering in Sibley College are manifesting great interest in electric railway work. About 110 are taking the general railway lectures, and one-half this number are in the more highly specialized course. The non-resident lecturers this year include C. O. Mailloux, of New York, and W. N. Smith, of Westinghouse, Church, Kerr & Company. Mr. Mailloux's lectures have dealt with velocity-time curves and mechanical integration as applied to their manipulation. The series of six lectures now being delivered by Mr. Smith discuss the construction of the road from the preliminary examination to its completion. They also include a comparison of steam and electricity in operation.

Such courses as this are given only in the latter half of the senior year. Up to that time the students are occupied with routine studies intended to train them for their practical work. It is felt, however, that in the last term the students should be given a general idea of the manner in which mechanical and electrical principles are applied to various phases of engineering work. Information courses are not considered to be of value, but illustrative material must be given to students at the proper time in order to fix in mind the principles and to produce a feeling of confidence in their applicability to practice.

B. R. T. EMPLOYEES' BENEFIT ASSOCIATION OPENS RESTAURANT FOR EMPLOYEES

The Brooklyn Rapid Transit Employees' Benefit Association has still further extended its influence over its members by operating a dining room for the men at the East New York quarters of the association. The formal opening took place Friday evening, May 3, when a dinner was given by the trustees of the employees' association. The association has for some time past had the matter of a dining room for the employees under consideration, the success of the arrangements made by the company for supplying the men at Coney Island during the summer season really suggesting a permanent restaurant. The traffic to Coney Island in the summer is extremely heavy, and the company several years ago found that the employees in many cases were compelled to patronize places nearby where the accommodations and food were none too good. Consequently, the company erected at the Culver terminal a restaurant where the employees could at once secure prompt service and wholesome food with a minimum of inconvenience.

The plan of the restaurant as operated at East New York, however, is somewhat different from that followed at Coney Island. At East New York the platform men employed on such lines as Broadway and Fulton Street and the elevated lines, and the shop employees in the elevated and surface car terminal all have access to the dining room. Here between 11 a. m. and 2 p. m. a regular dinner of five courses at 25 cents is available for those who desire it; individual dishes may be bought or a man, if he is in a great hurry, can stand up at a lunch counter, and take a bite just as the majority of business men do at the cafés which recently have become so numerous.

The part of the club house that has been set aside for the restaurant extends along Fulton Street, and was formerly used as a reading room. The reading room itself has been transferred to the gymnasium floor, which is very large and answers very well all requirements as the lighting is very good. In addition to the room thus taken over, an irregular extension has been built to the club house proper on the yard side, which provides five windows besides the two in what formerly was the old reading room. Back of the dining room is the kitchen. As the dining room and kitchen are on the level of the regular club house floor, there is available on the ground floor the rooms under the dining room and the kitchen. The room under the kitchen is used for the ice-box. The room under the dining room is used as a store house.

Besides the regular equipment of chairs and tables for the dining room, affording accommodations at one time for 150 persons, there is a special lunch counter at the yard side of the room such as are generally installed in buffets. This counter is about 22 ft. long, and directly back of it are two large windows. Here sandwiches and other *a la carte* dishes are served. In laying out the kitchen the watchword has been economy of space with the maximum room for convenient working. Entrance from the dining room to the kitchen is by swinging doors, one in and one out. To the right of the entrance is a movable swill table with working space on all sides. Against the right wall are a washing table, rinsing table, drain board, pot washers' sink and shelves. Then there is a sink with space on three sides. This completes the equipment for this side. At the back to the right are four large ranges with a common flue. To the side of them is a window which sheds light on the ranges.

On the yard side is the stairway leading down into the stock room, of which mention has been made before. To the side of the door leading out in the dining room is a large counter for salads, cold meats and pie, with suitable boxes underneath for silver. The table linen and the silver are marked with the emblem of the association.

TWIN CITY COMPANY INCREASES WAGES

The Twin City Rapid Transit Company, of Minneapolis, St. Paul and Stillwater, has announced that the wages of all its trainmen will be increased on June 1. This is a voluntary action on the part of the company and, coming as a complete surprise, was received with great satisfaction and pleasure. The following is the new schedule of wages to be effective from and after June 1, 1907: For the first year of service, 21 cents an hour; for the second year of service, 22 cents an hour; for the third year of service, 23 cents an hour; for the fourth and fifth years of service, 24 cents an hour; after five years, 25 cents an hour.

All trainmen appointed during the past year will receive the 22-cent rate during the second six months of the first year of service.

This means that a large percentage of the company's employees will immediately receive the maximum rate of 25 cents per hour, which is 3 cents more than the present scale provides.

It has always been the desire of the company to promote a feeling of friendliness and loyalty on the part of its men. This feeling has developed not only by reason of the sharing of its prosperity with its men, but when sickness, bereavement or other misfortunes have overtaken them the company has always shown a readiness to offer assistance, when such assistance was acceptable and desirable.

LEGISLATION IN PENNSYLVANIA

Now that the trolley eminent domain bill has been placed upon the Senate calendar practically as it passed the House, the organized electric railway interests of the State feel sure that it will reach the Governor before adjournment on May 16. That the Governor will sign it is not doubted. With the right to condemn land for construction purposes where the consent of 51 per cent of the affected land owners has been obtained, and the right to haul freight, the electric railway interests will have finally come into their own in Pennsylvania.

Representative Simpson's bill, to give electric railway companies unrestricted rights as common carriers under certain conditions, passed finally in the House last week. It provides that when an electric railway company and local authorities unite in petition, the electric railway company may handle heavy freight, such as stone and timber, as well as light freight and express matter, and become a general common carrier.

The bill now in the hands of the Governor prohibiting steam lines from controlling parallel or competing passenger railways, may affect the Pennsylvania Railroad Company's control of the electric line between Altoona and Hollidaysburg, and the Cumberland Valley Railroad Company's control of the large system of the Valley Traction Company, operating between this city and Carlisle, Marysville and New Cumberland, also the Chambersburg & Gettysburg Electric Railway. It is asserted that railroad companies, in view of the prospective grants of eminent domain and freight carrying privileges, were seeking control of other trolley lines, and that soon this means of transportation would be absorbed by the steam roads. The bill was introduced by Representative Hall, of Luzerne, and goes into effect immediately upon its approval by the Governor.

The House has unanimously passed the two remaining Reynolds bills, to enforce sections of Article 17 of the Constitution, and control common carriers by penal legislation. The first forbids the consolidation of competing or parallel transportation lines, whether railroad or canal, and provides a penalty of $20,000 for the offending corporations. In the second bill uniform rates for freight and passenger service to all patrons getting the same service are directed, the penalties being $20,000 fine for the corporation and $1,000, or three years in jail, for employees.

The Beidleman bill, requiring electric railway companies to equip their car platforms with enclosed vestibules, which has passed the House and now goes to the Senate, requires that every trolley car used in the transportation of passengers shall be enclosed between Dec. 1 and April 1. There is a fine of $10 per day per car for cars operated without being so equipped after December begins, the proceeds of the fines to be applied by the county for improvement of highways.

The Governor has signed the bill requiring steam and street railways to report on or before Aug. 1, next, and every three years thereafter, to the Secretary of Internal Affairs, the number of miles they operate. The bill fixes a penalty of $500 for failure to report, or make an incorrect report. It was drafted by Senator Williams, of Tioga County, and is designed to permit the railroads to charge passengers only for the actual number of miles traveled and not for the distance fixed by the roads.

REPORT OF THE 1906 CONVENTION

The copy of the proceedings of the American Street and Interurban Railway Association, at its Columbus Convention, has been issued by the secretary. It contains 472 pages, with the papers, reports, discussion, attendants, constitution, list of member companies, associate members, etc. Among the reports is that of the committee on municipal ownership, printed elsewhere in this issue, and that on standard rules.

SALT LAKE STRIKE SETTLED

The strike of the employees of the Utah Light & Railway Company, of Salt Lake City, declared Sunday, April 29, ended Wednesday, May 1, after a conference had been held between the men and General Manager Bancroft. The company positively refused to entertain the demand for recognition of the union, and this was finally waived. A new schedule of wages is announced, however. It is said to provide a rate of 25 cents an hour for first-year men and for 30 cents thereafter. The car house men are given a 10 per cent increase. The agreement is to continue for two years, or until May 1, 1909.

STRIKE DECLARED IN SAN FRANCISCO

The management of the United Railway of San Francisco is confronted with another strike of its employees. The men insisted on the demands enumerated in the Street Railway Journal of May 4, and finding they would not be granted went on strike, Sunday, May 5. The platform men this time are reinforced by the stationary firemen, who demand recognition of their union and an increase of wages from $2.75 to $3.25 a day. In addition to the strike of the street railway employees the iron workers are out, the large laundries are not in operation and the telephone service is partially suspended.

The Street Railway Journal has recorded from time to time the progress of events in San Francisco, and in the issue of March 16, 1907, published at great length the findings of the recent arbitration board. It is these findings that President Calhoun, of the company, says must be lived up to. Mr. Mullaly, speaking for Mr. Calhoun, said on Monday:

"No committee representing the local union will be recognized. The company has no quarrel with unionism as a principle, nor is it opposed to organized labor as a body, but it has done with the local car men's union. That union has twice broken faith with this company and has seized many opportunities to annoy and harass the company prior to presenting the unreasonable and impossible demand formulated within two months after the United Railways had granted an increase of 20 per cent in wages."

At 2:30 Tuesday the company made its first attempt to resume operations by sending out seven passenger cars, manned by about forty men. The start was made from the company's car house at Turk and Fillmore Streets, where a crowd of from 3000 to 5000 men and boys had gathered. That led to the serious riot in which four persons were shot. This serious conflict, however, was preceded just before noon by bloodshed, when an attempt was made to run a freight car manned by four inspectors out of the car house. An inspector was severely injured by a flying missile.

On Wednesday cars were run from Oak Street out to Devisadero and along the latter street, but no attempt was made to operate cars in the business section. The police disarmed all men running cars, and this seemed to incite the mobs to violence, for a number of skirmishes are reported in which considerable damage was done to the company's property.

COURT DECISION IN THE DETROIT CASE

A decision has been handed down by the State Supreme Court of Michigan to the effect that the city of Detroit cannot build street railway tracks to be leased to an operating corporation. For some little time there has been much discussion in Detroit as to the terms for renewing the franchises of the Detroit United Railway for the operation of a number of its lines. As yet the question has not been settled. The City Council in 1905 ordered the Department of Public Works to lay tracks on several streets and appropriated $10,000 to begin work, presumably for the purpose of securing competition for the Detroit United. A question as to the legality of this action was raised, and an injunction was sought to restrain the city. The decision of the State Supreme Court is the final result of the legal procedure instituted at that time.

EXTENSIONS IN THE THERMIT COMPANY

Owing to the resignation from the Thermit Company of R. F. Kelker, Jr., whose appointment as engineer of track in Chicago, under the Board of Supervising Engineers, is mentioned elsewhere in this issue, the company announces certain changes in its staff. Mr. Kelker's place will be taken by G. E. Pellissier, who has been traveling throughout the country for the Thermit Company during the past year and a half. Mr. Pellissier was formerly engineer of track and maintenance of way at Holyoke, Mass. The Thermit Company has also secured the services of C. F. Gailor and W. R. Hulbert. For the last two years Mr. Gailor has been chief engineer of the Binghamton Railway Company, of Binghamton, N. Y., and previous to that time was chief engineer of the Rutland Railway, Light & Power Company. He was also connected with the Hudson Valley Railway Company for four years, during which time he acted in nearly all capacities, from rodman to engineer in charge of construction. Mr. Hulbert has been managing editor of "Compressed Air" since May, 1906, and secretary of the Kobbe Company for the past year and a half. He is a graduate of the mechanical engineering course at Columbia University, and is a full member of the American Society of Mechanical Engineers. Before his association with the Kobbe Company he was assistant to the sales manager of the Rand Drill Company. These changes do not affect the position of A. M. Guenther, who for the past year and a half has had charge of the other branches of the thermit work.

NEW YORK RAPID TRANSIT COMMISSION REPLIES TO THE INTERBOROUGH COMPANY

The Rapid Transit Commission of New York voted unanimously May 2 to send an ultimatum to Theodore P. Shonts, president of the Interborough-Metropolitan Company, to the effect that the board will not allow the Interborough Company to third-track the Second and Third Avenue elevated lines unless the Interborough will agree to build, with its own money, the Lexington Avenue subway north of Forty-Second Street and the Seventh Avenue subway south of Forty-Second Street. This proposition was embodied in a resolution introduced by Vice-President Starin, who presided at the meeting. The resolution provided further that the Interborough Company must agree to give a system of universal transfers between subways, elevated and surface lines in Manhattan and the Bronx.

"I believe that the Interborough Company is under every obligation to construct the subways which were recently advertised, and which it says it will be willing to construct if the terms are made satisfactory," said Mr. Starin. "If, however, this board shall grant to that company these elevated additions, I am very certain it will be very useless for the city to look for any further co-operation on the part of that company in building municipal subways."

The Interborough will not accept the offer. Mr. Shonts says that it is absurd to think that any one is going to put money into subway construction under the conditions proposed and intimated very clearly that the company would stand on the letter that was sent to the board last week when the company failed to bid on new subways. This letter was condensed and published in the STREET RAILWAY JOURNAL for May 4.

OKLAHOMA COMPANY REORGANIZES

The Tecumseh-Norman Traction Company, which was recently chartered, has been reorganized as the Oklahoma Rapid Transit Company, with offices at Oklahoma City. The company will build an electric railway from Oklahoma City to Norman and to Tecumseh. The surveys from Tecumseh to Norman have been made and a line will now be run between Norman and Oklahoma City. The officers are as follows: George Silsby, president; W. E. Powell, vice-president; George Weed, secretary; D. D. Klapp, treasurer. The directors are J. H. Surber, S. B. Mitchell, H. Loop, E. W. Milburn, W. E. Powell, George Weed, M. H. Tennison and D. D. Klapp.

PUBLIC SERVICE BOND TAXATION HEARING IN BOSTON

Representatives of several Massachusetts street railways appeared at a hearing held on May 6, in Boston, before the legislative committee on traction, to protest against the passage of a bill taxing future issues of bonds by public service corporations. Bentley W. Warren, for the Massachusetts Street Railway Association, emphasized the burden which such a law would throw upon the street railways, and pointed out that many companies would be forced to the wall if the bill was passed. The present system of taxation has been in effect forty years, and since it went into effect practically all the street railways in the State have been built. By paying for part of the cost of street railways in bonds it has been possible to make both ends meet in many cases, where otherwise the roads could not have been built. If in addition to the tax on new bonds the companies are taxed for $50,000,000 bonds outstanding the street railways would be taxed far in excess of the average tax on all property, which is $16 per thousand in the State.

President Crapo, of the New Bedford & Onset Street Railway, urged that street railways now contribute to the public treasury more than any other business. The debt of all Massachusetts companies in 1905 was $71,000,000. They paid on their capital stock a tax of $1,892,000, but if the bill had been in effect the tax would have increased 60 per cent, although the average dividend was 4.5 per cent.

Attorney Hunt, for the Boston Elevated, stated that his company paid last year in direct taxes more than $1,000,000, with an additional $611,849 for the paving of streets outside the rails and the rentals of subways. The total amount paid to Boston Elevated stockholders was less than half this total. Within a short time the outstanding bonds of the company will amount to $13,300,000, which is the exact amount of the present capital stock of the company, and which last year was taxed $673,000. If the company should be obliged to double this amount the excess burden could come from no source other than the amount set aside for dividends, and the later would be reduced to about 1 per cent. Judge Hammond, president of the Northampton system, stated that the proposed law would take 2 per cent out of the dividend, and several other street railway men urged that its passage would mean either poorer service or increased fares.

The opinion of those who have followed the course of events is that the measure will not be passed.

STREET RAILWAY PATENTS

[This department is conducted by Rosenbaum & Stockbridge, patent attorneys, 41 Park Row, New York.]

UNITED STATES PATENTS ISSUED APRIL 23, 1907

850,951. Rail Tie; H. K. Myers, Swissdale, Pa. App. filed Feb. 13, 1907. A pair of cross-ties connected by a pair of spreader-plates which parallel the rails, the ends of the spreader-plates being disposed upwardly to form supports for the rails.

850,973. Quadruplex Cycle; Stoughton P. Shafer, Kansas City, Mo. App. filed Jan. 12, 1907. Relates to an amusement device.

850,979. Compound Railway Rail; George B. Stephens, Sherman, Tex. App. filed Feb. 12, 1907. The rail is divided into

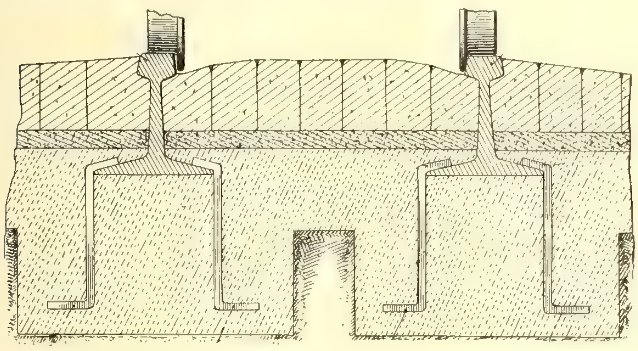
three parts in such manner that the whole tread or either side thereof may be removed and replaced.

850,982. Rail-Joint; Samuel Toman, Dayton, Ohio. App. filed May 10, 1906. The web of the rail and the fish-plates are slotted so as to receive H-shaped bolts, which are turned 90 degs., so that their heads will engage the sides of the slots. The fish-plates, which are wedge shaped laterally, are then driven into position.

851,029. Trolley Retriever; Simeon F. Pierce, St. Paul, Minn. App. filed Oct. 30, 1905. A pneumatic cylinder tensions a spring which normally holds the pole in raised position. A dash pot device causes a valve to relieve the air pressure in case of an abrupt upward movement of the pole.

851,273. Triple Valve; Robert H. Blackall, Edgewood Park, Pa. App. filed June 13, 1903. A quick action triple valve device having a small passage for equalizing the auxiliary reservoir and train pipe pressures, said passage being opened by the movement of the triple valve piston to its normal emergency position.

851,277. Fluid Pressure Brake; Francis L. Clark, Pittsburg, Pa. App. filed July 14, 1904. A primary brake cylinder and piston and a secondary brake cylinder and piston independent of the first brake piston, and a fluid-pressure operated clutch or locking mechanism for one of the brake pistons.



PATENT NO. 851,405

851,316. Automatic Air Signal, Air Brake and Steam Coupling; Herman C. Priebe, Blue Island, Ill. App. filed July 31, 1906. An automatic device for either air brake, air signal or steam couplings between cars.

851,405. Rail Fastening Device; James P. Crerar, Denison, Tex. App. filed Jan. 9, 1907. A street pavement of cement or concrete foundation, having fastening devices for railway rails adapted to be embedded therein, and comprising an end portion adapted to engage the flange of the rail and a body portion extending down into the pavement below the rail to form an anchor.

851,415. Trolley; Charles Y. Haile, Uniontown, Pa. App. filed June 26, 1906. Rods hinged to the harp and spring impelled upward therefrom to guide the wheel on the wire. The rods yield downwardly in passing hangers, etc.

851,442. Rail Fastener; Frank Schlicker, Willock, Pa. App. filed Feb. 18, 1907. A rail chair has lugs engaging the tie and the base of the rail and holes in said base through which spikes are driven to engage the fish-plates.

851,508. Switch Throwing Device; James Fisher, East Liverpool, Ohio. App. filed Sept. 17, 1906. A tappet wheel in the roadbed has radial arms adapted to be engaged by a shoe depending from the car. A rod is pivoted at one end to one of the arms of the tappet wheel, and at the other end has a crank pin connection with a disc connected with the switch point.

851,523. Automatic Block Signal; Newton C. Keeling, Bridgeport, Conn. App. filed Oct. 31, 1906. A single-track block signal system for trolley roads having an overhead trolley. Star shaped devices are mechanically impelled to rotate by the engagement of the trolley wheel in passing, and thus control the signal circuits.

851,590. Rail Splice or Joint; Jacob W. Fennel, Johnstown, N. Y. App. filed Jan. 17, 1907. The adjacent ends of the rails are cut away so as to overlap each other, and one of them is provided with perforations and the other with pins in its overlapping portion, one of which pins is provided with screw threads and nut, and a shoe or plate for the rails, the sides of which overlap the sides of the bottom of the rails.

PERSONAL MENTION

DR. KARL GOLDSCHMIDT, of the Goldschmidt Thermit Company, is in this country.

MR. JOHN I. PLATT, of Poughkeepsie, N. Y., formerly president of the Poughkeepsie City Railroad, is dead.

MR. FREEMAN C. GERBERICH, of Dauphin, has been appointed by Auditor-General Henry Houck chief of the Bureau of Railways, succeeding Mr. W. W. Morgaridge, of Corry, Pa.

MR. C. K. DEFINBAUGH has resigned as master mechanic of the Cumberland & Westernport Electric Railway Company, and has been succeeded by Mr. D. D. Price, of Frostburg, Md.

MR. E. W. POOLE has recently resigned as assistant treasurer of the Connecticut Railway & Lighting Company, at Bridgeport, and is now associated with the Philadelphia office of the United Gas Improvement Company.

MR. WALTER A. GRAHAM has resigned as claim agent of the local lines of the Consolidated Railway Company, at New Haven, Conn. Mr. Graham, who has been connected with street railway interests about forty years, retires to private life.

MR. J. B. LIVINGSTONE has resigned as auditor of the Oregon Water Power & Railway Company, of Portland, Ore., and Mr. A. L. Flatland has resigned as master mechanic of the company, to become connected with the Jersey Central Traction Company, of Keyport, N. J.

IN THE ARTICLE on the Lima Tramway system published in the May 4 issue, reference should have been made to the fact that the managers of the Empresas Electricas Asociadas are Dr. M. I. Prado y Ugarteche and Sr. Emilio S. Godoy. The tramway management is in the hands of Mr. Godoy.

MR. C. H. CLARK, who for four years has been superintendent of maintenance of ways of the Cleveland Electric Railway Company, has resigned, to enter the service of the International Traction Company of Buffalo in a similar capacity. In the local controversy in Cleveland Mr. Clark has had charge of removing tracks.

MR. HECTOR W. MACKAY, division superintendent of the Boston & Worcester Street Railway, has resigned to become superintendent of the Northern division of the New Hampshire Traction Company, with headquarters at Hampton, N. H. Mr. Edwin C. Whitney succeeds Mr. Mackay on the Boston & Worcester. His headquarters are at Marlboro.

MR. BURTON B. PIERCE, who for the past three years has been superintendent and chief engineer of the Mansfield Railway, Light & Power Company, of Mansfield, Ohio, has resigned from that company and accepted the position of chief engineer for the Washington Portland Cement Company, at Concrete, Wash. Mr. Pierce has already entered upon his new duties.

MR. GEORGE BULLOCK, president of the United Gas & Electric Company, of New York, has been elected president of the Lancaster County Railway & Light Company, succeeding Mr. W. W. Griest. Mr. Charles E. Griscom, of Philadelphia, has been elected vice-president, and Mr. M. W. Dodge secretary-treasurer of the company. The control of the company recently passed into new hands.

MR. C. M. CLARK, of Philadelphia, chairman of the executive committee of the Portland Railway, Light & Power Company, of Portland, Ore., has been elected president of the company to succeed the late Mr. Henry Walton Goode. Mr. Clark will maintain his residence at Philadelphia, and the active management of the property will be vested as heretofore in Mr. F. I. Fuller, in direct charge of the railway system, and Mr. F. G. Sykes in charge of the electric lighting and power branches.

MR. A. S. RICHEY has been appointed professor of electric railway engineering at Worcester Polytechnic Institute. Prof. Richey was successively in charge of the mechanical and electrical departments of the Citizens Street Railway Company at Muncie, Ind., and of the Marion City Railway Company, and chief engineer of the Indiana Union Traction Company. He has been assistant professor at Worcester since 1905. Dr. George R. Olshausen, who has been appointed assistant professor, was formerly chief engineer of the Union Depot Railroad Company at St. Louis.

MR. F. T. BUCHANAN, superintendent of the railway and amusement department of the Key West Electric Company, has resigned because of ill health and returned to his home in Woburn, Mass. Mr. Buchanan has been succeeded by Mr.

N. B. Rhoads, formerly of the Savannah Electric Company. Mr. Buchanan, previous to coming to Key West, was general superintendent of the Cape Breton Electric Company, of Sydney, C. B. He was transferred to Key West by Messrs, Stone & Webster, thinking the South would benefit his health.

MR. JOHN G. PHILLIPS, at present purchasing agent and superintendent of rolling stock of the Hudson Valley Railway Company, has been appointed assistant general manager of the company. Mr. F. W. Kinmouth, who has been superintendent, will sever his connection with the company, and Mr. John H. Cain, of Glens Falls, who has been the assistant to Mr. Kinmouth, will become superintendent. Mr. D. E. Van Wirt, chief engineer of the company, will hereafter have entire charge of the track and its maintenance, a task which has heretofore been supervised by the superintendents.

MR. R. F. KELKER, JR., who has been associated with the Goldschmidt Thermit Company, of New York, for the last three years as its principal outside engineer, has resigned from that company to take up engineering work in connection with the reconstruction of the tracks in Chicago, under the Board of Supervising Engineers. Mr. Kelker's experience in the track departments of the Brooklyn Rapid Transit, International Railway Company, of Buffalo, and the Baltimore & Ohio Railroad Company eminently fits him for the rehabilitation in Chicago, which will come under his charge. He took up his new duties May 6.

MR. BARRO HARSON, of Toledo, Ohio, has been appointed general superintendent of the Mexico Electric Tramways, Ltd., by Mr. R. C. Brown, managing director of the company, who has been in charge of the property since the resignation of Vice-President and General Manager W. W. Wheatly some time ago. Mr. Harson has long been engaged in street railway work and at one time was connected with the Mexico City Tramways. This was about ten years ago, when the property was managed by Mr. Thomas McLean. In 1897, Mr. Harson resigned from the Mexico Company to enter the employ of the Toledo Railways & Light Company, with which he was connected until about a year ago, when he entered the employ of the International Company, which is engaged in the production of sugar in the State of Vera Cruz.

MR. HARVEY B. FLEMING, chief engineer of the Chicago City Railway Company, has been appointed a member of the new supervising board of traction engineers of Chicago, to represent the Chicago City Railway Company on the board provided for by the new traction ordinances. Mr. Fleming has been for seven years employed by the Chicago City Railway Company. He was educated at Washington University, St. Louis, where he did post graduate work after obtaining his degree as bachelor of science and the degree of master of engineering. For three years Mr. Fleming was an assistant engineer in the water department of St. Louis; then he entered street railway work and was for two years in the employ of the St. Louis Transit Company and the National Railway Company. Mr. Bion J. Arnold is the president of the board, under the provision of the ordinances.

MR. F. W. JOHNSON, who for the past five years has been claim agent of the Connecticut Railway & Lighting Company, with general headquarters at Bridgeport, resigned from that company March 1, to accept the position of assistant general claim agent of the Philadelphia Rapid Transit Company. Mr. Johnson commenced his street railway experience in the claim department of the former Lynn & Boston Street Railway Company, under Mr. E. O'Callaghan, claim agent. He remained with this company until after its merger into the Boston & Northern Railroad, and afterwards accepted the position with the Connecticut Railway & Lighting Company, which he has recently resigned. Mr. Johnson is a member of the executive committee of the American Street and Interurban Railway Claim Agents' Association. While in Bridgeport he compiled a series of instructions to motormen and conductors on the prevention of accidents, which has been republished in pamphlet form.

MR. BION J. ARNOLD, according to a newspaper dispatch received as the STREET RAILWAY JOURNAL goes to press, has met with a distressing accident. The report states that while Mr. Arnold was making some adjustment of the machinery of the automobile of his brother the engine "kicked back," striking his chin, which brought his teeth together and the end of his tongue was entirely severed. The account continues, "Mr. Arnold closed his mouth firmly, though the blood from the severed tongue drenched his clothes, sprang into the machine and drove rapidly and accurately to the Mercy Hospital, where he arrived 20 minutes after the accident happened. The surgeons stitched the tongue together and assured Mr. Arnold that it would knit and that he would in time be able to speak again." Another account states that in the hospital Mr. Arnold with pencil and scratch pad gave this explanation of how the accident happened: "Was with my brother in his new auto. He killed the engine; I got out to crank it. Spark lever was too far advanced. Engine kicked back and pulled my chin down on radiator. It cut my tongue clean off. I drove machine to Mercy Hospital, where Dr. J. M. Lilly sewed it on. I am doing no talking for several days."

MR. CHARLES V. WESTON has been selected by Mayor Busse, of Chicago, as the city's representative on the Board of Supervising Engineers, that will have charge of reconstructing the street railway systems of the city. Mr. Weston is 50 years old and has been a civil engineer all his life. In the early eighties he was chief engineer for various Kansas and Texas railroads, coming later to Chicago as engineer for the Northwestern Railway. Soon after locating in Chicago, in 1888, he built the Lake View in-take crib and water tunnel. In 1894 he completed the Van Buren Street tunnel for the West Chicago Street Railway, after which he became in turn chief engineer for the Northwestern and Lake Street Elevated Railways and the Union Loop. Since 1903 he has been chief engineer of the South Side Elevated Railway. The body now consists of Mr. Bion J. Arnold, named in the ordinances as chief engineer and chairman of the board; H. B. Fleming, named by the Chicago City Railway as its representative, the appointment of whom is noted elsewhere in this issue, and Mr. Weston.

MR. IRA A. McCORMACK, heretofore manager of the Grand Central Station and general superintendent of the electric division of the New York Central & Hudson River, has been appointed assistant to the general manager of that road, having charge of matters pertaining to electric operation and performing such duties as may be assigned. Mr. McCormack was born at Pittsburg, Pa., in 1858, and was for twenty years identified with steam railroad work. In 1895 he was appointed general superintendent of the Brooklyn Rapid Transit Company, and after three years of service resigned to become vice-president and managing director of the Syracuse Rapid Transit Company. After serving in this capacity for seven months under the administration of the Everett-Moore syndicate, he was appointed general manager of the Cleveland Electric Railway. On May 11, 1902, he resigned to become assistant manager of the Grand Central Station at New York, and on Nov. 1, 1903, was made manager. On Dec. 1, 1905, he was given the additional title of general superintendent of the electric division of the New York Central. It is expected that Mr. McCormack will spend several months abroad studying foreign electric practice for the purpose of assisting to bring the electric operation of the New York Central up to the most desirable standard. As stated in the STREET RAILWAY JOURNAL of April 27, Mr. McCormack is succeeded as general manager of the Grand Central Station and general superintendent of the electric division of the company, by Mr. A. R. Whaley.

MR. CHARLES M. CRAWFORD, of Hartford, Conn., has been appointed chief engineer of the Cincinnati Northern Traction Company, of Hamilton, Ohio, to succeed Mr. C. A. Alderman, resigned, who, as noted in the STREET RAILWAY JOURNAL of April 6, has become connected with J. G. White & Company. In 1873, when a very young man, Mr. Crawford went to Southern California as one of the corps on the survey made through the Colorado Desert and the Bad Lands of Arizona, serving in that capacity for about four years. Returning to the East in 1879 he entered the employ of the Pennsylvania Railroad and assisted in laying out, under Chief Engineer Brown of the company, the present site of the Broad Street Station in Philadelphia. Afterwards he became assistant engineer for the Pennsylvania Railroad. Mr. Crawford severed his connection with the Pennsylvania Railroad in 1883, and accepted the position of superintendent of the Danbury & Norwalk Railroad, which was rehabilitated under his supervision. In 1886 this road was sold to the Housatonic Railroad. Mr. Crawford's next work was with the Meriden & Waterbury Railroad, which he built for Mr. Horace C. Wilcox and his associates, and managed until it too was sold to the New York, New Haven & Hartford Railroad. About 1894, Mr. Crawford became connected with the Hartford Paving & Construction Company, of Hartford, as secretary and treasurer, and it is this position that he has just relinquished to become connected with the Cincinnati Company. Mr. Crawford has already entered upon his new duties.

Street Railway Journal

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DATE ON WRAPPER shows the month at the end of which the subscription expires. The sending of remittances for renewal prior to that date will be much appreciated by the publishers.

Of this issue of the Street Railway Journal, 8200 copies are printed. Total circulation for 1907 to date, 163,550 copies, an average of 8177 copies per week.

A Sound Decision

In our last issue we gave brief notice of a very important decision given by the Railroad Commissioners of Ohio, bearing upon the question of fair competition between steam and electric roads. It is so far-reaching in possible effect as to be worth some further consideration. In effect, it held that a railroad could not crush out electric road competition by cutting rates merely where it touched such competition. The same sort of question arises in connection with many commercial monopolies in which local rate-cutting is a very common method of destroying competitors, but in this railroad case there was fortunately a statute which bore so directly upon the situation that it could not be dodged, and the rights of the public were protected. For in the last resort the public interests were those chiefly imperiled. We have often of late dwelt upon the real community of interest between street railways and the people they serve, and this example is much to the point. Had the railroad been allowed to cut rates locally against its competitor one of two things must have happened. Either competition would have wrecked the electric road and thrown it into the hands of its adversary, or there would have been a long and dubious struggle.

If the first condition had occurred it is pretty certain that both steam and electric fares would have been raised and the last state of that people would have been worse than the first. In the second case, unrestrained by the present salutary decision, there would have been nothing to prevent a rise in railroad fares all along the line to compensate for the losses in competition, thus forcing the public to pay for the stick made ready for their backs. As the decision actually stands, a common carrier in Ohio cannot discriminate in rates to meet local competition. If it wants to cut rates it must cut them generally. We hope this decision will carry weight elsewhere, for it may rescue more than one hard-pressed electric road from unjust methods of attack. There could be no clearer indication of the real scope and value of electric traction than this, that an electric road can live and flourish on rates that drive a steam road to desperate and illegal scalping. These rates are of direct importance to the community, and they can be preserved only so long as the community stands by to prevent methods that imply the destruction of the electric road and of competition. If means could be found to insure fair play in all cases for the electric road, as well as illegal reduction of local fares, the public would very soon find out the difference in improved facilities and bettered service.

We have yet to hear of an electric line which has taken advantage of its patrons by unreasonable fares. They uniformly give the public the square deal, and they deserve a square deal in return. This Ohio decision tends to that very end. A scalping match between common carriers is of permanent benefit to nobody, for it tends to troubles later; but fair competition at fair prices tends to benefit all parties concerned in the long run, for it builds up business, which droops under the conditions fostered by the destruction of competition.

Certain portions of our country are well known to suffer acutely from the policy of exclusion adopted in the past against electric railway construction. Such a policy is detrimental to the suburban and country resident and so indirectly is injurious to the steam line, as the main province of the electric road is usually to act as a feeder to its steam

neighbor. It can open up territory into which the steam line would find it financially unprofitable to build. As the leader in our legal department this week shows, it supplies a local passenger service which a parallel line built under steam road conditions cannot furnish, even if equipped with electric power. Moreover, the electric line can flourish without much assistance from freight, which steam railroad magnates are wont to say is the only paying part of their traffic. It is satisfactory to know that certain States which have heretofore been the most backward in their grant of rights for electric railway construction are now realizing these facts and are removing some of the most burdensome restrictions under which the electric road has suffered.

Concentrated vs. Distributed Traffic

One of the most important results of the development of rapid transit facilities in large cities is the concentration of traffic at the terminals of high-speed routes. Enlarged opportunties for travel stimulate the movement of passengers all along the line, and in the business districts outlets must be provided for the increasing streams of traffic which reach their daily maximum values in the morning and evening rush hours. In a general way, the street railway companies are obliged to carry the public as nearly as is possible to the most favored points on their systems, but this frequently leads to excessive crowding at individual terminal stations. Lateral distribution of traffic en route between the outskirts of the business districts and these terminal stations is becoming more and more essential to the smooth handling of a densely populated territory.

A typical case of this kind is apparent at the present time in Boston. Only a few weeks ago, in response to a strong public sentiment in favor of such action, the Boston Transit Commission decided to terminate the Boston end of the Cambridge subway at Park Street, instead of at Scollay Square as at first contemplated. These two points are within 5 minutes' walking distance of each other, but there was no mistaking the popular desire to be delivered at the present Park Street subway station, which is, in most respects, the heart of the Boston Elevated system. The decision was undoubtedly a wise one, but in view of the growing tendency of subway and elevated train traffic to converge upon Park Street station, it is beginning to be clear that some plan is desirable to effect a wider distribution of passengers in the shopping district. The proposition to build a cross-town tunnel between Park Street and the South station offers a natural means of lateral relief, for such a route would enable a large part of the passenger traffic at Park Street to be delivered at points in the shopping or wholesale districts much closer to the desired destination than is now the case.

Such a tunnel, with suitable stations en route, would tie the present subway, the new Washington Street tunnel, the projected East Side subway for surface cars, and the Atlantic Avenue elevated line together, and tend to relieve excessive concentration of traffic at single stations in the business district. The enlargement of the Park Street station by one-third at its entrances and exits can scarcely provide for the increase of travel which is sure to follow the opening of new routes between the western suburbs of Boston and the city proper. The diversion of the present elevated train traffic from the Tremont Street subway to the Washington Street tunnel when the latter is completed is calculated, with the operation of the Cambridge subway, to reduce the present delays due to slow movement of cars in the Back Bay district, but there is little question that these changes in routes will be of slight avail in lessening the burdens placed upon Park Street station.

These questions are of more than local interest, because they emphasize the importance of developing rapid transit lines in a homogeneous way, and they show that in street railway work the distribution of passengers throughout a district is preferable to their concentration for entrance and exit at a single point. This is the reason why many companies operate through-cars from one side of a city to another, even though the communities served may have little social or commercial intercourse. A surface line of cars can collect and distribute passengers along its route with the maximum degree of flexibility, although it has to be done in many cases at a sacrifice of running time. Distribution between parallel trunk-line subways can be accomplished by suitable laterals, and if these laterals can be made containing tracks of other radial high-speed routes, the situation becomes relatively simple to handle. In steam railroad practice the whole tendency of the times is toward the union of terminals in urban territory, but the volume of passenger traffic in steam railroad service is relatively small in comparison with the ebb and flow of patrons on a large street railway system. It has been well said that a street railway cannot expect to do for 5 cents what a hack or a cab will do for ten times that sum—pick up a passenger at any point in a city and carry him to any other designated place in the 50-cent zone. Yet, this is the ideal which transit facilities tend toward in cities where the inter-relation of new routes is considered in planning costly avenues of speedy travel. The day is far distant when congestion will not occur at important stations, no matter what the service may be elsewhere, but each year of operating experience points the way toward smoother solutions of the main problems of urban rapid transit through the distribution of abnormal conditions over wider areas.

Overhead Construction

The general form of overhead construction for the ordinary direct-current interurban railway has become almost standard. Poles carrying transmission lines at the top are placed at about 100-ft. intervals at one side of the track, and carry the trolley wire on brackets, with direct-current feeder, telephone and signal wires on cross-arms below the transmission lines and at about the height of the trolley. Except that there has been some disposition to adopt a catenary construction in the hanging of the trolley wire, the arrangement outlined has been followed by most of the interurban roads now in operation. There seems to be no good reason for departing from the general arrangement, although more attention to the design of the details of the construction would, in many cases, result in making the lines much more reliable in their operation and more economical in their maintenance.

As we do not for the moment wish to be speculative, but rather to deal with the materials available to the en-

gineer who may be planning construction at the present, no discussion will be made of the possibility of the future general use of concrete or steel or concrete-steel for poles. Wood is still the pole material most feasible for the ordinary interurban line construction; whether it is cedar, pine or chestnut of course depends upon the relative location of the points of shipment and of use. The size and length of the poles, and the method and location of setting, however, admit of considerable variation, and should be carefully considered. With transmission lines on the same pole line, the poles should be long enough to allow plenty of free space between the transmission lines and other wires. The cost of an additional 5 ft. in the length of the poles is small compared with the gain in reliability and safety to workmen. The side spacing of poles, or the distance from the center of the track, is an important point, as an increase in this distance means longer trolley brackets and an addition in the side strain on the pole, due to the weight of the trolley hanging further away from the pole, although it also means greater safety in operation, and these matters should be carefully weighed against each other. On a single-track road, the possibility of double-tracking in the near future may determine on which side of the track the pole line should be located; but at long, easy curves it may well pay to cross over in order to place the poles on the outside of such curves. There are two advantages in this: the pole line is guyed much more easily when located on the outside of the curve; also, when so located, it does not prevent a clear view of the track ahead, as is the case when located inside. The setting of poles should receive especial care, if economical maintenance is sought for, and although not many interurban lines are so constructed, in many parts of the country the soil is of such a nature that the setting of all poles in concrete would undoubtedly be wise.

There is a splendid opportunity for the exercise of good judgment in the location of the various wires on the pole line. In the majority of cases, five sets of wires are to be carried—transmission lines, trolley, direct-current feeder, signal and telephone wires. The location of trolley and transmission wires are fixed when their heights and the side spacing of the poles are determined, but considerable variation may be made in the placing of the other wires. With the trolley on brackets, the side pull due to its weight may be balanced to a greater or less extent by hanging the direct-current feeder on the opposite side of the pole. In a case we have in mind, the wires were so placed on the pole that with the sizes used and average height of a 40-ft. cedar pole the center of gravity of the entire construction fell well within the base of the pole when set with an 8-in. rake away from the track, although a No. 000 trolley was carried on 8-ft. brackets.

Care should be used in the placing of telephone and signal wires that there is little opportunity for them to short-circuit with one another or with the direct-current feeder, although if the spacing is right all may be safely carried on one cross-arm. Wires strung tight on poles well guyed wherever the direction of line changes in the slightest is, of course, the best protection against these accidental short-circuits.

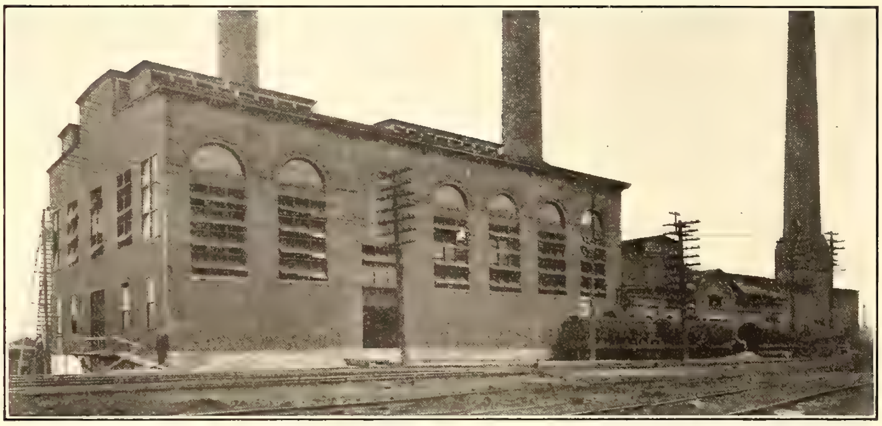
The form of trolley bracket most generally and properly used is that from which the trolley is flexibly suspended from a steel stranded wire instead of directly from the rigid arm of the bracket. The bracket should be made long enough, however, to extend enough beyond the trolley to provide this flexibility. An extra 6 ins. of trolley bracket will cost a few dollars per mile in the first place, but will prove to be a very good investment in trolley maintenance. Catenary construction, of course, provides this flexibility in a different manner, and may prove to be the most economical in the long run, even with ordinary voltage direct-current work. But experience has proved that rightly designed construction of the older type is fairly satisfactory, and undoubtedly most of the mileage constructed will be of this older design for several years to come, or until the advantages of the catenary type have been clearly proved by experience.

If continuity of service is at all important, a duplication of transmission lines will prove advisable. Even with the two transmission lines carried on the same pole line, the troubles most frequently encountered will only affect one circuit. A bad insulator, a burnt cross-arm, a broken wire, or a short-circuit caused by a foreign wire or branch of a tree may put one of the circuits out of commission, but in most cases will leave the other entirely clear. The point that one circuit cannot with safety be repaired while the other on the same pole line is in operation is well taken. In general, such attempt should not be allowed, but the advantage of supplying power with the good circuit during the time occupied in getting men to the scene of the trouble has been gained, and in most cases the time spent in locating such trouble and getting men to it is longer than that spent in actual repairs. The cost of construction is, of course, increased by the use of two circuits, due to practically doubling the number of cross-arms, pins and insulators; but the investment is generally worth while in the additional safety against interruption of service. A further point in favor of two circuits is that, with the same weight of copper as in a single circuit, and the same power, the voltage drop is less, due to the lower impedance of the smaller wire.

A method of transmission line construction on railway poles which has been suggested, and which has much to recommend it, may be mentioned here. The railway poles are necessarily set at intervals of about 100 ft., a longer spacing not being possible on account of the weight of trolley and feeder wires. The transmission wires, however, being, as a rule, small, can safely be carried in spans of 200 ft. Short poles, of only sufficient length to carry the trolley, feeder and telephone wires, are alternated between longer ones carrying the transmission lines in addition several feet above the others, these longer poles being about 200 ft. apart. As by far the greater part of transmission line troubles come from insulator failures, these troubles are at once reduced one-half, and may be still further reduced by putting a part of the money saved in less cost of poles into better high-tension insulators, pins and cross-arms. On curves, poles of sufficient length to carry the transmission lines should be set at closer intervals, but on straight line construction the 200-ft. span is perfectly safe for the sizes of wire most generally used for railway transmission lines.

THE NEW TURBINE POWER STATION OF THE DALLAS ELECTRIC CORPORATION

In line with the general policy of improving the property of the Dallas Electric Corporation, Dallas, Tex., a new turbine power station has been erected in Dallas. The new station is built contiguous to the old one, and is used in conjunction with it to furnish power for both the railway and the lighting systems of Dallas. At present the new plant contains two 1500-kw, two-phase, 60-cycle Curtis steam turbines, but provision has been made in the construction of the building and in the arrangement of the piping for future extension as the growth of the system requires.



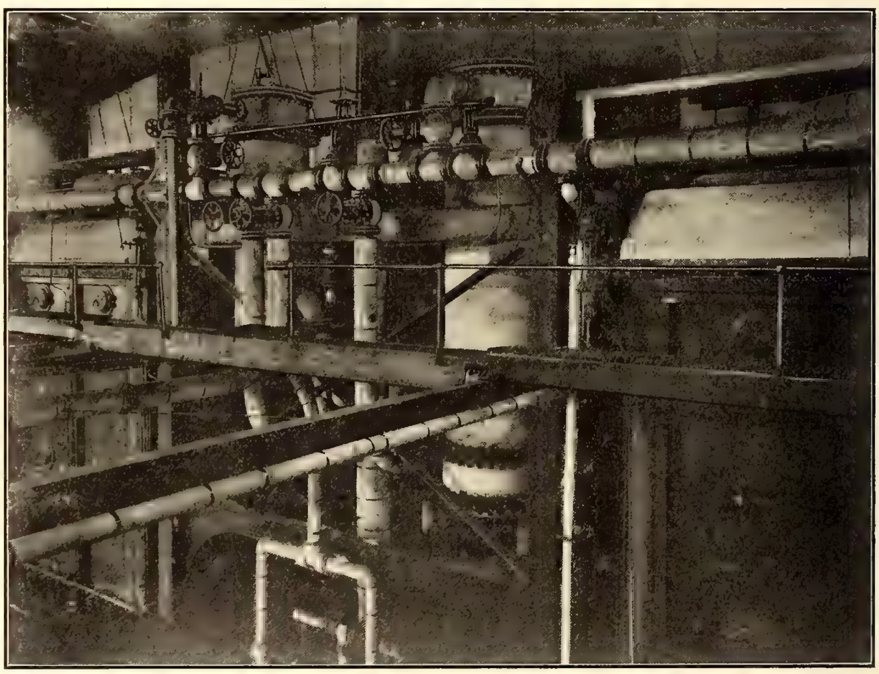
BOILER ROOM OF NEW PLANT WITH THE OLD PLANT TO THE RIGHT; ILLUSTRATING ALSO THE FACILITIES FOR VENTILATION

The station is located in the northwestern portion of the city between the yards of the Missouri, Kansas & Texas Railroad and the line of the Cotton Belt and Rock Island Railroads, and about one-half mile from the Trinity River. It is housed in a structure consisting of a steel framework with brick curtain walls built in and with concrete roof and floors. Both engine and boiler rooms have basements under them, and the engine room contains a switchboard gallery running the full length of the building. A portion of the concrete foundation rests on bed rock, while that nearest the river is on piles. The building is, in fact, built over what was formerly a rock bluff about 50 ft. or 60 ft. high. Near the division wall between the boiler and turbine rooms this bluff sheers off abruptly, so that while it was necessary to excavate the rock for some of the footings under the columns in the boiler room basement, others 10 ft. distant are supported on piles. Two of the piers under the new stack rest on piles, while the other two are on rock. The division wall and all of the turbine room foundations rest on 40-ft to 50-ft. piles, which are cut off below the low-water mark and are capped with concrete piers.

The climatic conditions of Dallas resulted in unusual provisions for ventilating the building, and in addition to the numerous windows in the walls the roof contains several monitors or lanterns provided with ventilating windows. Monitors running the full length of the building are located directly over the central firing alley in the boiler room and in the central portion of the engine room roof. In addition small monitors are located over the boilers. The boilers now installed are served by two stacks, an old one of brick which serves the old boilers and a new steel, self-supporting one 11 ft. in diameter at the base and 150 ft. high which rests on a steel framing about 40 ft. above the basement floor and immediately over the feed-water heaters and boiler service pumps. The steel framing of the building is designed for the ultimate erection of a similar steel stack directly across the firing alley, to take the place of the present brick one.

BOILERS

The boilers of the old plant were installed in two boiler rooms, one at the north of the engine room containing four 500-hp Altman-Taylor water-tube boilers, while the other one was south of the old engine room and occupied a portion of the space now covered by the boiler room of the new plant. This contained three 500-hp Altman Taylor water-tube boilers of the B. & W. type. These boilers were dismantled, turned around and re-erected a few feet from their original position and at the higher elevation of the new boiler room floor. On account of the heavy load, the operating force could only spare one of these boilers at a time, and it was necessary to get one into service before disconnecting the next.



FEED-WATER HEATERS UNDER NEW STACK

On account of the poor foundations originally under these boilers, one end resting on a rock and the other on mud, very little excavation could be done in the vicinity of the boilers until they were all changed. These three boilers are now located on the east side of the main firing alley and are served by the old brick stack. They supply saturated low-pressure steam to the old plant only. On the opposite side of the firing alley are six new 500-hp Stirling water-tube boilers provided with superheaters of

sufficient capacity to give 150 degs. superheat, and installed in three separate batteries. Between two of the batteries and under the base of the stack are located the hot well, feed pumps and feed-water heaters.

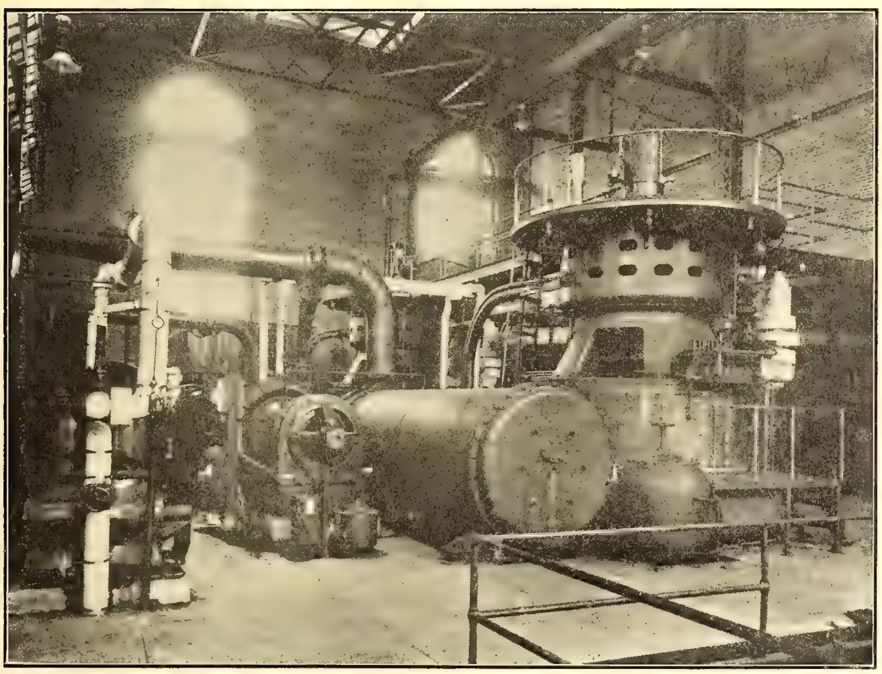
Oil is at present burned in the furnaces, but in view of the possible use of coal the boiler furnaces are built so that automatic stokers can be installed. When coal is used, the ashes and screenings will drop down into metal hoppers in the basement and will be discharged into ash cars running on tracks extending the full length of the boiler room.

COAL-HANDLING APPARATUS

On account of the increasing price of oil the company is making arrangements to install coal-handling apparatus consisting of a Berquist bunker extending the length of the boiler room over the firing alley and suspended from girders which were installed when the steel was erected. This bunker will be supplied by a Hunt conveyor which will take coal from a hopper to be erected in the yard south of the station. This hopper will be served by a locomotive crane with clam-shell bucket. The crane will take the coal either from the cars or the storage pile. The bunker will be supplied with chutes which will connect with the furnaces through weighing hoppers.

BOILER FEED

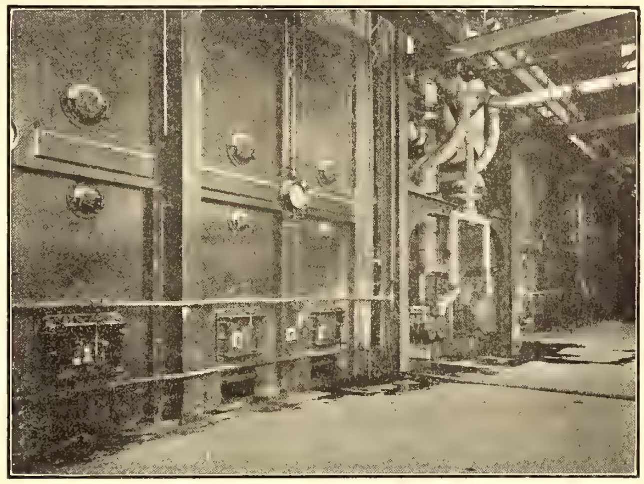
The condensed steam from the turbines is returned to an 8200-gal. hot well located on the boiler room floor near the boiler feed pumps. The make-up water is supplied either from the city water supply through a 6-in. pipe which was installed independent of the 4-in. supply to the old station or from artesian wells located on the premises. This water is stored in a steel storage tank of 50,000 gals. capacity connected with the station through 8-in. and 10-in. pipes.



INTERIOR OF TURBINE ROOM, SHOWING TURBINE, CONDENSER, VOLUTE PUMP AND PIPING

The make-up into the hot-well tank is regulated by a float feed valve. Two Blake 14-in. x 9½-in. x 12-in. duplex plunger feed pumps are connected through two Goubert feed-water heaters of 3000 and 2000-hp capacity, respectively, to two 6-in. feed lines. One of these passes along in front of all the boilers and is cross-connected at each end of the room so as to completely encircle the firing alley, and has connections to the low-pressure boilers. The other, a 6-in. auxiliary feed line, is carried along the rear of the Stirling boilers, and is connected to these boilers only. The old boilers are generally fed by a separate 4-in. line, either from the old station or from an old 10-in. x 6-in. x 12-in. duplex Blake piston pump located near the large pumps.

No economizers are installed. Flue gases pass drectly upward from the rear of the boilers into riveted steel flues suspended from the roof trusses directly over the rear of the boilers. On account of the great heat in the long summer these flues are covered with magnesia and asbestos.

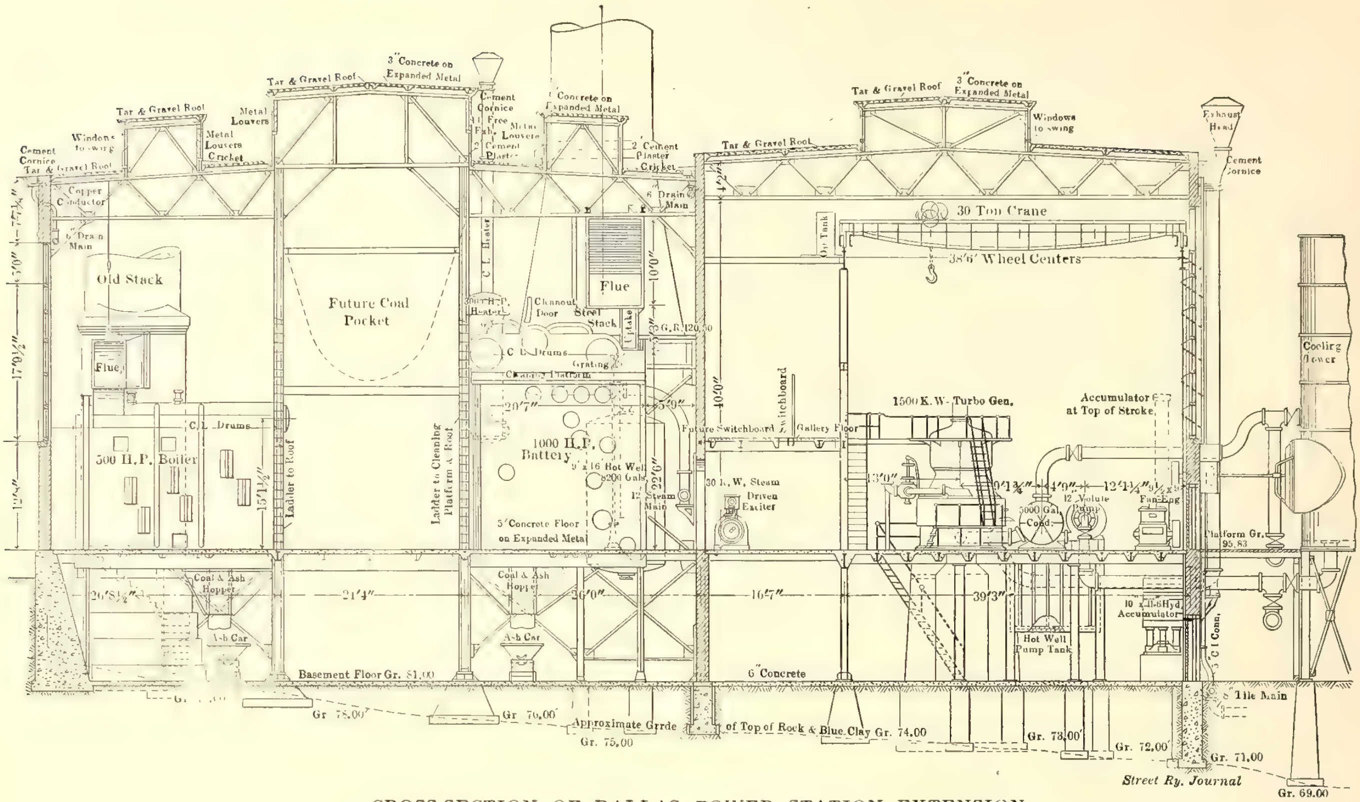


FRONT OF BOILERS, SHOWING FUEL OIL PIPES AND FEED PUMPS

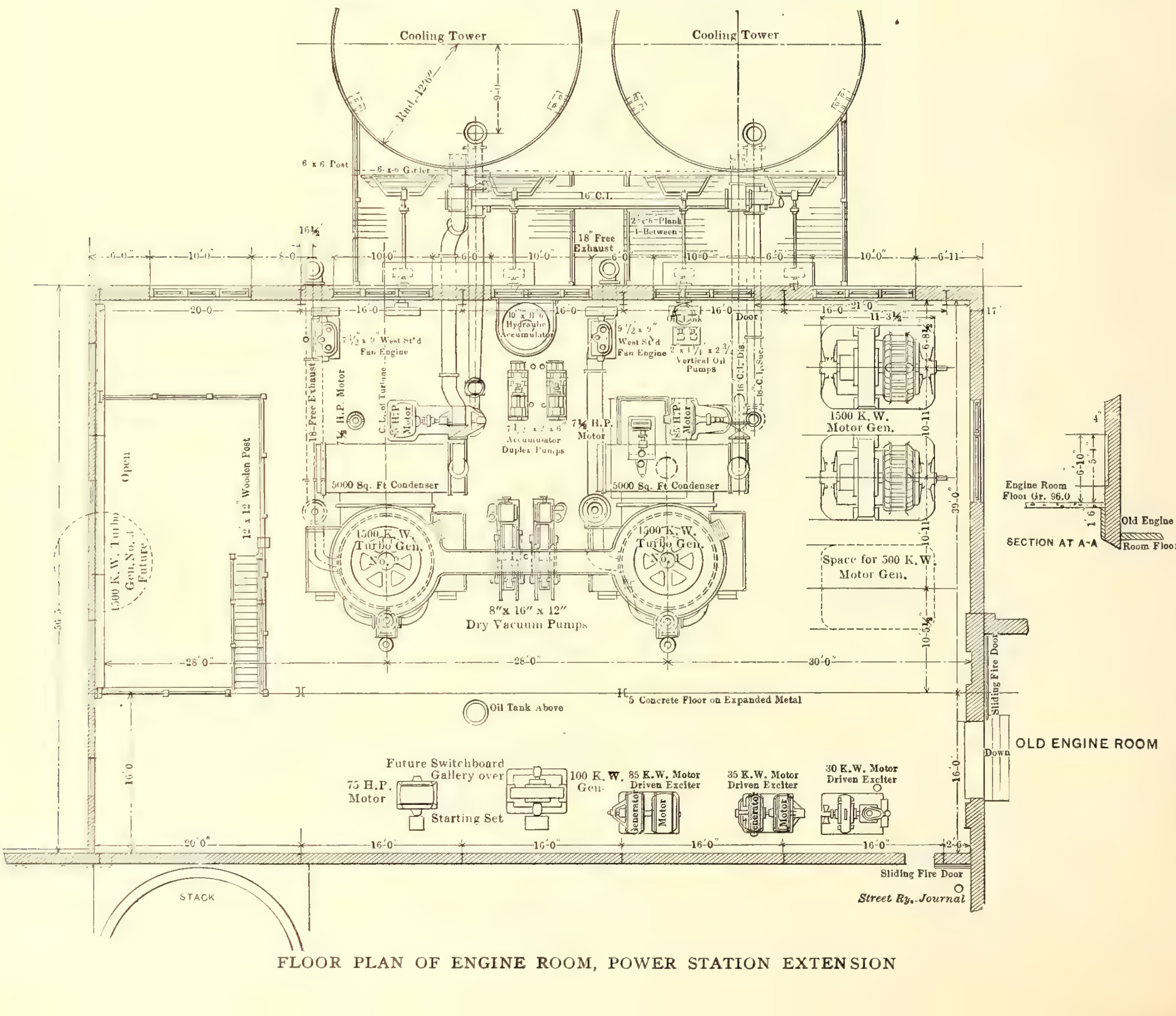
STEAM MAINS

The Stirling boilers are connected to a short 10-in. pipe over each battery by 180-deg. 6-in bends through automatic non-return or reverse-current Davis valves, which, by the way, have worked nicely on several occasions. In addition to these valves regular stop valves are provided. The 10-in. line from each boiler connects through long bends to a 12-in. header located in an alley back of the boilers. This header is provided with tees, with one end blanked to connect to batteries which may be erected on the opposite side of the firing alley.

The header is supported on roller brackets fastened to the columns in the division wall, and is about 6 ft. above the floor. At the south end this main connects to the steam piping of the old station through a 12-in. reducing valve, and at the opposite end it is capped with a blank flange. Where it passes under the steel stack it is carried upward and around the hot well already referred to. Between each battery of boilers the main contains a sectionalizing valve, and behind each battery it is cross-connected to a 6-in. main carried back of the boilers which supplies steam to the auxiliary apparatus in the boiler room. Both the 12-in. main and that for the auxiliary apparatus are drained into a 2½-in. drip main which discharges into a receiver located in the basement. From this receiver a small duplex pump forces the drip into the boiler-feed mains. A 10-in. line is carried from the main steam header to each of the two turbines.



CROSS-SECTION OF DALLAS POWER STATION EXTENSION



FLOOR PLAN OF ENGINE ROOM, POWER STATION EXTENSION

One turbine lead is controlled by a hydraulically-operated valve, the other by a hand-operated valve, both being operated in the alley back of the boilers. The hand-operated battery stop valves are controlled from the turbine room by extension valve stems extending through the division wall.

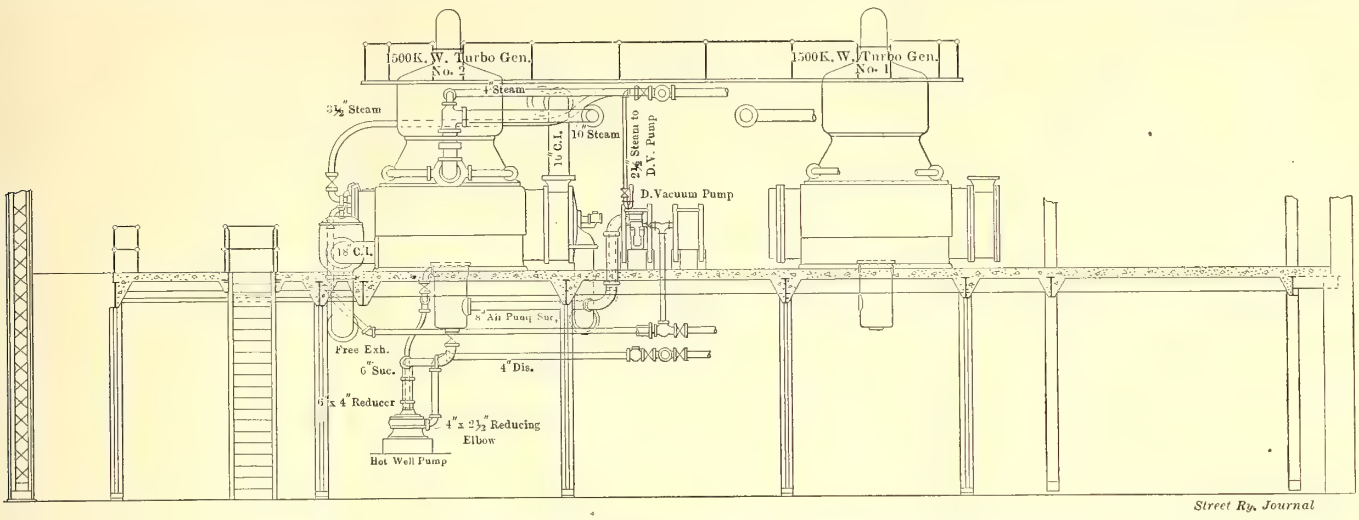
THE STEAM TURBINES

One accumulator and one set of accumulator pumps serve both turbines, but with this exception each turbine is supplied with independent auxiliary apparatus, all of which is placed close around each machine.

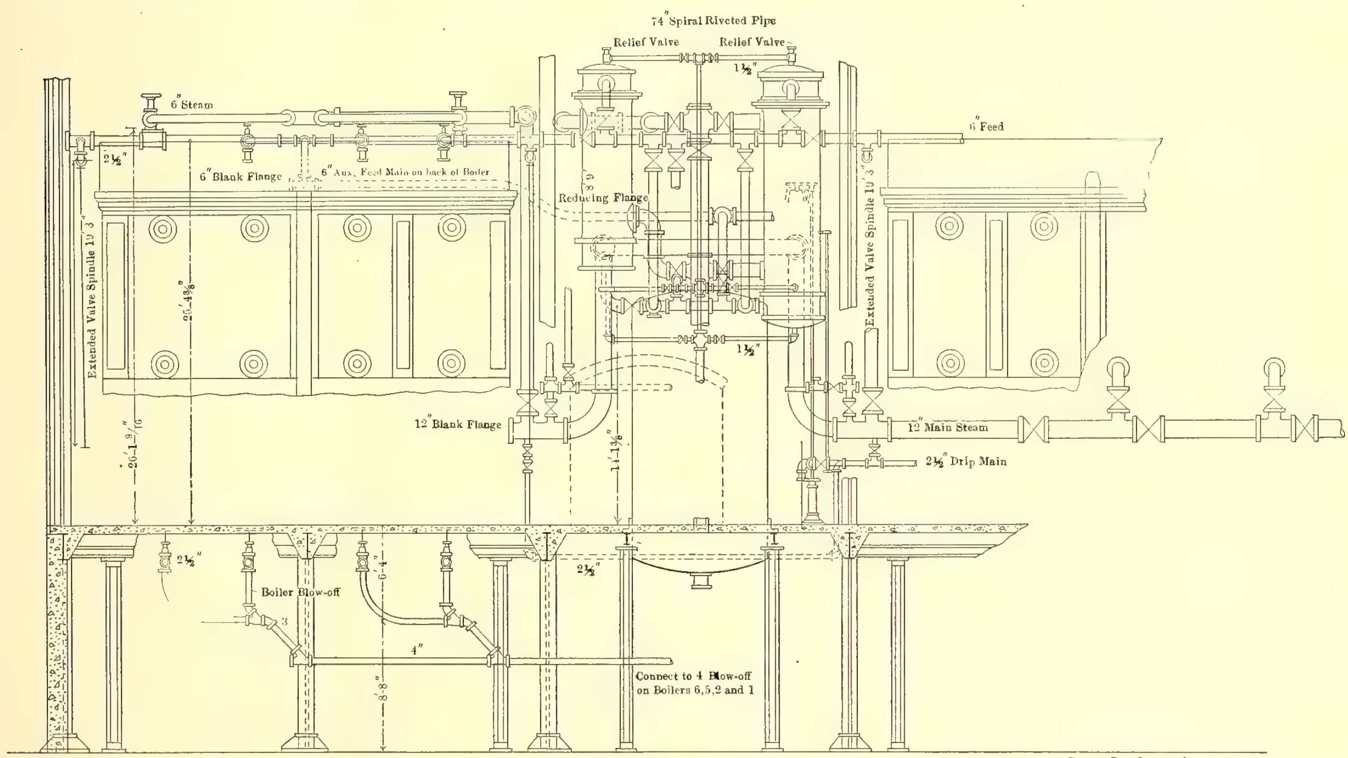
The condenser for each machine is of the Worthington type and is installed at the base of its respective machine. Adjacent to it is a 12-in. motor-driven volute pump for supplying the condensing water.

COOLING TOWERS

An 18-in. suction and a 16-in. discharge from each pump are connected to cooling towers just west of the building. The two cooling towers for the new plant are each 25 ft. in diameter and 36 ft. high. The water which is sprayed into them at the top by revolving arms is cooled as it falls through the tower by an opposing current of air produced by fans which are belt-driven from 9½-in. x 9-in. Westinghouse vertical engines located near the west wall of the turbine room. The piping of all three cooling towers, which includes one for the old plant, is interconnected so that they may be operated either separately or in multiple.



LONGITUDINAL SECTION THROUGH ENGINE ROOM LOOKING WEST, SHOWING STEAM, AUXILIARY AND EXHAUST PIPING



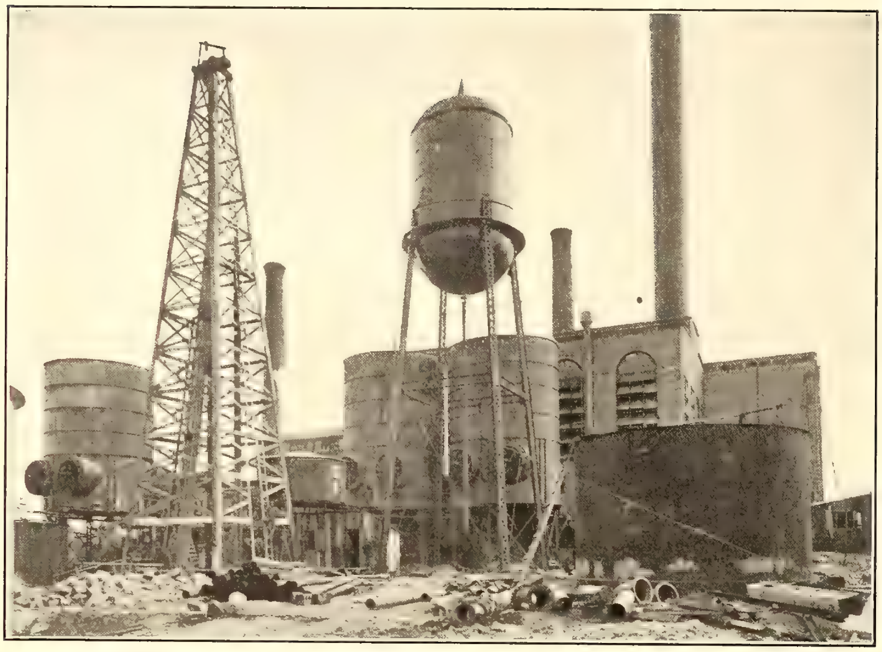
LONGITUDINAL SECTION THROUGH BOILER ROOM LOOKING WEST, SHOWING STEAM, AUXILIARY AND EXHAUST PIPING

The make-up water is supplied from the water system through float valves, while an electric alarm on each tower gives warning if the water level drops. The overflow from the towers is returned to a pump tank.

HOT-WELL PUMPS

Connected to the hot well of the condenser of No. 1 turbine is a horizontal motor-driven 2½-in. volute pump. This is installed directly under the condenser at the level of the basement floor. Because of the possibility of floods due

to high water in the river the pump set was installed in a steel water-tight pit having walls extending up to the floor above. The hot-well pump for the other condenser is of the vertical type with the motor installed on the main floor. This latter arrangement obviated the necessity of a water-tight compartment. Both hot-well pumps discharge through a common 6-in. main into the suction of the boiler feed pumps and into the bottom of the hot well. A 6-in. main connects each condenser to an 8-in. x 16-in. x 12-in. Worthington dry vacuum pump, both pumps being located on the main floor between the two turbines.

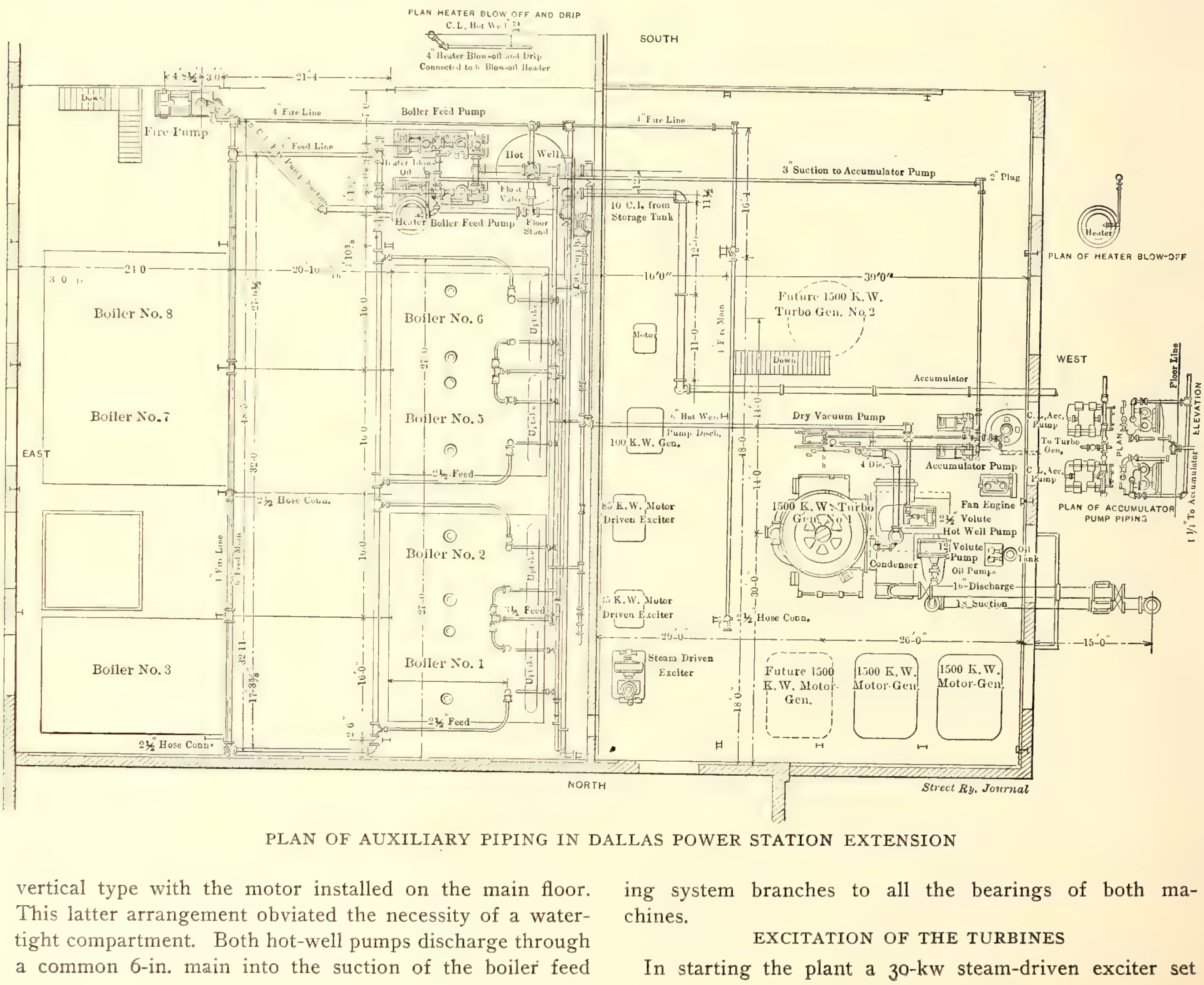


PLAN OF DALLAS STATION, SHOWING THE THREE COOLING TOWERS, ELEVATED TANK, PUMP HOUSE OVER WELLS AND DERRICK USED IN DRILLING A NEW WELL

Near the west wall of the turbine room and midway between the two turbines is a 10-in. x 11-ft. 6-in. hydraulic accumulator for maintaining an even pressure on the step bearings of the turbines. The foundation of the accumulator is on the basement floor, but the apparatus extends when at the top of its stroke several feet above the main floor. A pressure of 425 lbs. is maintained in the accumulator by either of two 7½-in. x 3-in. Worthington duplex accumulator pumps, which have their suction pipe connected both to the suction of the boiler feed pumps and to a tank which is supplied with filtered water.

OILING SYSTEM

The two turbines are oiled by means of a gravity oiling system, all the piping of which is of brass. Two Blake duplex 3-in. x 2-in. x 3-in oil pumps elevate the oil into a tank located just under the roof trusses and from which a piping system branches to all the bearings of both machines.



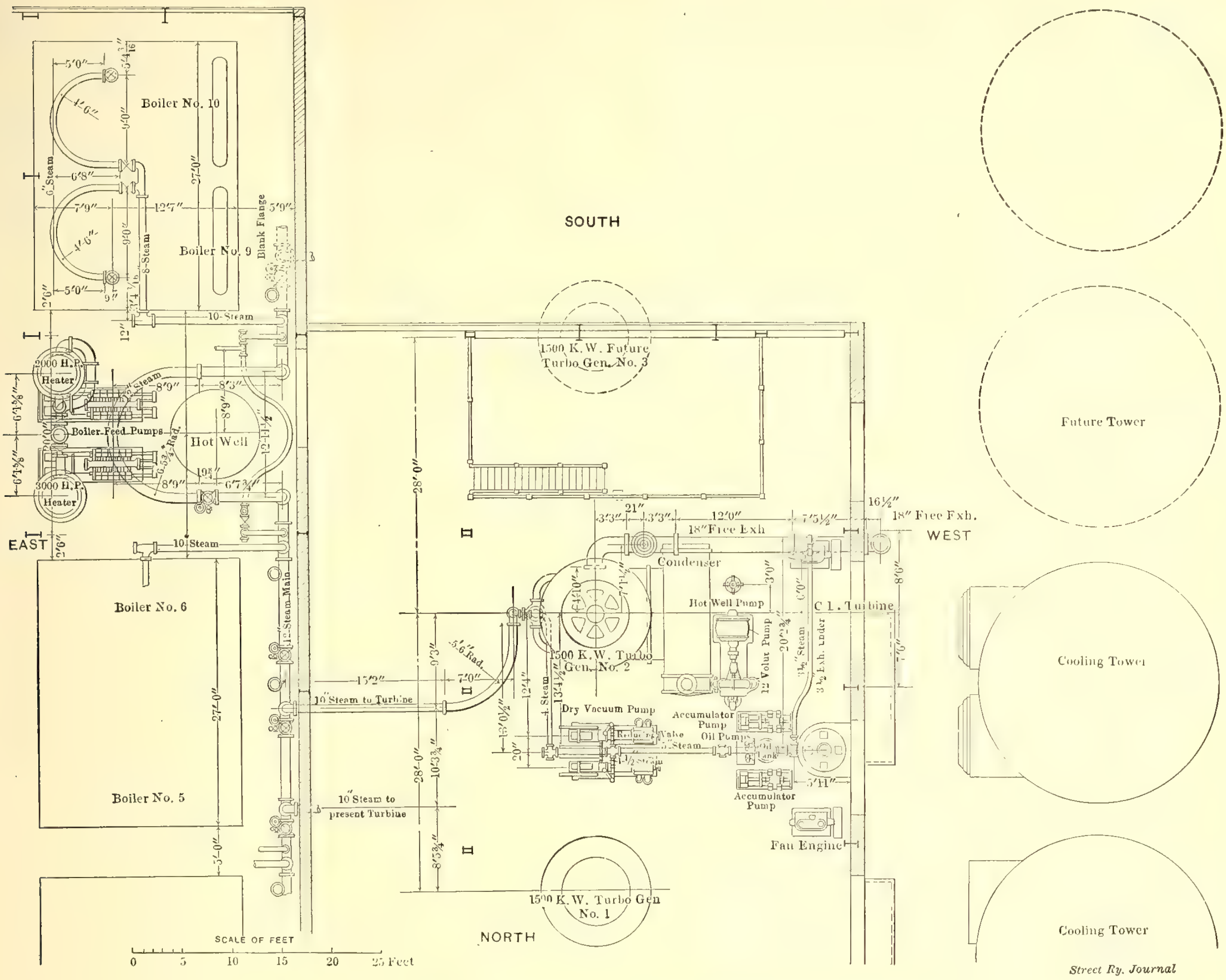
PLAN OF AUXILIARY PIPING IN DALLAS POWER STATION EXTENSION

EXCITATION OF THE TURBINES

In starting the plant a 30-kw steam-driven exciter set

consisting of a vertical engine and a generator mounted on one base is used. For continuous use there are two motor-driven exciters, one of 35-kw and another of 85-kw capacity. Two 500-kw motor-generator sets installed in the north end of the generator room supply direct current to the street railway system, and provision has been made for a third machine.

At the present time all of the current generated in the plant is distributed from temporary panels through the switchboard of the old plant. Work is under way, however, to erect a permanent switchboard of the latest design on the gallery in the turbine room. The direct-current feeders and the alternating-current mains will leave the station in underground conduits which will continue under the adjacent yards of the Missouri, Kansas & Texas Railroad to a cable house from which the cables will be carried up to a pole line.



PLAN OF STEAM AND EXHAUST PIPING IN THE DALLAS STATION

WATER SYSTEM

The water supply for the old station was obtained from two 4-in. artesian wells, each about 800 ft. deep, reaching to the lower Woodvine strata. In order to raise this water to the surface, air lifts were used, requiring the use of air compressors and the consequent expenditure of considerable energy. As there is an abundance of good water in another strata 700 ft. lower, known as the Paluxy, which is under pressure sufficient to give 50 lbs. at the ground level, it was decided to sink a large well having a 10-in. casing, for a depth of about 500 ft., reducing to 8 ins. for the balance of the distance to the strata, and this work is well under way.

This well when completed is expected to supply all the water required for years to come. At present the deficiency is made up by water from the city mains. The water from the wells is discharged into an underground tank 16 ft. in diameter and 13 ft. deep. In the bottom of this tank are two 4-in. vertical centrifugal pumps driven by vertical motors, located in a motor house high above the highest flood level, or at the grade of the new station floor.

The water from the pumps is delivered into an underground piping system which is connected with the 50,000-gal. storage tank already mentioned. This tank is erected just west of the building on a structure 80 ft. in height. The piping system is also connected to the tanks of the old station.

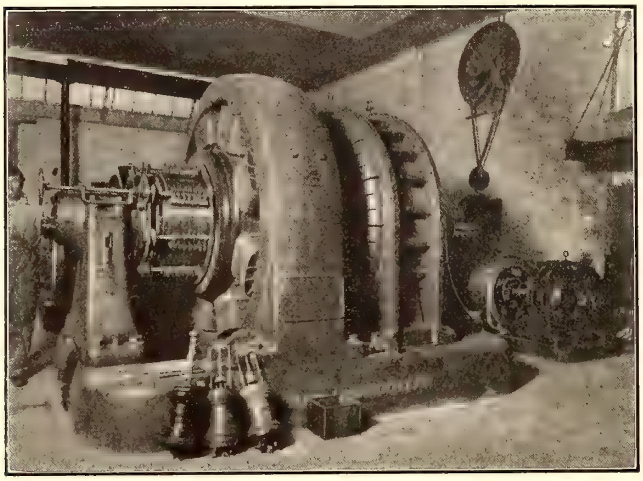
FIRE PROTECTION

From the water system an 8-in. main leads to a 14-in. x $7\frac{1}{2}$-in. x 12-in. fire pump located in the boiler room. This pump discharges into 4-in. fire mains which extend under the main floor the full length of both the boiler and turbine rooms. Two risers in each room are fitted with fire hose. In the event of failure of either the

well system or the city water, by closing one valve and opening another the fire pump and the boiler feed pumps as well may be fed from either system.

GENERAL

In addition to the work done upon the main station, the construction company has installed in a sub-station located in the center of the business district of the city a 500-kw motor generator. The installation of this machine necessitated the enlargement of the building. The station was formerly used only for lighting service and contained two



500-KW MOTOR-GENERATOR IN THE DALLAS SUB-STATION

325-kw double motor generators connected to a 250-volt, three-wire system. The same company also made several structural improvements in the old power station.

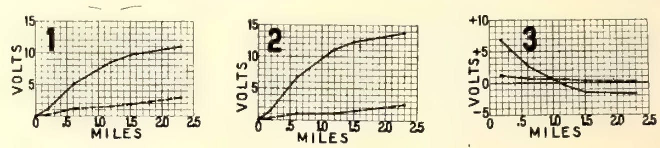
The Dallas Electric Corporation is managed by Stone & Webster, for whom M. M. Phinney is district manager in Texas. E. T. Moore is manager of the railway and lighting properties in Dallas. The station was begun by the Columbia Improvement Company, who subsequently sublet its completion to the Stone & Webster Engineering Corporation, constructing engineers.

THE EFFECT OF THREE-WIRE OPERATION ON ELECTROLYSIS IN BOSTON

The publication of the April number of the Proceedings of the American Institute of Electrical Engineers has released the interesting data on Boston electrical conditions presented during the Institute discussion on electrolysis at the March 1 meeting by Paul Winsor, chief engineer of motive power and rolling stock, and John W. Corning, electrical engineer, of the Boston Elevated Railway Company.

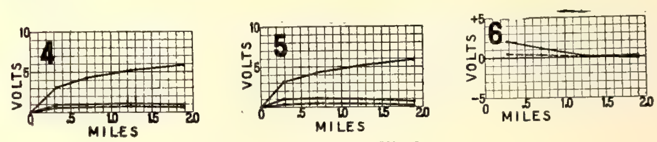
They said that while the company has a well-bonded system, electrolysis had taken place near the Harvard power station, where there is a marsh of salt water, and beyond which, about a mile away, is the first car track in that direction. Numerous water mains are located nearby, but a careful study of the situation has reduced the trouble materially. The local telephone company takes great pains to survey its cables, and when it finds a place where it thinks there is danger of electrolysis, it consults with the Boston Elevated Railway Company's engineers, who put in either a negative feeder or a connection to the rail to remove the trouble. On its own cables, the Boston Elevated Railway has cut the lead in many places and made special connections to avoid electrolysis. Similarly, in another case where the Metropolitan Water and Sewerage Board has some large pipes running into Boston, it was found advisable to put eleven insulating joints in them. Some of the joints are of rubber and some of wood, ordinary bell and spigot joints, with 5/8 in to 3/4 in. pine calking. Some time ago some experiments were made in operating certain portions of the road on the three-wire system. As the practical difficulties of operating stations on a three-wire system are thoroughly appreciated, the results are not offered as a panacea for the cure of electrolytic troubles nor even as a practical method of operating, but merely as being of general interest.

The Boston Elevated Railway Company's distributing system is supplied with power from ten stations and is divided



FIGS. 1, 2 AND 3

into upward of seventy feeder sections. To explain the results of the three-wire trials more intelligently, attention is directed to Figs. 14 and 15, showing nine of the feeder sections fed by the Harvard power station. The dash lines on these maps indicate the boundaries of the feeder sec-



FIGS. 4, 5 AND 6

tions, the numbers of which appear, and the heavy lines indicate tracks. Passing through this district from one side to the other will be seen depicted some 48-in. water mains. The power station location is indicated by the star.

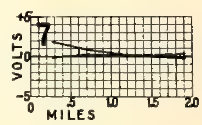
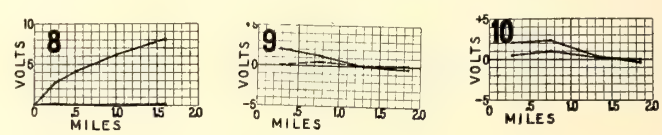


FIG. 7

The company operates on the two-wire, single-trolley grounded-return system. Fig. 14 represents the ordinary relation between feeder sections with this system. Referring now to Fig. 15, it will be noted that certain of the feeder sections have been shaded. In the experiments referred to these sections were supplied from this power station by current from



FIGS. 8, 9 AND 10

a generator connected in three-wire relation with the rest of the station. No line change was made in the feeder sections beyond installing an additional set of insulating joints in the trolley wire at the points of intersection of positive and negative sections. For the purpose of the investigations, test-wires were run from the power station in three directions for a distance of from 1.5 to 2.5 miles, and simultaneous readings taken at several points along the line under both two-wire and three-wire operation. The observations of interest in connection with the subject of electrolysis were the return drop, potential difference between pipe and rail, and the current flowing on pipe.

The observations under two-wire and three-wire opera-

tion were taken about two hours apart for a period of one-half hour each, the endeavor being to have the loads on the individual feeder sections as nearly as possible the same throughout both sets of observations.

Fig. 1 shows the return drop to the power station from a point about 2.25 miles distant under two-wire and three-

Section.	Table I. Average Load on Section.		Table II. Average Load on Section.		Table III. Average Load on Section.		Table IV. Average Load on Section.	
	Two-wire.	Three-wire.	Two-wire.	Three-wire.	Two-wire.	Three-wire.	Two-wire.	Three-wire.
70........	246.0	222.0	278.3	305.2	245.2	266.6	215	208
71........	183.6	133.2	196.9	303.2	145.2	189.2	136	149
73........	263.6	251.9	272.6	275.0	231.0	295.2	241	262
90........	413.0	411.0	488.0	516.0	524.0	527.0	480	454
91........	271.0	249.0	325.0	339.0	378.0	329.0	266	300
Totals..	1377.2	1267.1	1560.8	1738.4	1523.4	1607.0	1338	1373

wire operation. As before stated, the results are averages of readings taken at intervals of ten seconds throughout a period of thirty minutes. The load on the shaded sections of Fig. 15 under two-wire and three-wire operation are as shown in Table I.

From this table it will be seen that the conditions with respect to load are almost identical in both cases. The re-

Section.	Table V. Average Load on Section.		Table VI. Average Load on Section.		Table VII. Average Load on Section.		Table VIII. Average Load on Section.	
	Two-wire.	Three wire.	Two-wire.	Three-wire.	Two-wire.	Three-wire.	Two-wire.	Three-wire.
70........	224.6	181.9	234	199	205	267	286	321
71........	152.6	134.6	113	111	190	199	170.6	199
73........	232.4	232.6	284	285	301	235	280	236
90........	455.6	464.0	445	404	488	536	627	600
91........	264.0	302.0	249	277	384	370	372	380
Totals..	1329.2	1315.1	1325	1276	1568	1607	1735.6	1736

turn drop under two-wire operation, represented by the full line, was reduced 83 per cent by three-wire operation as shown by the dash line.

Fig. 2 gives the similar results of a test which was repeated on another day. Table II. gives the loads in the several feeder sections.

Fig. 3 gives the potential relation between pipe and rail along the line of the first test-wire. The full line repre-

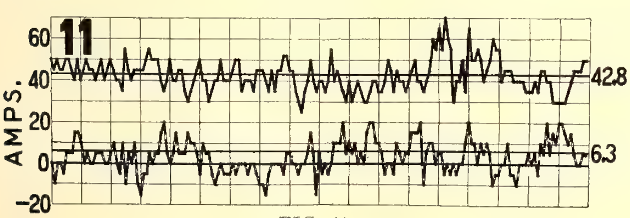


FIG. 11

sents the relation under two-wire operation, and the dash line that under three-wire operation, the values above the zero line referring to positive condition of the pipes and those below the line to negative condition of the pipes. It will be seen that the high reading obtained near the power station has been reduced very materially, although at the same time the pipe has been rendered positive throughout the whole length under consideration by a gradually decreasing amount. The loads in the several shaded feeder sections under two-wire and three-wire operation while the above test was being made are shown in Table III.

Figs. 4, 5, 6 and 7 give results obtained along the second test-wire. Figs. 4 and 5 show return-drop relations on two different days. The current relations in the several shaded feeder sections for Figs. 4 and 5 are shown in Tables IV. and V.

Attention is called to two sets of results, in each case under three-wire operation. While the upper set of observations was being taken, section 70 was feeding in the usual manner; whereas, while the lower set of observations was being taken it was fed from the other side of the three-wire system.

Figs. 6 and 7 show the potential relations on the pipe along the line of the second test-wire under two-wire and three-wire operation, and it is clearly seen that in these cases the potential differences between pipe and rail have been almost eliminated. The load relations of the sections while these observations were being taken are shown in Tables VI. and VII.

Fig. 8 gives the return drop along the line of the third test-wire. While the three-wire system was in operation section 70 was fed part of the time from one side and the rest of the time from the other. The results are as shown. It will be seen that the return drop in this case was practically wiped out, the three-wire potential curve practically coinciding with the zero line. The effect of reversing section 70 in this case was not as great as it was in the last instance, but is just as noticeable. The load on the several sections while these results were being taken is shown in Table VIII.

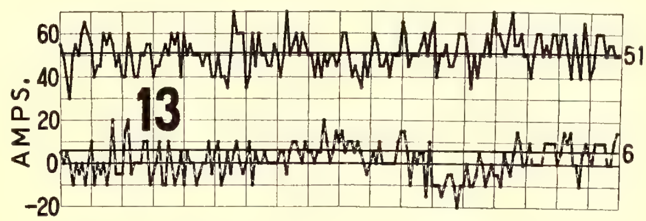


FIG. 13

Figs. 9 and 10 show the effect on the pipe potential in this district of three-wire operation as compared with two-wire operation, and similar relations of potentials are observed as in the previous cases.

Figs. 11, 12 and 13 show readings of current under two-wire and three-wire operation flowing on the large mains which traverse the district in question. These readings

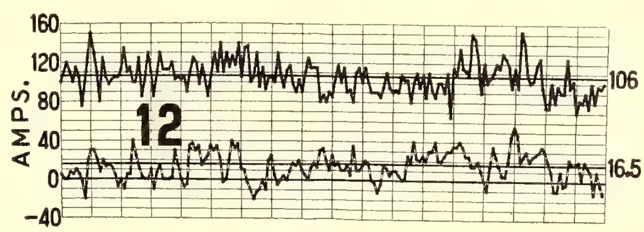


FIG. 12

were taken for a period of thirty minutes at intervals of ten seconds. It will be seen in Fig. 11 that under two-wire operation the average current flowing on the pipe was 42.8 amps., with a maximum of 70 amps. Under three-wire operation this current was reduced to an average of 6.3 amps. and a maximum of 20 amps. On Fig. 12 an average current of 106 amps., with a maximum of 155 amps., is reduced by three-wire operation to an average of 16.5 amps. and a maximum of 55 amps. In Fig. 13 an average current of 51 amps., with a maximum of 70 amps. under two-wire operation, is reduced by three-wire operation to an average of 6 amps. and a maximum of 20 amps. The results in each one of these last three figures were taken at a dif-

ferent point on these pipes, the current being calculated from the resistance of the pipe, and the potential drop along a single length, not including joints. In the case of the

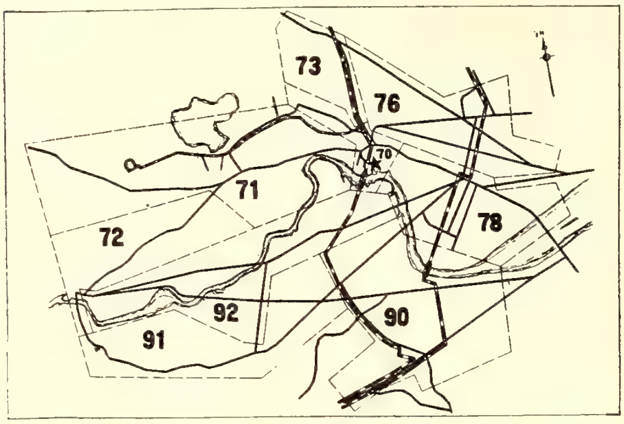


FIG. 14

three-wire operation the averages given are averages of all observations, those below the line being taken with a posi-

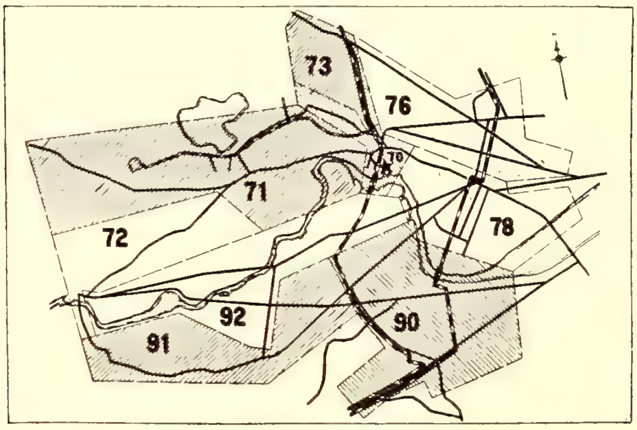


FIG. 15

tive sign. In these three cases the three-wire operation shows a reduction in current flowing on the pipe of 85, 85 and 88 per cent, respectively.

ELECTRIC POWER FOR WESTERN PACIFIC

Reports continue to be circulated throughout California to the effect that the Western Pacific Railway will be operated by electric power. The source of supply will be the works of the Great Western Power Company, with head works in Lassen County. This company is said to be controlled by the same Gould interests which control the Western Pacific. The Great Western Power Company's plant will supply 50,000 hp. With this it is anticipated that the whole Western Pacific road from San Francisco to a point near the middle of the State of Nevada can be supplied with ample power. In Salt Lake another electric supply system will be installed to handle the line from that point to a connection with the Nevada point. The main works in California are to be at Big Bend. The Western Power Company has bought the whole of Big Meadows in Lassen County. The north fork of the Feather is being dammed, and at Plattville the mountain is being tunneled into Butte Valley, where will be the vast reservoir in which will be stored the water that will supply the fall and power necessary in the dry season. A supplementary station will be established in Nevada.

RAIL CORRUGATIONS IN PHILADELPHIA.

As readers of this paper know, the wide prevalence of rail corrugations has brought out many diverse theories to account for their origin. The latest European contribution on this subject was furnished by Joseph A. Panton in a paper presented in London before the Institution of Electrical Engineers, Mar. 21, 1907, and printed in the April 13 issue of this publication. As Mr. Panton dealt only with corrugation as manifested under British operating conditions it should be of interest to present a case in this country where corrugations have occurred under circumstances that have led to the theory that this trouble is the result of a vibrating rail.

It will be noted from a study of Mr. Panton's paper that he believes rail corrugations primarily are due to trucks out of square and the unequal distribution of driving power on the axles inherent in the common method of electric-car propulsion. In the case of Philadelphia, the American city chosen for comparison, the corrugations have occurred under such circumstances that H. B. Nichols, engineer of maintenance of way of the Philadelphia Rapid Transit Company, believes that they are really caused by vibrating rails.

Before attempting to describe the Philadelphia situation in detail it may be well to point out some of the important respects in which English and American street railway practice differ, especially as rail corrugations appear to occur more frequently abroad, so it is possible that some difference in track construction or car operation is responsible for its greater frequency. Instead of the tie construction so common in this country many English city lines have the rails laid on concrete stringers 9 ins. to 12 ins. deep and 8 ins. wide, a form of construction which on poor foundations soon causes the rail to move up and down over considerable distances. The second difference lies in the width of the grooves of rails, as the British Board of Trade regulations do, or did, not usually permit a wider groove than 1⅛ ins. on straight track and 1¼ ins. on curved track. This explains why flange breakage is more frequent than here, because a ¾-in. wheel flange is often obliged to run in a groove only half an inch wider, which causes binding on sharp curves and may encourage corrugation, as an extra strain is put on the track at such places. Another difference which may have some bearing on the increased corrugation is the British use of double-deck cars, which, naturally, gives a greater load per wheel.

In at least one important point, Messrs. Nichols and Panton are thoroughly agreed, namely, that corrugations are not due to any inherent defects in the rails. Mr. Nichols has found that even a manganese steel switch has become corrugated, a discovery which would seem to weaken greatly the theory that this phenomenon originates from soft spots.

As to the statement made by Mr. Panton that corrugations do not occur on steam railroads, it is, of course, impossible for those familiar with American conditions only to criticise his statement with reference to English steam lines. As a matter of fact, corrugations have appeared on the tracks in the Philadelphia yards of one of the large steam railroads where the amount of wheel movement is comparable to that on a street railway. It would seem, therefore, that the mere fact of operation by electricity does not imply corrugation, but that the wheel movement must be an important factor. So far as known, no interurban electric railway—which, of course, does not run cars on fre-

quent headway—yet has been troubled with corrugation. Another explanation of the rarity of this appearance, from the standpoint of the vibration theory, is that on steam railroads or interurban electric railways the track is always exposed and open to inspection, so any sinking of the roadbed or looseness of joints can be repaired without trouble. Even when the track is loose on a steam railroad the corrugations are less because the rail is forced ahead in a long wave by the weight of the locomotive and there is very little slipping of the trail car wheels.

In Philadelphia trouble with corrugated rails first occurred about six years ago. A later instance appeared one year after the company laid 2000 ft. of 9-in., 90-lb. girder rail on wood ties. When the excavation was made the earth was found to consist of a spongy mixture of clay and water-bearing gravel. The excavation, therefore, was carried 7 ins. below the ties and the space filled with concrete to a point 1 in. below the grade of the bottom of the ties. The rails were then tamped with a mixture of fine concrete and the space between them filled to the base of the rail, which was also tamped. An additional 2 ins. of concrete formed the foundation for the paving. It was found on this line that the corrugations extended over practically the entire

standard four-motor double-truck type weighing 37,000 lbs. without passengers.

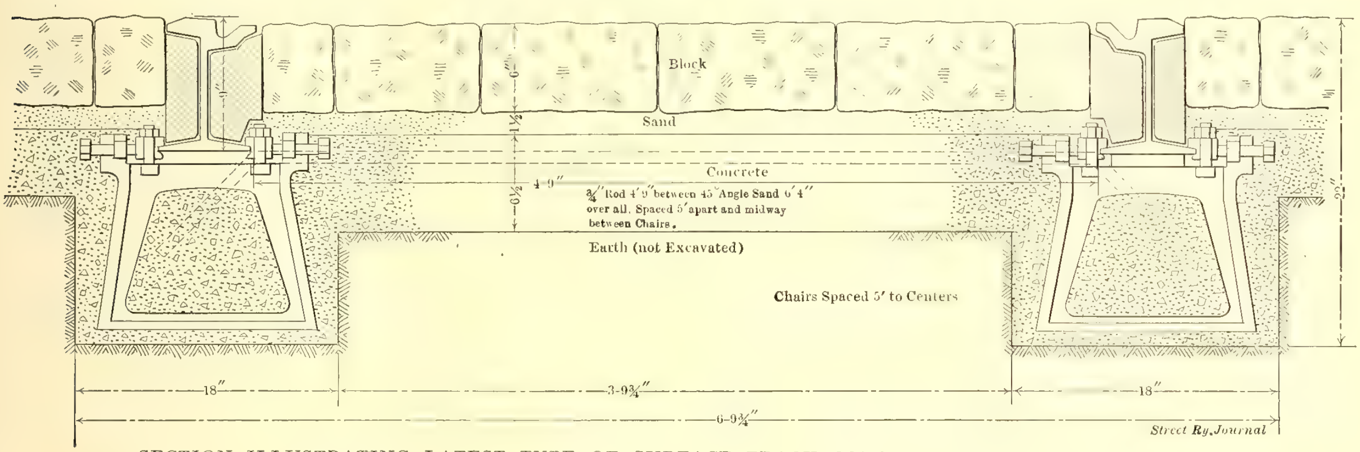
No. 1—Woodland Avenue: On slightly decayed ties in a dirt roadbed with stone block paving; the rails have fishplate joints.

No. 2—Chestnut Street, east of Sixteenth Street: Roadbed like No. 1, but with riveted joints.

No. 3—Tenth Street: South of Glenwood Avenue: Roadbed and joints like No. 2.

No. 4—Chestnut Street, east of Bridge: Resembles No. 2, but is on a down grade. This line is on a good foundation, but the web of the rail was found vibrating owing to heavy braking and the nearness of the track to the Baltimore & Ohio Railroad station. The wheels on this line are frequently skidded. This is very interesting, as in the discussion on Mr. Panton's paper one of the speakers asserted that he had found corrugations on a line where there was heavy braking. Of course, it can not be denied that braking imposes an additional strain upon the rails and may cause them to vibrate.

No. 5—Chestnut Street, west of Bridge: Although laid on wood ties in a concrete foundation the track was found to be slightly loose after only one year's service. Exam-



SECTION ILLUSTRATING LATEST TYPE OF SURFACE TRACK CONSTRUCTION IN PHILADELPHIA

length at intervals of 1 in. to 1½ ins. and for about two-thirds of the width of the head from the gage line. To ascertain the cause of the corrugations the pavement and concrete above the ties and around the rails were removed and measurements made to learn if there had been a lateral bending or vibration of the rail. The latter was found to be the case and eventually the trouble was corrected by stiffening the web of the rail with outside braces at alternate ties.

The accompanying table has been prepared to show the extent of rail corrugations in Philadelphia and the conditions under which they have occurred. The routes are numbered for convenient reference.

Line.	Age and Condition of Rail.	Lorain Section.	Length of Average.	Corrugations in Ins.		Depth of Corrugation in 64ths of an Inch.
				Min.	Max.	
1	Old, very loose............	2-90	3¾	3	5	1⅓ to 4
2	6 years, slightly loose.......	137-371	5	..	..	1
3	2 years, loose............	93-206	3¾	3	6	1½ to 2
4	5½ years, slightly loose......	93-206	3	..	..	1 and less
5	1 year, very slightly loose...	93-206	3	..	..	1 and less
6	2 years, slightly loose.......	137	3¾	..	..	1 and less
7	2 years..................	6 ins.	1½	1	2	1 to 2

Most of the cars on all the foregoing lines except No. 3, on which single-truck cars are run, are of the company's

ination showed that proper allowance had not been made for shrinkage of the concrete after installation, hence vibration of the rail was set up because it did not have a continuous support.

No. 6—Thirteenth Street, north of Indiana Avenue: This track is built on a firm gravel foundation, but it was found that the ½-in. web of the section used was vibrating. This section was replaced by a 141-lb. rail with a web 9/16 ins. thick and no further corrugations appeared.

No. 7—Spring Garden Street Bridge: As this line is on a bridge the appearance of corrugation was of particular interest. The section is 1500 ft. long, laid on a curve of about 100 ft. radius. Oak planks were used for ties and, with the rails, are embedded in concrete. The investigation made after corrugations began to appear showed that there was no bending in the web and, in fact, no movement of either the rails or ties could be detected in the concrete. As the corrugations appeared only on the slightly elevated outer rail which took the greater part of the car thrust, further investigation was given to the support on that side and it was finally discovered that the trouble was due to the vibration of the buckle-plates of the bridge floor under the outer rail. This case is worth noting, inasmuch as Mr. Panton stated that he had never found corrugations on bridges despite the obvious vibration of the track.

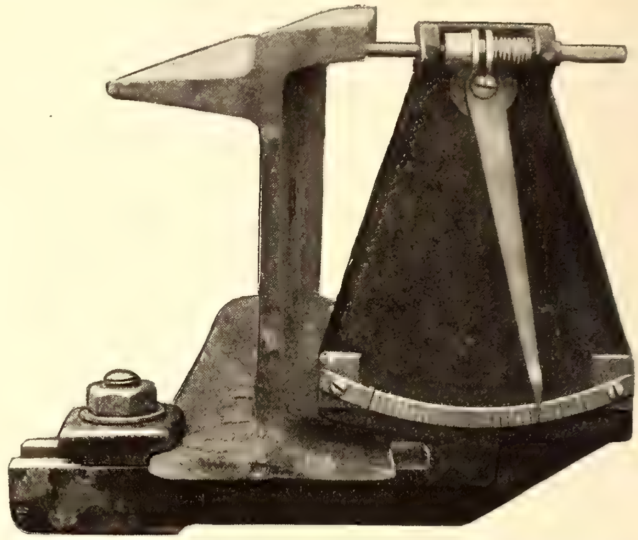
At this point attention should be called to the fact that

all of the heavily traveled streets in the down-town section of Philadelphia are laid with 141-lb. rail on concrete stringers after the manner described in the Sept. 23, 1905, souvenir issue of the Street Railway Journal; that is, in this type off construction no wood is used, and provision is made for taking up the shrinkage of concrete when drying and setting by temporary shims introduced between rail and iron yoke. This type of construction has been in use between four and five years, and wherever laid the company has experienced no trouble whatever from corrugated rails.

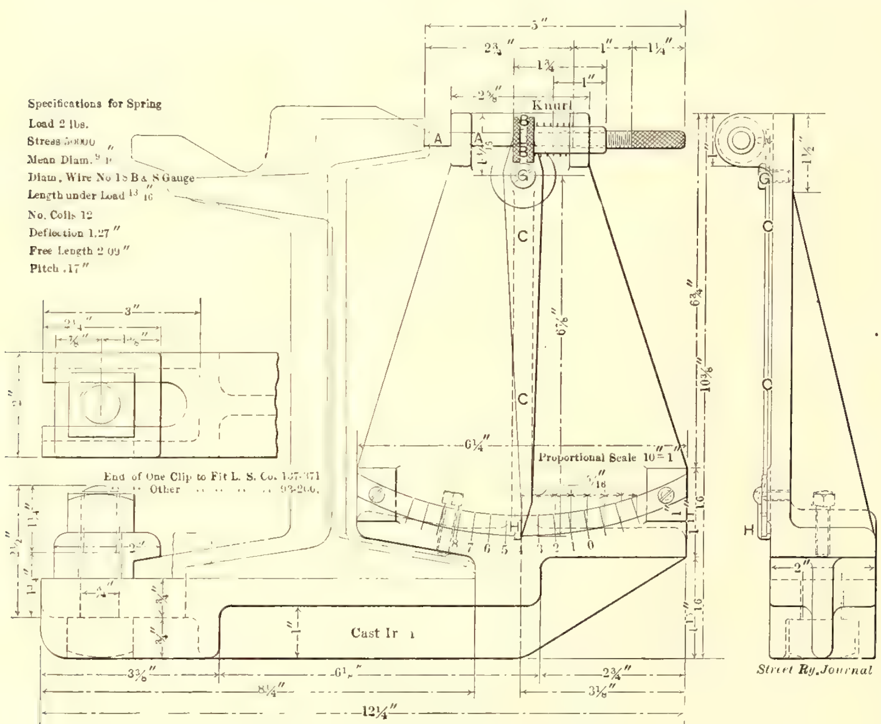
In all cases that have come under the observation of Mr. Nichols it appears that corrugations have never occurred on any line except those where the rail was under vibration, due either to loosened track or bad roadbed. Where the foundation is poor, grinding down the head of the rail or even tightening the spikes and retamping the ties affords only temporary relief. Corrugations in rails too light for the service, where the corrugations extend on the inner side of the head, may be remedied by filing them off and setting the track to a slightly wider gage. This change prevents the wedging action of the wheels against the gage line and permits the outer portion of the head to take the load. In other instances the rail with the 8/16-in. web has been replaced by one with a 9/16-in. web, and in every case where this has been done corrugations have ceased because the track had been strengthened enough to resist the tendency to vibrate or bend under the loads imposed.

While at first sight the rail vibration theory does not harmonize with that offered by Mr. Panton, it would seem that the unequal drive of the axles on an unsymmetrical truck must impose a greater load on the track and thus set up vibrations which would not occur on the same track if the rolling stock was properly designed or the foundations rigid enough.

Mr. Panton also says that it takes on an average three years to develop corrugations on a new system, that being the usual period elapsing before the rolling stock has become badly out of square. Looked at in another way, one might assume that the same period could be required to loosen the rail from its foundations sufficiently to cause trouble. Mr. Nichols has found that corrugations can be produced on a new but vibrating track in from ten to twelve months, while the adjoining rigid track under the same traffic was unaffected.



TEST GAGE FOR RAIL VIBRATION USED IN PHILADELPHIA



CONSTRUCTION DETAILS OF TEST GAGE FOR RAIL VIBRATION

To prove whether or not the corrugations were due to a lateral bending or vibration of the rail, Mr. Nichols devised the instrument shown in the accompanying cuts. It will be noted that the frame may be rigidly clamped to the base of the rail, and that the vertical arm is provided with a piston *A* carrying a nut *B*, the piston being forced against the head of the rail by a spring behind the nut. A hand or pointer *C* is pivoted at *G*, the upper end of this hand engaging the nut, the other end resting on a graduated arc. The lengths of the upper and lower arms of the hand or pointer are in the ratio of 10 to 1, each graduation representing 1/64 of an inch. In using this machine it is only necessary to clamp to the base of the rail and set the lower end of the hand at zero, which can be done by turning the piston in the nut. The amount of lateral motion in the head of the rail, due to bending or buckling of the web, will then be indicated by the marker *H*, which is placed against the hand before a car is allowed to run over the rail. In many cases a movement of 3/32 in. has been noted.

For measuring the depths of corrugations, Mr. Nichols uses a flat wedge graduated in sixty-fourths of an inch. The depth is measured by setting this wedge between the bottom of the corrugation and a straight edge resting on the summits.

Under the recently amended Park Board law all the money received by the city of Indianapolis from the local street railway company and the interurban lines entering the city as a franchise tax goes to the Park Board for improving and bautifying the numerous parks of the city.

STORE ROOM ACCOUNTING AT FORT WORTH, TEX.

A system of store-room accounting requiring a minimum amount of time to keep it up, yet by means of which records of costs, stock on hand, and other required data is kept readily accessible, is in use in the storeroom of the Northern Texas Traction Company at Fort Worth, Tex. This method, as well as some of the details of the systems used by purchasing and supply departments of the road, was the subject of a paper by A. W. Q. Birtwell at the last May convention of the Southwestern Electric & Gas Association held at Galveston, Tex.

The system requires three special forms and an ordinary journal or day book. All materials received are entered in the journal and the entries are afterward checked with the invoices. Supplies are obtained from the storeroom on requisitions signed by the foreman and the materials given out are afterward entered from the requisitions on a stock slip. These stock slips, which are in duplicate, are bound in book form and are numbered consecutively. The stock slip contains thirteen lines and usually only one slip is used per day. If, however, all the material cannot be gotten on one sheet, two or more are used. After entries have been made the requisitions are all pasted to the stub of the duplicate stock slip. The original stock slips, which are perforated, are torn from the book and are sent to the general office of the company, where they are checked and summarized. At the end of the month this summary is checked with the duplicates.

S. & W. C526

Northern Texas Traction Co.

No. .... Date .... 190 ...

PLEASE DELIVER THE FOLLOWING MATERIAL TO

TO BE USED AT ....

MATERIAL

TO BE USED FOR ....

SIGNED ....

NORTHERN TEXAS TRACTION COMPANY.

Date .... 190....

To be used for ....

Signed ....

REQUISITION

NORTHERN TEXAS TRACTION COMPANY. No. ....

RECORD OF MATERIAL TAKEN FROM STOCK ROOM.

Date .... 190....

To be used at .... Charge ....

MATERIAL.	Quantity Received.	Rate.	Cost.	Account to be Charged

Remarks: ....

Received the above material for use as stated. Signed: ....

STANDARD STOCK SLIP

ORDER NO	DATE RECEIVED	FROM WHOM PURCHASED	QUANTITY	PRICE	AMOUNT	EXPENSE	TOTAL	STOCK SLIP	QUANTITY	ISSUING PRICE	AMOUNT	BALANCE QUANTITY	BALANCE AMOUNT

BACK OF STOCK CARD

Article ....

Size .... ***Grade*** .... ***Unit*** .... ***Section*** .... ***Shelf*** ....

ORDER No.	DATE RECEIVED	FROM WHOM PURCHASED	QUANTITY	PRICE	AMOUNT	EXPENSE	TOTAL	STOCK SLIP	QUANTITY	ISSUING PRICE	AMOUNT	BALANCE QUANTITY	BALANCE AMOUNT

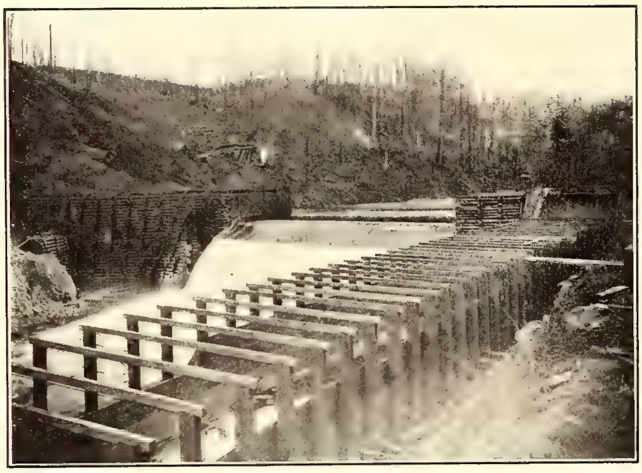
FRONT OF STOCK CARD

When goods are returned to the storeroom a credit stock slip of practically the same form as that for material issued is made out, the goods being credited at the price they were charged out. A card system stock ledger is kept on cards measuring 6 ins. x 8 ins. A separate card provided for each article is divided into a debit, a credit and a balance section. The debit side is posted from the journal already referred to, in which received materials are posted. The credit side is posted from the stock slips, except in case of small and frequently used articles such as screws, nuts and bolts. A separate record is kept of these and they are posted to the stock card once a month. The total cost of the material is obtained by adding to the actual cost the "expense," which includes express, freight, and hauling. The issuing price for the month is figured at the beginning of each month by dividing the total price by the quantity.

By reference to the balance side of the cards the quantity of stock of any article on hand may be found. The card also shows the rate at which goods are being used so that the probable time at which the stock on hand will be used can readily be ascertained.

POWER GENERATION AND TRANSMISSION IN PORTLAND, ORE.

That the rapid, healthy growth of the Northwestern States during the last decade has been fully shared by the city of Portland, Ore., is evident from the equally remarkable increase in the electrical power requirements for the city's railway, lighting and industrial purposes. The latest acquisition to the power equipment of the Portland Railway, Light & Power Company is the Cazadero hydro-electric station, which is now furnishing 15,000 hp but ultimately will give 25,000 hp. As even this plant will not satisfy the later power demands, work has been begun on a plant of equal size a few miles up the Clackamas River.

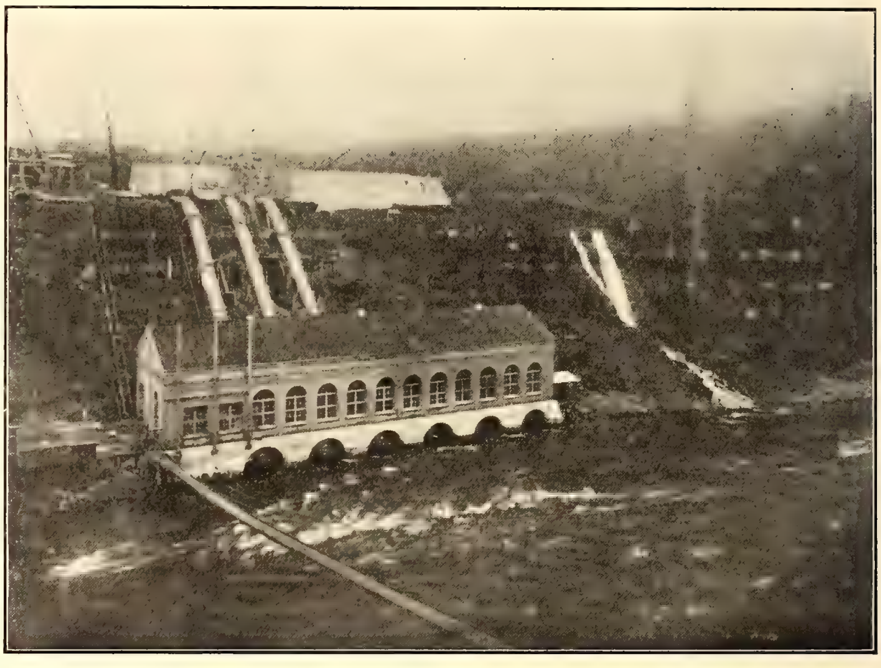

VIEW OF CAZADERO DAM, SHOWING A PORTION OF THE FLUME

THE CAZADERO PLANT

The Cazadero station is the largest electric plant in the State, was four years building and cost upward of $1,000,000. It is situated 37 miles from the city of Portland, on the Clackamas River, and has a present output of 15,000 hp, which will be increased shortly to 25,000 hp with the addition of two more generating units as originally planned. About a mile above the power house is the dam proper, which is 176 ft. wide and 130 ft. long at the base, and whose total length at the top is 400 ft. Here the water is taken from the Clackamas River through a bulkhead 17 ft. x 25 ft. and into a flume 2622 ft. long. This flume, which follows the contour of the hillside, discharges into a canal 2898 ft. long, 35 ft. wide at the bottom, 20 ft. deep and 75 ft. wide at the top, which in turn empties into the main reservoir or lake. The reservoir, which covers 50 acres when filled to an average depth of 20 ft., has a capacity of 326,480,000 gals. When filled to this level the reservoir will supply power sufficient to run the wheels of the power plant below for six hours after the gates at the dam have been closed. The forebay gates are located at the lower end of the reservoir and set in massive concrete walls built on the top edge of the river bluff. This wall, of steel and concrete construction, is 8 ft. thick at the top and 20 ft. thick at the bottom, built on foundations of sandstone bed rock. The water is led from the forebay gates to the power house, 138 ft. below, in tubes 8 ft. in diameter, inclined at an angle of 45 degs. and lying along the hillside. The power house is of concrete construction, 180 ft. long x 54 ft. wide.

A 20-ton electric traveling crane, which can be run the full length of the building, facilitates any repair work that might be necessary. A railway spur terminates inside the power house so that any loading or unloading of heavy machinery can be done with this crane.

The power equipment is composed of three double 42-in. hydraulic Victor turbine wheels of the Francis type made by the Platt Iron Works, of Dayton, Ohio. A friction brake is provided on the end of the water-wheel shaft of sufficient capacity to stop the wheels when the gates are closed. Each unit is provided with a Lombard type N vertical governor. To these wheels are direct connected three Allis-Chalmers generators of the standard two-bearing water-wheel type with horizontal shaft and a normal rated output of 2500 kw each at a terminal pressure of 11,000 volts, three-phase. The revolving field has twelve poles and the speed is 330 r. p. m., thus giving a frequency of 33 cycles per second. Each alternator is equipped with a direct-connected exciter, the armature of which is mounted on the end of the alternator shaft; the exciter field yoke is carried on an extension of the bed of the alternator. The bearings are of the ring oiling self-aligning type, water-jacketed. The stator yoke is of unusually stiff construction, being provided with heavy end heads, which serve to clamp the laminations and at the same time reinforce the main part of the yoke. The laminations are of especially selected steel carefully varnished and assembled. The core is provided with numerous ventilating ducts through which a strong blast of air is forced by the revolving field. The armature coils are placed in open slots and can thus be easily replaced in case of damage. Tests on these machines showed that they were capable of carrying full load continuously with a rise in temperature less than 35 degs. C., thus giving them a liberal margin for overloads.


CAZADERO POWER HOUSE ON THE CLACKAMAS RIVER

The current is conveyed from the generator to the type-H-3 motor-operated General Electric oil switches by

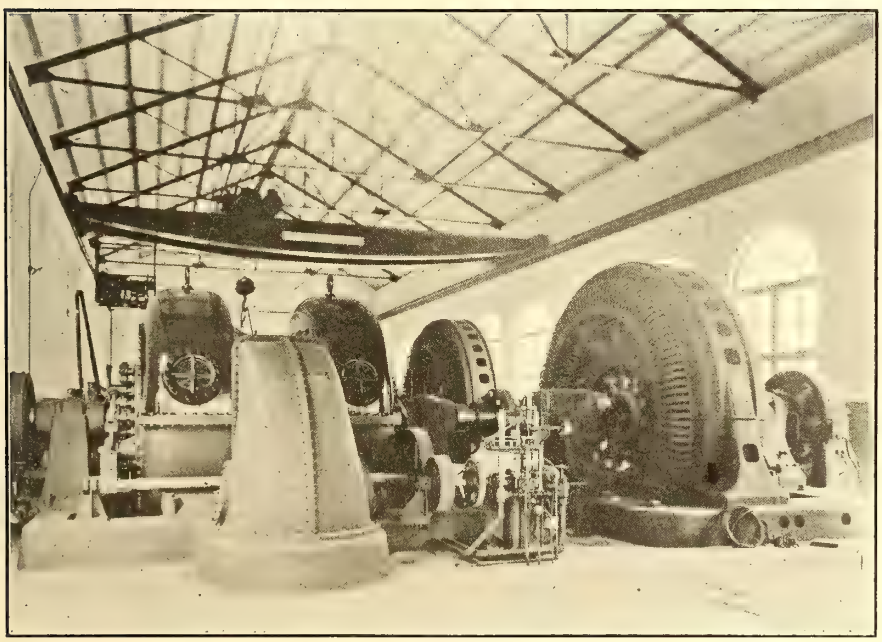
three-conductor, 15,000-volt cambric insulated cables.

A reinforced concrete structure consisting of a core wall flanked by wings and surmounted by a gallery upon which are located switch cells and a concrete bus-bar compartment forms the high-tension equipment of the station. On the main floor and immediately in front of this gallery is located the switchboard. This switchboard is composed of black Monson slate panels, there being a panel for each generator and a corresponding panel for each exciter, also a line totaling panel and a panel for the station lighting. The remote-control operating switches for the H-3 oil switches mentioned are located on this switchboard, as are also the usual instruments and the time-limit relays for operating the trips. Curve drawing indicating wattmeters of the General Electric make are used in connection with each generator.

A basement underneath the switchboard provides ample room for the location of the field rheostats for the generators. This basement is provided with a ventilating shaft reaching to the top of the building.

On leaving the power house the current passes directly over the Clackamas River to a transformer station located on the opposite bluff. This building consists of a series of cells for nine 850-kw oil water-cooled 11,000-33,000-volt transformers manufactured by the Stanley-G. I. Electric Manufacturing Company, and a switch room in which are located the outgoing line switches. These switches are of the Stanley 60,000-volt, three-pole, single-throw type and are solenoid-operated, the control switches being located on the main switchboard in the power house on the opposite side of the river.

The transformers are guaranteed to operate at 57,000 volts Y with grounded center, though at the present time the transmission voltage is 33,000. The design of the building is such as to provide ample space between all wires, and each wire is separated from its neighbor by a concrete barrier. Special attention has been given to the water-cooling equipment, an alarm being provided which will warn the attendant in the station across the river in the event of any interruption to the water.

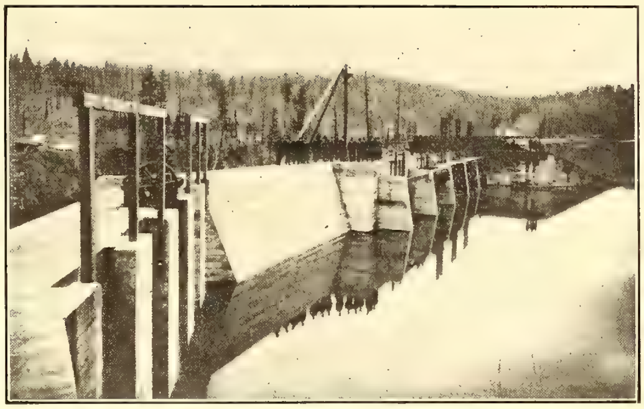


WATER-WHEEL AND GENERATOR INSTALLATION IN THE CAZADERO STATION

Multiplex lightning arresters for 33,000 volts, three-phase, the General Electric make, are installed in the transformer station. A gallery for the convenient operation of the disconnecting switches is also provided.

THE CAZADERO POWER TRANSMISSION

From the transformer station power is conducted at 30,000 volts to Portland, over a distance of 37 miles. Two separate and similar pole lines have been constructed throughout the entire distance, each carrying a single three-phase circuit. These two lines, which are at a distance apart varying from 40 ft. to 90 ft., are constructed for 14 miles of the distance along the company's railway right of way. For 10 miles they follow the country road and purchased rights of way. At the Portland city limits the two lines separate, following different routes for 7 miles to a sub-station located in the heart of the city. The poles used are all of Oregon cedar, 50 ft. long for the lines to the city limits and 60 ft. within the limits. These poles are spaced on an average of 140 ft. apart, and the butts are painted with avenarius carbolineum to 1 ft. above the ground.



FOREBAY WALL, SHOWING INTAKE GATES TO THE PENSTOCKS

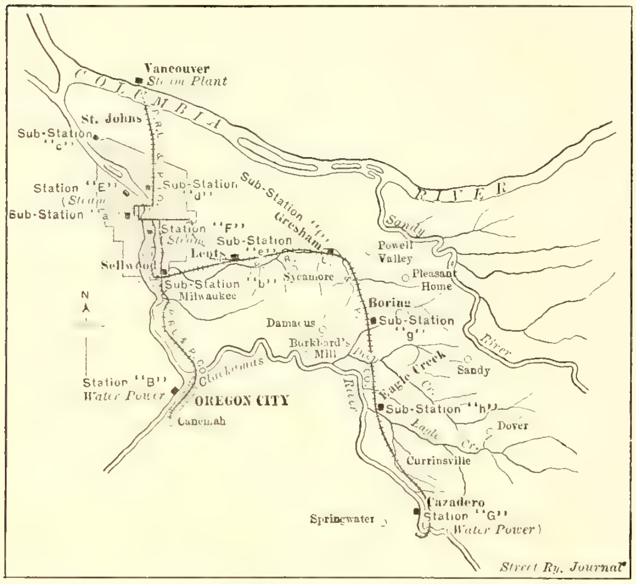
The conductors are placed in an equilateral triangle, with the apex at the top of the pole, and consist of a seven-strand cable, of 115,570 circ. mils. For the pole top construction a 6-in. x 6-in x 18-in. arm is used, and fastened to the pole by means of a "U" strap, around the pole, and which terminates in ⅝-in. bolts, through the arm; the lower arm is 4 ins. x 6 ins. x 7 ins. long, and is so spaced as to give a 6-ft. side to the triangle. The lower arm is fastened with a through bolt and braced with 1¼-in. x 1¼-in. x 24-in. iron braces. On all angles of over 15 degs. the poles are double-armed, using two insulators, per wire. All 90-deg. corners are turned on three insulators, so spaced as to divide equally the strain between the three. The pins are a malleable iron ribbed with through bolt, and are cemented into the insulators, which are a triple petticoat, 9¾-in. diameter by 8¼-in. height, and are rated at 37,500 volts. A telephone line consisting of a No. 9 galvanized-iron wire is strung on a special two-pin cross arm 10 ft. below the 30,000-volt line, and is transposed every ten poles.

Throughout the entire length of the line all trees have

been cut for a distance of 200 ft. on each side to avoid the possibility of a burn-down from this source.

THE OLD POWER STATIONS AND THE SUB-STATIONS

In addition to the water-power plant, at Cazadero, of 15,000-hp capacity, the system of the Portland Railway, Light



MAP SHOWING THE POWER STATIONS AND SUB-STATIONS OF THE PORTLAND RAILWAY, LIGHT & POWER COMPANY

& Power Company comprises generating stations and sub-stations as follows: A 12,000-hp water-power plant (B) at Oregon City, a 12,000-hp steam station (E) in North Portland, a 2500-hp steam station (F) in East Portland, and eight sub-stations, distributing throughout the system.

The two main sub-stations, "a" on the west side of the Willamette River and "d" on the east side, receive the bulk of the power generated, and are the distributing centers for approximately all of the light and power furnished to consumers throughout the city and suburbs. These two sub-stations also distribute to the railway system the greater portion of the power utilized by the city and suburban lines. The remaining sub-stations are equipped with rotary converters, and utilized solely for the feeding of the railway system of the company.

With regard to sub-station "a," it should be noted that the company is about to build a new sub-station in connection with its new combined office and railway station. At the present sub-station "a" there are installed four 1000-kw railway rotary converters, together with the necessary transformers and switchboards, also four 1000-kw lighting motor-generator sets, each consisting of a three-phase, 33-cycle, 10,000-volt synchronous motor, driving by direct connection a 60-cycle, three-phase, 2300-volt generator; also one 500-kw lighting motor-generator set, consisting of a three-phase, 33-cycle, 10,000-volt synchronous motor, driving by direct connection a 60-cycle, 2300-volt, three-phase generator. The company has also installed at this sub-station a number of H-3 oil switches, used in connection with its various transmission lines, from station E, North Portland, station B, Oregon City, and sub-station "d," Albina, all of which center at this sub-station. The company also has installed at this sub-station ten 75-light magnetite arc sets, consisting of constant current transformers, switches and mercury rectifiers. All of this apparatus was furnished by the General Electric Company.

The power from the Cazadero plant is received in Portland at sub-station "d," on Knott Street in East Portland. This sub-station is approximately 140 ft. long, 46 ft. wide and 44 ft. high, and is built of brick with reinforced concrete bus-bar compartments and switch cells. There are installed here six 850-kw oil, water-cooled, 33,000-11,000-volt Stanley G. I. transformers, similar to those installed at Cazadero. The 30,000-volt current is stepped down to 10,000 volts and is used to furnish power to the various sub-stations in Portland, in multiple with station B, Oregon City, and station E, steam plant, in North Portland. The company has installed in this sub-station two 1000-kw G. E. six-phase rotary converters, and one 1000-kw G. E. motor generator set, which consists of a 10,000-volt, 33-cycle, three-phase synchronous motor, direct connected on the same shaft to a 2300-volt, three-phase, 60-cycle generator. There are also installed in this sub-station eleven magnetite arc sets with the necessary tub transformers and mercury rectifiers. A 20-ton traveling crane, made by Pawling & Harnischfeger, is also used in this sub-station.

Sub-station "b" is located at the junction, Sellwood, of two interurban lines, from Portland to Oregon City and from Portland to Cazadero, and feeds into the system at this point. Between Sellwood and Cazadero, a distance of 35 miles, there are four sub-stations, furnishing power to this interurban line, as shown on the accompanying map. At St. Johns, a suburb to the north of Portland, there is a sub-station which at the present time is used solely for the purpose of furnishing power to the railway system in that vicinity, but will shortly have its capacity increased to take care of the light and power distribution to customers in the same territory.

A CORNER ON THE 30,000-VOLT TRANSMISSION LINE

The power furnished to the railway system throughout is at 550 volts, direct current, and is obtained through rotary

converters installed in the several sub-stations of the company and from 500-volt railway generators in the steam plants E and F.

HIGH-TENSION TIE LINES

As described heretofore, the output of the water-power plant, at Cazadero, is transmitted by duplicate 30,000-volt lines to sub-station "d," located in East Portland.

From the water-power plant (B) at Oregon City, power is transmitted to sub-station "a," in Portland, a distance of 15 miles, by duplicate three-phase, 10,000-volt circuits constructed along the west side of the river, and upon a single pole line, one circuit located on each side of the pole. The conductor is a 250,000-circ. mil cable. There is also a three-phase, 10,000-volt circuit of No. 1 copper from this station in Oregon City to sub-station "d," which is constructed along the east bank of the river.

Similarly, there are duplicate three-phase, 10,000-volt circuits, size No. 0, between steam station E, in North Portland, and sub-station "a," a distance of 2 miles; also duplicate lines of No. 1 copper, and for 10,000 volts between sub-station "a" on the west side and sub-station "d" on the east side, a distance of 2 miles.

These duplicate tie lines between the several stations give a most flexible system, and places available for use at any point desired the power generated in the several stations. They also permit the shut-down of any one station or of any particular line without impairing the efficiency or continuity of the service.

In addition to the system of high-tension lines between stations, as here described, the several railway sub-stations are tied together by a 10,000-volt three-phase circuit which is fed from station G at Cazadero, from station B at Oregon City, or by the tie lines it may be fed from the steam station E in North Portland. This 10,000-volt line loops into the several stations in such a way as to make it possible to cut out any section of the line without interfering with the operation of the several sub-stations upon the system.

RAILWAY DISTRIBUTION

For feeding the separate railway lines throughout the city, the area is divided into four districts, with the steam stations E and F and the sub-stations "a" and "d" respectively as centers of distribution of the separate districts. The trolley wires in each district are sectionalized, each section being fed by a separate feeder. By this means trouble in any part of the system affects only a small area. The high-tension transmission system is at a frequency of 33 cycles. With the exception of a few large power customers supplied at this frequency, all current is furnished at 60 cycles to customers throughout the city and suburbs for light, and power is approximately 25,000 hp; of this about 8000 kw sets, installed in sub-stations "a" and "d" for the city and in station B for feeding Oregon City.

The present demand upon the company's system for light and power is approximately 25,000 hp; of this about 8000 kw is utilized in the operation of its railway system, and the balance to supply the demand by its customers for light, heat and power.

MANAGEMENT

The officers of the Portland Railway, Light & Power Company are as follows: President, C. M. Clark; vice-president, in charge of railway department, F. I. Fuller; general manager, in charge of light and power department, F. G. Sykes; secretary, C. N. Huggins; treasurer, S. G. Reed; and general superintendent of railways, C. J. Franklin. The construction work in connection with the Cazadero plant was completed under the jurisdiction of the light and power department, and the following engineers of this department had immediate charge of the various branches of the work: T. W. Sullivan, hydraulic engineer, of the construction work upon the dam, flume, reservoir, and all hydraulic work in connection with the plant; O. B. Coldwell of the electrical construction work and operation; and H. S. Sladen of the construction of the 30,000-volt transmission line.

COMBINED TELEGRAPH AND TELEPHONE SYSTEM USED BY THE INTER-URBAN RAILWAY, DES MOINES

BY E. R. CUNNINGHAM, Electrical Superintendent

The Inter-Urban Railway, of Des Moines, Ia., has worked out for itself a composite telegraph and telephone system which differs very materially from any other in general use, and has many features to recommend it especially for interurban dispatching lines. The following description may be of interest to those who have occasion to operate dispatching lines under similar conditions.

The system originally installed was intended for the telephone dispatching of the cars on the Beaver Valley Division of the Inter-Urban Railway. It consisted of two No. 9 BB galvanized iron wires from Des Moines to Moran Junction, where the line branches, the branch line running 4 miles to Woodward and the main line 12 miles to Perry. The Perry end of the main line is 36 miles from Des Moines and the Woodward end of the branch line 28 miles from Des Moines. The telephone system was carried on standard cross-arms on the same pole and below the high-tension transmission line, and was transposed every ten poles by a transposition pin and insulator designed especially for this use. The telephones were of standard make and bridged on to the line in the usual manner, one being used at each station and passing point on the line. In all, there were fourteen telephones bridged onto the line. The dispatching switchboard is located at the Des Moines end of the line, and is a fifty-line central energy board with ten lines now wired up, one of which is the Beaver Valley dispatching line. Besides being used for dispatching purposes, the latter line was also used for transmitting messages arising from freight, express, passenger and other departmental business. It was found necessary, therefore, either to build another telephone line for the commercial business or equip the present line with telegraph instruments to make a dual use of the one line. The latter plan was found to be much the cheaper, as it involved but a nominal expense for the telegraph instruments, and was adopted not only for that reason, but because it was thought to give a more extended and reliable service than two separate telephone lines. It would have been quite natural in adopting the telegraph system on this line to fall into the well-beaten path of American telegraph practice of connecting the telegraph instruments in series. To do this, however, necessitated the use of at least eight condensers cut in the telephone line.

Fig. 1 illustrates the usual method of connecting telegraph instruments in series on a composite telephone and telegraph line. Since both sides of the telephone line are used as one side of the telegraph line, it is necessary, at each intermediate telegraph station, to cut in a condenser in each side of the telephone line to open the line to the

d. c. telegraph current and cause it to flow through the telegraph key and relay.

In using the telephone it is necessary to signal and talk through these condensers, and while they do not interfere with the small undulating voice currents used in talking, they do seriously interfere with the signaling current, especially where there is a large number of telephone instruments bridged onto the line. Condensers are very delicate, and are an expensive fixture on a long dispatching telephone line, especially where it parallels and is in close proximity to high-tension and power lines. They are so sensitive that they are continually being knocked out by lightning, induced static charges or stray currents from other lines. If this occurs and the condensers are not kept in proper order the telegraph current will interfere with the telephone service. To avoid the use of these expensive

The sounder is connected in the usual manner, either with a local battery, which in this case can be ordinary dry cells, as the sounder is on open circuit when not in use, or by shunting the ground light in a series of five incandescent lights in the same manner as power is obtained on the line.

All telegraph instruments on the line, when connected in multiple, are, of course, connected up exactly alike, and require but one impedance coil to each telegraph station and no condensers. They are all independent of each other, and any one of them can be cut on or off the line at any time by opening the double-pole knife switch, indicated in Fig. 2.

Another advantage of the multiple system is that it is impossible for the operator to go away and leave the line open by leaving his key open. If the series system were

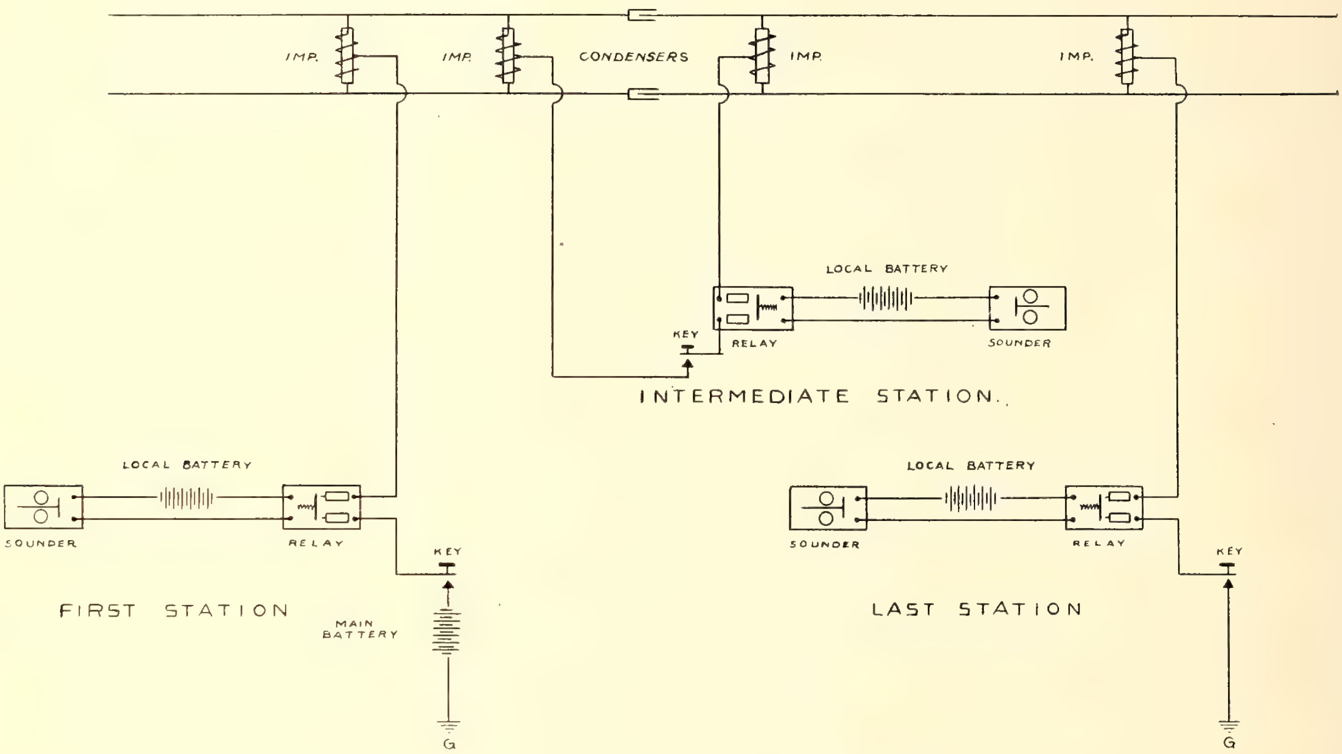


FIG. 1.—TELEGRAPH INSTRUMENTS IN SERIES

and troublesome condensers and to secure other very desirable results that will appear later, we decided to connect the telegraph instruments in multiple, more after the Continental or European telegraph practice than the American, the telegraph relay being cut in, as illustrated in Fig. 2, between the neutral point of a suitably wound impedance coil, bridged across the telephone line and grounded through about 1000 ohms resistance.

The telegraph key, which is of the open-circuit type (key without a lever switch), is cut in from some source of energy in multiple with the relay. As we have the 500-volt d. c. railway circuit at each telegraph station, we connect the key between the fourth and fifth lamps in a series of five 16-cp lamps, as illustrated in Fig. 2, to obtain about 100 volts on the telegraph line. For the fifth or ground lamp we used four 16-cp lamps in series multiple, as illustrated in Fig. 2, which have the same resistance as one lamp; but, being in multiple, there is no danger of the ground side of the series opening and thus throwing full potential on to the telegraph line.

used it would require two impedance coils at each intermediate telegraph station and two condensers, as illustrated in Fig. 1. Another very important feature of the multiple system is that the neutral point of every impedance coil is connected to ground through the relay and about 1000 ohms of non-inductive resistance. This on lines paralleling high-tension lines serves to carry off the static charges which otherwise would accumulate on the telephone line.

It is a well known fact that both sides of the telephone line sometimes act as secondaries to the high-tension line and that a high and dangerous accumulation of static electricity is induced on the telephone line. These impedance coils are so wound and connected that they act as impedance to the undulating voice and a. c. telephone signaling current flowing from one side of the telephone line to the other, but do not act as impedance to current flowing from both sides of the telephone line to the ground. Therefore, the static or other stray currents of small volume but high potential can pass unimpeded from both sides of the telephone line to the ground.

On account of the sensitiveness of the telephone receivers to even a slight flow of current, they are very seriously affected by small induced currents from other lines which parallel the telephone line, especially from lighting, power and high-tension lines. It is important, therefore, to have a well-constructed telephone line. It must be perfectly balanced as regards resistance, impedance, inductance and capacity; that is, it must have the same resistance, impedance, inductance and capacity in each side of the circuit. Not only must each side total the same, but it must have the same amount between each talking station. The line must be so transposed that each leg of the circuit shall occupy and travel in the same zone or position relative to other parallel lines and conductors half of the distance between each talking station. The line must be properly insulated, not only from all other lines, but from the ground and all other objects having capacity which would unbalance the circuit by adding capacity to one side or the other.

The greatest source of trouble, and the one most difficult to overcome on telephone dispatching lines, arises from

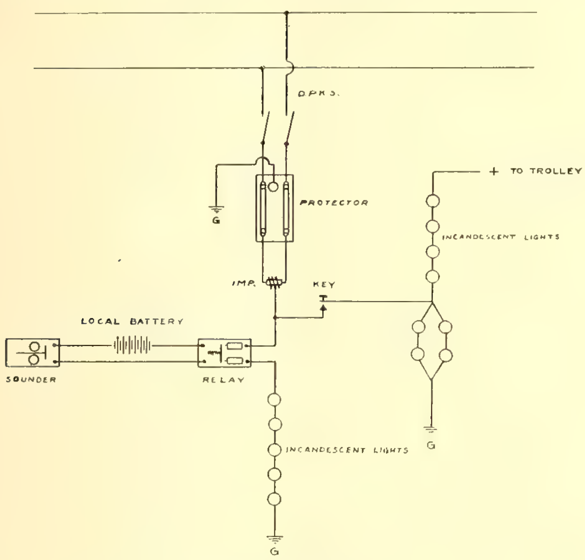


FIG. 2.—TELEGRAPH INSTRUMENTS IN MULTIPLE (ALL STATIONS ALIKE)

two opposite and opposing conditions, both of which seem to be necessary—one for the operation of the line and the other for the protection of the same—from a dangerous difference of potential between both sides of the telephone line and the ground likely to be induced from the high-tension lines. A difference of potential of 300 to 400 volts will discharge across the protectors usually employed on the line, leaving the line safe, but not very serviceable, as the capacity of the grounded side is increased so as to unbalance the circuit and cause a continuous flow of current through the receivers on the line from one side of the circuit to the other, making the line so noisy that it is practically inoperative. These protectors or ground devices are usually carbon plates separated about 1/100 in. by perforated mica or celluloid, one being connected to one side of the telephone circuit and the other to the ground. When a discharge takes place from one carbon plate to the other it usually blisters it and leaves the line permanently grounded, and it is then necessary to go over the line and clean the protectors. Dust and dirt is also likely to collect in these protectors and ground the line with the same result.

Thus you are between the "Devil and the deep, blue sea" all the time. You must not let your line touch the ground yet you must keep it within 1/100 in. of the ground in many places. It is from these two opposite and opposing conditions that nearly all the trouble on telephone lines paralleling a high-tension line arises.

Since the installation of the telegraph instruments on the Beaver Valley dispatching line, most of the above troubles have disappeared on account of the neutral point of the impedance coils being grounded and carrying off the static and other stray electricity which otherwise would accumulate, discharge across the protectors and blister them.

Since it is necessary to have a well-balanced line to prevent disturbances to the telephone from high-tension and other parallel lines, the use of the telegraph on the same line as the telephone does not necessitate any further care than would be necessary for any satisfactory operating telephone line.

A composite system not only doubles the amount of business that can be handled over a single line, but is much more reliable and convenient than either a telephone or telegraph line alone, because the telegraph and telephone service are not both subject to the same troubles. Although the telephone is more sensitive both to atmospheric disturbances and to induced currents from other lines, and consequently is less reliable than the telegraph, yet it is more convenient than the latter for handling a certain class of business, such as reporting cars at passing points and places where there are no operators, for reporting break-downs, interruptions to service and all other kinds of business where it is necessary to get in close touch with the party addressed. In many cases quick action and an immediate response is required; nor does one wish to talk through a second party—the operator—when it is possible to communicate personally with the person wanted. There is sometimes a great deal of satisfaction in talking direct to the train crews, sub-station attendants, and other employees. For such work the telephone is most desirable, and for other cases where one does not care for a personal interview a telegraph line has its advantages.

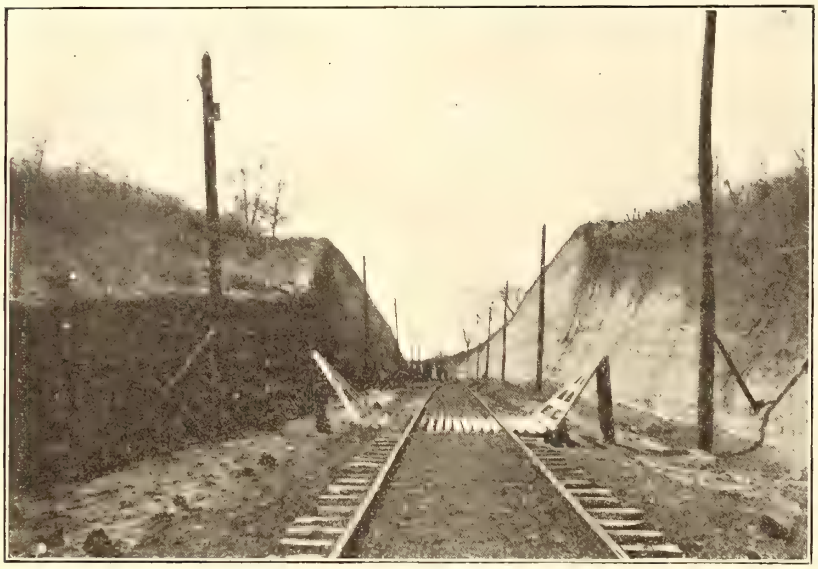
The great trouble with the telephone for dispatching purposes is that the currents used are so small the lines will easily pick up foreign and induced currents from parallel circuits. Consequently the instruments are very noisy unless the line can be built to remain unaffected. Telephone transmitters usually operate on from two to four volts, and, as their resistance is from ten to twenty ohms, they will not transmit over about one watt. If a transmitter could be designed to handle, say, one hundred watts, then the receivers could be made less sensitive to currents from foreign lines, and they would not be so affected by atmospheric conditions.

The composite system has all the advantages of both systems, with very little additional expense. It introduces no new troubles or complications and greatly diminishes the likelihood of a total interruption.

It is reported that contracts have been signed between the Pacific Express Company and the Toledo, Urban & Interurban, the Western Ohio, and the Dayton & Troy, and that through-express cars will be operated over the lines the same as the fast passenger trains. It is also said that the express company has made a contract with the Springfield, Troy & Piqua to operate over its line. The express business is growing to be an important feature on the electric roads.

THE OMAHA AND SOUTHERN INTERURBAN RAILWAY

The recently completed line of the Omaha & Southern Interurban Railway Company, which extends from South Omaha, Neb., to Belleview College and Fort Crook, 6 miles south, is particularly noteworthy because of the amount of grading required. For the entire length of the line cuts averaged about 40,000 cu. yds. per mile, and for several miles the road is a succession of cuts and fills. The deepest cut is midway of the line and is 48 ft. deep. Owing to the peculiar holding qualities of the clay in which the cuts are made the slope of the banks is made ¼ to 1, which is quite in contrast to the practice of 1½ to 1 elsewhere.



A 48-FT. CUT ON THE OMAHA & SOUTHERN INTERURBAN RAILWAY, SHOWING THE STEEP BANKS

The line will probably be extended to Plattsmouth, about 10 miles south of Fort Crook, the present southern terminus. This fort is a government post, and usually four or five companies are stationed at it. The line is built on private right of way 100 ft. wide. Fills for single track are 22 ft. wide at the tops and cuts are 37 ft. wide at the bottom. Oak ties and 70-lb. rails were used. Span trolley construction is employed. The poles, which are of cedar, are spaced 100 ft. apart, and those on one side of the track are high enough to carry high-tension cross-arms. The butts are treated with a tar compound, the bi-product obtained in the manufacture of artificial gas. A lightning arrester is installed every quarter mile.

At present power is obtained direct from the direct-current power house of the Omaha & Council Bluffs Street Railway Company. As the terminus of the line is 12 miles from the power house, a booster is employed which raises the voltage at the power house to 825 volts. The booster set consists of two 100-kw Edison bi-polar generators. The winding of the one serving as a motor is unchanged. The voltage of the other has been halved and the amperage doubled by connecting the armature leads so as to give two independent circuits paralleled by the brushes. Future plans contemplate a sub-station in South Omaha for the city lines and power for the interurban line will then be obtained from this.

An hourly service is ordinarily maintained by one car, but during the summer season three will be operated. The cars used are 30 ft. long, seat forty-four people, and are equipped with four G. E. 67 motors. They are maintained in the shops of the Omaha & Council Bluffs Street Railway.

R. N. Towl, of Omaha, had charge of the construction.

CORRESPONDENCE

INCREASE IN CANADIAN SUBSCRIPTION PRICE

MONTREAL, May 13, 1907.

Editors STREET RAILWAY JOURNAL:

I notice, with interest, your announcement of the annulment of the postal arrangement for newspapers between the United States and Canada and the increse in your charge to subscribers in Canada. Viewing the matter from the Canadian standpoint, I cannot but feel that while the new regulations will cause us to pay more for our American periodicals, they are only just to this country. I understand that there are 20 lbs. of newspapers shipped from the United States into Canada for every pound shipped from Canada into the United States, so that the Canadian Post Office Department would be expected to do twenty times as much work as the United States Post Office Department, but get the revenue only on the Canadian magazines. On reading your article, however, I could not but feel that it was a pity that the responsibility for the short notice given to American publishers was not placed where it belongs, with the United States postal authorities, and not with those of Canada. As I understand it, the latter suggested a postponement of the date upon which the agreement should go into effect, but the former refused consent. I should be glad to have the facts stated prominently in your journal, as I do not like to have my country blamed for an act of apparent injustice when the blame does not attach to it.

CANADIAN SUBSCRIBER.

MOTOR BUCKING AND FLASHING OVER

PITTSBURG, PA., April 29, 1907.

Editors STREET RAILWAY JOURNAL:

I have read with interest the discussion in your issue of April 6 upon motors flashing over and bucking at high speed and the performance of cars on down grades. I have noticed that some of our cars will run slower on a down grade with power on than with power off, and attribute it to the motors binding on the axle. When the power is on the motor rises up or down on the axle bearings, and with the lost motion in the journal boxes and truck frame exerts a binding effect on the axle, causing the car to run a trifle slower. When the power is off the motor rides free.

Flashing over may occur from about twenty different causes. One common reason is that the brush-holder springs are weak, so that the brushes have poor contact, thereby causing flashing. Another reason is high mica in the commutator, causing the brushes to jump up and down. Another cause is an open coil in the armature, causing a ball of fire to fly around the commutator, or a loose, bare coil which strikes the pole pieces as the armature revolves. A flat commutator is still another cause. A bent armature shaft will run all right if the brush-holder springs are kept tight, but if they are loose the motor will flash and buck as soon as it gains speed. Tight gearing also will make a perfect armature buck. These are only a few of the most common causes for motors bucking.

R. W. P.

A NEW BALL-BEARING LIFTING JACK.

A new ball-bearing lifting jack, which embodies a number of new ideas and improvements and which will be manufactured in connection with the Duff roller bearing screw jacks, is being placed on the market by the Duff Manufacturing Company, of Pittsburg, Pa., the sole manufacturers of Barrett ratchet jacks. The bearings of the new jack, it is said, cannot wear unevenly, and the balls are made larger than in other jacks, insuring easier operation. This also gives greater capacity and obviates any liability of their being crushed. Another important feature is the fact that the gears cannot come out of mesh. This is most important, as any trouble of this kind would tend to derange the load and destroy the jack. Each of these new jacks has an additional bearing on the level pinion, insuring ease of operation. Duff ball-bearing screw jacks are made interchangeable with the well-known roller bearing jacks which this company has been building for several years, so that it is possible to use roller bearings in place of ball bearings when desired.


BALL-BEARING JACK

A NEW WATER-TUBE CLEANER PLANT

The recent completion of the new plant of the Lagonda Manufacturing Company, of Springfield, Ohio, marked an interesting epoch in the history of the company. Twenty years ago, when water-tube boilers first began to be introduced, a man named Weinland invented a machine for cleaning scale from the tubes. It was of the type now known as the "turbine." When these cleaners were put on the market, the business was carried on in a 10-ft. by 12-ft. room, the cleaners being made outside. The cleaners came into favor so rapidly, however, that machinery for their manufacture was purchased and installed in a room 24 ft. by 24 ft., and the company then began to take contracts to clean boilers. Again the quarters became too small. This time the plant was moved into a 28-ft. by 70-ft. two-story building. As water-tube boiler plants became larger and larger and the scale problem assumed more importance, the Lagonda Manufacturing Company got out its Weinland mechanical boiler tube cleaner.

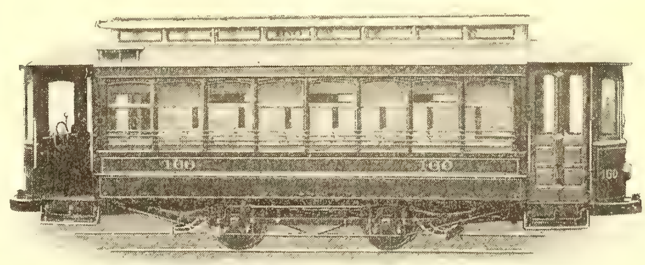
From time to time the company has added other specialties, and from the modest beginning before mentioned the business has grown so that the new plant consists of a two-story 50-ft. by 200-ft. building located on two acres of ground, which will be available for future extensions. The walls and floors of the new building are of artificial stone. Every machine tool is driven by an individual motor receiving power from a gas engine-driven generating plant. All the lathes and automatic machines are made with special attachments for turning out the peculiar bearings, water-wheels, arms and other small parts accurately and in great quantities. The equipment includes furnaces for heating oil, lead baths for tempering and an elaborate testing bay for trying out each finished cleaner before allowing it to leave the factory. This testing department contains tanks, pumps and gages of proper size to subject every cleaner to actual working conditions. The cut-off valve department is devoted to the manufacture of a device placed in the steam connections of boilers for automatically stopping the passage of steam in either direction in case a steam main bursts or a boiler tube gives way.

VERTICAL CROSS COMPOUND ENGINE FOR THE BRISTOL TRAMWAYS, BRISTOL, ENGLAND

The Bristol Tramways & Carriage Company, Limited, of London, operating the tramways of the city of Bristol, recently purchased, through its manager, Sir J. Clifton Robinson, an Allis-Chalmers vertical cross compound Reynolds-Corliss engine with cylinders 26 in. and 56 in. x 48 in. stroke. This unit will be installed in the central power station at Bristol to drive a 1000-kw, direct-coupled, direct-current generator. The engine, operating under 140 lbs. steam pressure, will develop approximately 1700 ihp. The fly-wheel to be provided will have a diameter of 20 ft. and weigh approximately 93,000 lbs. The Bristol station now contains four Allis-Chalmers vertical, cross compound engines, which are somewhat smaller than the new unit just purchased. They have cylinders 22 in. and 44 in. x 42 in., and are used to drive 550-kw generators. The engines now in the British station have been in continuous operation for eight years. Sir J. Clifton Robinson is also manager of the London United Tramways station, which contains three 22-in. and 44-in. x 42-in. vertical engines of the same size as those installed in the Bristol station, and two larger units with cylinders 26 ins. and 54 ins. x 48 ins., or about the same size as the new engine purchased for Bristol.

NEW ROLLING STOCK FOR NORTHERN TEXAS TRACTION COMPANY

The Northern Texas Traction Company, which owns all the present lines operated in Fort Worth in addition to the interurban line between Dallas and Fort Worth, recently placed an order, through Stone & Webster, general managers of the road, for ten grooveless post semi-convertible cars. These cars were delivered a few weeks ago by the G. C. Kuhlman Car Company, and were built under Brill patents. The majority of these semi-convertibles will run over the 5 miles of new track which was opened a short time ago in Fort Worth. The total mileage of the system is now 72 miles, over which about one hundred cars are run.


SEMI-CONVERTIBLE CAR FOR TEXAS

The illustration shows one of the new cars when operated as an entirely closed car. The principal dimensions of the car are: Length over end panels, 21 ft., and over vestibules, 30 ft. 5 ins.; width over sills, including plates, 7 ft. 8½ ins.; over posts at belt, 8 ft.; height from floor to ceiling, 8 ft. 4⅜ ins.; from track to under side of sills, 2 ft. 2⅝ ins.; size of side sills, 3⅜ ins. x 5 ins.; end sills, 3½ ins. x 8⅜ ins.; sill plates, 15 ins. x ⅜ in. The car bodies are carried on the No. 21-E truck with 7-ft. 6-in. wheel base; two motors, of 40-hp capacity each, were installed on each car. The interiors, which are of cherry, contain transverse seats of rattan, and numerous specialties of the same builder are incorporated in the equipment.

DETAILS OF THE ELECTRIC EQUIPMENT OF THE DETROIT RIVER TUNNEL

Six 100-ton direct-current locomotives of the swivel truck type, with two 280-hp geared motors to each truck, will comprise the initial equipment for hauling both freight and passenger trains through the tunnel being built under the Detroit River between the United States and Canada on the Michigan Central Railroad. The Sprague-General Electric multiple unit control system will be furnished and current taken from the third rail. Each locomotive will be capable of hauling a 900-ton train up a 2 per cent grade at a speed of 10 miles per hour. Automatic, high-speed air brakes will form a part of the equipment. The electrical equipment for the locomotives, as well as for the tunnel in general, will be furnished by the General Electric Company.

Power for operating the system will be purchased from the Detroit Edison Company and will be delivered to a sub-station at Detroit at a potential of 4400 volts and at a frequency of 60 cycles. At the sub-station two 1000-kw synchronous motor-generator sets will be installed for supplying direct current to the third rail. Each of these sets will consist of a 1000-kw, 4400-volt, three-phase, synchronous motor direct connected on a common base to a 1000-kw, 650-volt, compound wound, direct-current generator. A 15-kw, 125-volt exciter for the synchronous motor will be mounted on a shaft extension of each of the motor-generator sets.

A very complete electric lighting and electric pumping equipment forms a part of the project. The yards and approaches to the tunnel will be lighted by arc lamps, while the tunnel itself will be illuminated by incandescent lamps arranged on duplicate circuits. Alternating current from the main power supply at a frequency of 60 cycles will be used on the lighting circuits. To insure an uninterrupted lighting service the lighting circuits in the tunnels are so arranged that half the lamps in both tunnels will burn if, by chance, either of the lighting circuits in the tunnels should be broken. A single three-phase distributing circuit will run through each tunnel and from these circuits suitable connections will be made to step-down transformers. The secondaries of the step-down transformers will be interconnected with duplicate circuits for half the lamps in each of the tunnels.

No less interesting will be the equipment for keeping the tunnel dry. Five pumps will be provided in the tunnel, each pump drained by induction motor centrifugal pumps arranged in duplicate. The motors on the pumps will operate directly at 4400 volts, and the controlling circuits with compensators will be centralized in the sub-station. For indicating the amount of water in each pump, a float system will be provided having both visible and audible indicating devices.

At the sub-station a regulating storage battery will be provided to carry the fluctuations of the load. If the main power supply from the Detroit Edison mains should be interrupted, this storage battery will have sufficient capacity to operate the entire system for half an hour. In such an emergency, the lighting and pumping alternating-current equipment will be energized by 60-cycle alternating current from a 50-kw motor-generator set, the driving motor being supplied with current from the storage battery. Flexible switching arrangements will be installed to enable this interchange of power supply to be easily and quickly made.

The tunnel will replace the present ferry service between Detroit on the American side and Windsor on the Canadian side of the river. Two tracks will be laid in separate iron tubes 65 ft. beneath the surface of the river. The tubes will rest on beds of concrete, and will be planked by concrete walls. The electrified zone will be 3.6 miles in length and will comprise, with the yards, some 15 miles of single track.

PROGRESS ON THE ST. CLAIR TUNNEL ELECTRIFICATION

The tunnel under the St. Clair River between Sarnia, Ont., and Port Huron, Mich., owned by the Grand Trunk Railroad through the St. Clair Tunnel Company, will soon receive its electrical equipment, which will consist of six single-phase Westinghouse locomotives. The overhead system will be used, the transmission and service wires to be carried on bridge work supported by towers with concrete foundations, braced by steel rods imbedded in concrete, as shown in the accompanying illustration. The tunnel, which has been used for steam traction for many years, will be cleansed, the interior painted white and well lighted by electricity. A power house is being built on the St. Clair River, which will contain two turbo-generators of 2000 hp capacity.

Briefly, the tunnel consists of an approach on the American side some 2500 ft. long, the tunnel proper about 6000 ft. and the approach on the Canadian side, which is 3100 ft. long. Five steam locomotives of special design are now employed to handle freight and passenger trains in the tunnel, and daily they haul from 800 to 1600 cars.

THE TERMINAL YARD, SHOWING BRIDGES FOR CARRYING POWER AND SERVICE WIRES

On the afternoon of Saturday, May 25, the New York Electrical Society will visit the Port Morris power station of the New York Central & Hudson River Railroad Company. E. B. Katte, electrical engineer of the company, will address the party.

LEGAL DEPARTMENT*

STEAM RAILROADS AND STREET RAILWAYS

On various occasions attention has been called in this place to different tests of negligence as between steam railroads and street railway companies. There are two recent cases turning upon the difference in positive functions to be discharged by the agencies of transportation, respectively. In matter of Rochester, etc., Traction Co. (102 N. Y. Supp. 1112), the Fourth Appellate Division of the New York Supreme Court, overruling the action of the Railroad Commissioners, held that an application on the part of a trolley railroad company for a certificate that public convenience and necesssity required the construction of a proposed trolley road should be granted, although it appeared that the new road would parallel an existing steam railroad and the roads of other trolley lines to a considerable extent, and that, if established, it would injuriously affect such other roads. It was shown that a considerable portion of the territory to be covered had practically no railroad facilities, and a large number of people residing near the proposed new route had testified that the operation of such road would amount to a great public convenience. Such opinions were founded upon consideration of the infrequency of trains upon the railroads and the long distance necessary to be traveled to reach stations. The court gave weight to the fact that no witness residing along 104 miles of the proposed route expressed any contrary opinion.

The action of the court in this case is entirely commendable. The opposition to the granting of the certificate was obviously inspired by interested motives of existing companies. The gist of the reasoning is contained in the following extract from the opinion:

> The fact that the Erie Railroad Company proposes to electrify its road does not materially alter the proposition. That does not mean that it is to be converted into a street surface railroad, but, rather that the motive power for the transportation of passengers will be changed from steam to electricity. Regular trains, passenger and freight, will be run then, as now, but must be run on schedule time, and will only stop to take on or let off passengers at the regular stations. The passenger trains may run more frequently, but with all the changes suggested the people along the route will not have such facilities as is understood will be afforded by a street surface railroad.

This point brings out one of the essential differences between a steam railroad, even when electrified, and a street railway. The latter is supposed to accommodate casual passengers for short distances, stopping when and where the passenger pleases, and it would be highly unjust to ignore the necessity for this particular kind of public service, because, incidentally to affording it, a trolley road also carries passengers for longer distances, and thereby, to an extent, cuts into the business of a steam railroad company.

The other case above referred to was Spalding v. Macomb, in the Supreme Court of Illinois (80 N. E. 327), which also distinguishes the theoretical identity of steam railroads and street railways. The question was whether an additional and unauthorized servitude had been imposed upon a street, the fee of which, subject to the public easement, was owned by abutting owners, and as part of the reasoning against the defendant's contention that it was a street railway, and therefore that the construction of its roadbed did not constitute an additional servitude—as would concededly the construction of a steam railroad—the court said:

> Street railroads are generally understood to be only such as are constructed and operated in the streets of a city for the purpose of conveying passengers, with ordinary hand luggage, from one point to another along the line thereof. Whether the road be a street railroad or not will depend upon the character of its traffic. The bill alleges that this road is carrying not only passengers with ordinary hand luggage but practically freight of all kinds from one point to another on the street and from town to town along the entire line of the road. Under these allegations of the bill, admitted to be true by the demurrer, defendant in error cannot be held to be a street railway.

* Conducted by Wilbur Larremore, of the New York Bar, 32 Nassau Street, New York, to whom all correspondence concerning this department should be addressed.

CHARTERS, ORDINANCES, FRANCHISES

CALIFORNIA.—Municipal Corporations—Streets—Rights of Abutting Property Owners—Injury to Right to Use for Travel—Private Easements—Street Railways—Franchises—Use of Streets—Signal Towers—Eminent Domain—Condemnation of Land—Appeal—Discretion—Temporary Injunction — Denial — Review —Injunction — Preliminary Injunction—Remedies—Monetary Damages.

1. An injury to an adjoining property owner's right to travel from place to place on a street in front of his lot or elsewhere being one which he enjoys in common with the public, he is not entitled to maintain an action for damages or for an injunction for an injury to such right.

2. An owner of a lot adjoining a street has certain private easements therein, consisting of the right of ingress and egress, the right to receive light and air from the space occupied by the street, and the right to have the street space kept open, so that signs or goods displayed in or upon the lot may be seen by passers in order that they may be attracted as customers, etc., for injury to which rights the property owner is entitled to sue regardless of the number of persons who may suffer a similar injury to similar private easements appurtenant to other lots fronting on the street.

3. The granting of a franchise to lay street car tracks in a street, and to run cars thereon by electricity, did not confer the right to erect a signal tower in the street, at least without a showing that it could not be made of practical use if located on private property.

4. Where a street railway company placed a signal tower at the intersection of certain streets, to the injury of the private easements of an adjoining property owner, it was no answer to the railroad company's obligation to condemn private property for the location of such tower that the expense of such proceedings would be great.

5. The denial of an application for a temporary injunction pendente lite will not be reversed on appeal, unless there appears to have been an abuse of the trial court's discretion.

6. Where the damage or injury threatened is of a character which may be easily remedied if a temporary injunction is refused, or where the damage is chiefly monetary and the defendant is solvent, the injunction pendente lite may be properly refused.

7. Where one or the other of the parties to a suit will suffer by the granting or refusing of an injunction pendente lite, the inconvenience likely to be incurred by each, from the action of the court in granting or refusing the injunction, should be balanced, and the injunction should be granted or withheld accordingly.

8. Defendant street railway company erected a signal tower in a street nine feet from the plaintiff's property. The post alone interfered slightly with plaintiff's right of ingress and egress. It did not appear that the defendant was insolvent, and that full damages could not be recovered in the action; the court under the prayer for general relief being authorized in the final judgment to restrain the use of the tower and command its removal, unless the damage was paid or the right to retain the tower was obtained by condemnation proceedings. Held, that the refusal of an injunction restraining the use of the tower pendente lite was not an abuse of discretion.—(Williams vs. Los Angeles Railway Company (L. A. 1,676), 89 Pac. Rep., 330.)

INDIANA. — Eminent Domain — Procedure — Remote Damages—Statutes Requiring Fencing.

1. Damages resulting from danger to the person or stock of the owner of land from the construction and operation of a trolley line are too remote, uncertain, and speculative to be considered by the jury in fixing the amount of the owner's compensation for lands taken and for the depreciation in the value of the lands which will be damaged, but not actually taken, by the construction and operation of the proposed road.

2. Under acts 1903, p. 426, c. 227, interurban railroads are required to fence their right of way, and the danger to animals on the land adjoining, but not taken by them, will be only speculative, and should not be considered in determining the diminution of the market value of such land.—(Indianapolis & Cincinnati Traction Co. vs. Larrabee et al., 80 N. E. Rep., 413.)

ILLINOIS.—Eminent Domain—Damages—Injury to Property Not Taken—Evidence—Instructions.

1. Since the measure of damages to land not taken in proceedings to condemn land for an electric railroad right of way is the difference in the fair cash market value of the land before and after the construction of the road, the jury, in determining the amount of damages to land not taken, must deduct benefits actually enhancing the market value of the property, for such benefits are special and not general, though they are common to other property in the vicinity.

2. Where, in a proceeding by an electric railroad to condemn land for a right of way through a farm, the jury might find that the farm would be enhanced in value by reason of the operation of the railroad and that other farms in the vicinity would also be increased in value from the same cause, an instruction that the jury should not set off against damages to the land not taken any general benefits which the land would share in common with other land in the same vicinity, and that only such benefits as were special to the farm and not common to other farms in the vicinity could be thus set off was prejudicial to the railroad.—(Peoria, B. & C. Traction Co. vs. Vance et al., 80 N. E. Rep., 134.)

ILLINOIS.—Dedication—Statutory Dedication—Defective Acknowledgment — Equity — Pleading — Allegations as to Ownership of Fee in Street—Admissions by Demurrer—Street Railways — Commercial Railroads — Eminent Domain — Remedies of Landowners — Injunction — Laches — Equity—Pleading.

1. Law of Jan. 4, 1825, Sec. 3 (Rev. Laws III. 1828-29, p. 184), as to the making of town plats, required County Commissioners, before offering a plat for record, to acknowledge the same. Sec. 4 provided that, if a mistake were made in a plat of a town as to the acknowledgment, it should be the duty of the County Commissioners, or a majority of them, to correct the same. Held, that an acknowledgment of a town plat by two only of three County Commissioners was not a compliance with Sec. 3, and a plat so acknowledged did not convey the fee of the streets to the town.

2. A bill alleged that plaintiff was the owner of certain city property fronting on the street; that the original proprietors of the city caused plats of the same to be made; so that there was a common-law dedication of the streets marked on the plats, instead of a statutory dedication, and that thereby the fee in the streets remained in the original proprietors; that the city consented to the dedication; and that, by grants from the original proprietors, plaintiff had acquired title to the land in the street to its center. Held, that taking the allegations of the bill in connection with the plats and surveys, sufficient facts were set out so that a demurrer must be held to admit that plaintiff was the owner of the fee to the center of the street in front of his property.

3. Where a railway company did not limit its business to carrying passengers with ordinary hand luggage, but engaged in the transportation of practically all kinds of freight from one point to another on the street and from town to town along the entire line of its road, it was not a street railway.

4. Where a railway company constructs its road in a city street without first obtaining the consent of the owner of the fee, and without condemning such right of way, and operates its trains thereon, such use is an additional burden upon the owner of the fee, of which a court of equity, on a proper showing, can compel the removal of a mandatory injunction.

5. A railway company constructed its road in a city in December, 1903, without first obtaining the consent of the owner of the fee or condemning a right of way, but it did not appear when the road was first operated. In August, 1905, the owner commenced his suit to compel the removal of the railway from the street. Held, that plaintiff was not guilty of laches in not beginning suit at an earlier date.

6. The general rule is that the defense of laches to be available must be set up by plea of answer.—(Spalding vs. Macomb & W. I. Ry. Co., 80 N. E. Rep., 327.)

MASSACHUSETTS.—Street Railways—Remedy of Owners of Property Injured—Statutes—Construction—Eminent Domain—Taking Property—Streets—New Use—Validity.

1. A street railway company, changing the grade of a highway for the construction of its road in accordance with locations granted by the officers of a municipality, is not liable for damages to an abutting owner.

2. Rev. Laws, c. 48, Sec. 7, and chapter 51, Secs. 15 and 16 authorizing a person aggrieved by the relocation or alteration of a highway to petition for the assessment of his damages by a jury, etc., afford no relief to an abutting owner for injuries caused by a change of the grade of a highway made by street railway company for the construction of its road in accordance with locations granted by municipal officers.

3. A street railway, authorized by St. 1901, p. 388, c. 455, to construct its railway largely outside the limits of highways, which was empowered by the selectmen of a town to cross a highway below grade, without providing that abutting owners should be compensated for injuries sustained, is not liable to an abutting owner, either under St. 1906, p. 604, c. 463, pt. 3.

3. Sec. 47, relating to the liability of a street railway company crossing a public way, or under Rev. Laws, c. 112, Sec. 44, authorizing street railway companies, without payment of any fee, to open any road in which any part of its railway is located, etc.; the condition imposed on the company carrying the highway over its tracks on a bridge being reasonable and promoting the security of travelers on the highway.

4. The statute authorizing the selectmen of a town to permit a street railroad company, in the construction of its track, to change the grade of a street without making compensation to abutting owners injured thereby, is not unconstitutional, since such abutting owners, on the condemnation of their land for a public highway, received compensation for such injury, within Const. pt. 1, art. 10, providing that, when property is appropriated to public uses, the owner shall receive compensation therefor.—(Hyde vs. Boston & W. St. Ry. Co. et al., 80 N. E. Rep., 517.)

NEBRASKA. — Street Railways — Use of Streets — Permit — Conflict With Franchise.

An ordinance of a city, which requires street railway companies and other corporations holding franchises to use the streets of the city to file an application for a permit before entering upon and obstructing the streets, and which requires the applicant to file specifications of the manner in which the work is to be constructed and to fix the location thereof, and requires it to give bond to hold the city harmless for damages caused by the proposed work, and which gives the City Council power to grant or refuse such permit, is not invalid, as interfering with or violating the franchise rights of the company in the streets.

2. The court will not presume that under such an ordinance the city authorities will act arbitrarily or abuse their discretion, but will presume that the ordinance will be construed according to its legal effect, and that if the proper conditions are met the permit will not be refused.—(State ex rel. Lincoln Traction Co. vs. Frost, District Judge, 110 N. W. Rep., 986.)

NEW YORK.—Municipal Corporations—Use of Streets—Private Railway—Greater New York Charter—Board of Estimate and Apportionment—Powers—Obstruction of Street—Injunction—Right to Sue.

1. Laws 1891, p. 3, c. 4, as amended by Laws 1905, p. 1550, c. 631, to provide for rapid transit railways in cities of over 1,000,000 inhabitants, provided (Sec. 5) that consent of the Board of Estimate and Apportionment and the Mayor, without the consent of the Common Council, Board of Aldermen, or other board or officer of the city, should be the only consent of local authorities required for the establishment of a route chosen by the Rapid Transit Commissioners. Greater New York Charter, laws 1901, p. 107, c. 466, Sec. 242, as amended by laws 1905, p. 1545, c. 629, provided that the Board of Estimate and Apportionment should thereafter, except in cases where franchises, rights, or contracts should be granted or authorized pursuant to rapid transit act, Laws 1891, p. 3, c. 4, and the amendment thereof, have the exclusive power on behalf of the city to grant franchises or rights involving the occupation and use of the streets and other enumerated public places within or belonging to the city for railroads, pipe, or other conduits or ways or otherwise for the transportation of persons or property or the transmission of gas, electricity, steam, light, heat or power. Held, that the purposes so enumerated were for the benefit of and in the interest of the public at large, and that the board had

no power to grant the owners of a department store a personal privilege to construct and operate a spur track in the street, to connect its store with a street railway, to be used exclusively for the transportation of its goods.

2. The owner of property adjoining such department store and abutting the street at the point where such spur track was intended to be constructed, whose means of ingress and egress would be seriously interfered with thereby, had sufficient capacity to sue to restrain the construction of such track.—(Hatfield et al. vs. Strauss et al., 102 N. Y. Sup., 934.)

NEW YORK.—Street Railways—Organization—Validation of Organization—Alteration of Route—Extension of Street Railway—Injunction.

1. Laws 1860, p. 16, c. 10, Sec. 1, provides that it shall not be lawful to lay or operate a railroad on any of the streets in the city of New York except under the regulations and restrictions which the Legislature may thereafter provide. Held, that after the passage of such act a corporation could not be organized under the general railroad law of 1850, and its amendments to operate a street railroad in the city of New York, nor could it be formed under the law without specifying in its articles the route of its projected road.

2. Where, after the passage of Laws 1860, p. 16, Sec. 10, relating to the incorporation of street railroads, an attempt was made to organize under the general railroad law of 1850, such organization could not be validated, nor could the corporation acquire a franchise to build a street railway in New York by an assignment to the corporation of a franchise given by Laws 1873, p. 1238, c. 825, nor could such railroad alter or change its route; the franchise being in the hands of the assignee subject to all the restrictions imposed on it by the act which granted it.

3. A change or alteration of route of a street railway is only permitted by general railroad law 1850 for the improvement of the lines, and not to extend it for the purpose of increasing revenues or to change its direction.

4. An abutting owner can maintain an action to restrain a street railway corporation from constructing an extension of its road in front of his premises on the ground that the corporation has not acquired the right to construct the same—Webb vs. Forty-second Street, Manhattanville & St. Nicholas Avenue Railway Company, 102 N. Y. Sup., 762.)

NEW YORK.—Street Railways—Pavement—Duty to Construct.

Laws 1890, p. 1112, c. 565, Sec. 98, as amended by Laws 1892, p. 1404, c, 676, provides that every street surface railroad corporation shall keep in repair that portion of the street between its tracks, and two feet in width outside thereof, under the supervision of proper local authorities. Held, that such section imposes on a street railway company the duty to keep in permanent repair the pavement of such portions of the streets occupied by them irrespective of any request or demand on the part of the local authorities.—(Schuster vs. Forty-second Street, Manhattanville & St. Nicholas Avenue Railway Company, 102 N. Y. Sup., 1054.)

NEW YORK.—Pleading—Supplemental Complaint—Appeal—Reversal—Law of Cace—Street Railways—Grant of Franchise—Conditions—Filing Bond—Failure to File Bond—Right to Equitable Relief.

1. Where, at the commencement of a suit by a street railroad company to restrain a town from granting to another company the right to use its strets, the company seeking the injunction had no cause of action because of its failure to file a bond required by the consents or franchises granted it by the town, plaintiff could not thereafter file such bond for the purpose of showing that at the comencement of the action it had a cause of action, and hence would not be permitted to plead the subsequent filing of such bond by supplemental pleading.

2. Under Code Civ. Proc., Sec. 603, providing that, when the right to an injunction depends on the nature of the action, it may be granted on a complaint showing plaintiff entitled to a judgment, an injunction may be granted only upon complaint, and, where a decree granting an injunction upon facts presented by the original complaint was reversed on appeal and remanded, and there was no supplemental complaint before the court, the injunction will be denied.

3. Where the consent granted by a town to a street railroad company to use its streets required the company to give a bond to be approved by the highway commissioners or trustees, the company was not entitled to an injunction to restrain the granting of such right to another company, unless the allegations of its complaint showed that the bond was given as required by the consent, and, where no time was stated therein for such filing, it will be presumed that the parties to the contract contemplated that they should be filed within a reasonable time, which, at the most, would not exceed the time within which the railroad was to be built by the terms and conditions of the consent.

4. Where a street railroad company to whom a town granted the right to use its streets on certain conditions had not, in fact, so constructed the road, the company was not entitled to the aid of equity to specifically enforce by injunction an implied negative provision in the consents denying the town the right to grant to another street railway company the right to use its streets.—(South Shore Traction Company vs. Town of Brookhaven et al. (two cases); Same vs. Village of Patchogue et al. (two cases), 102 N. Y. Sup., 1074.)

NEW YORK—Corporations—Consolidation of Street Railways—Effect on Contract Exemption From Paving Obligations—Conditions of Incorporation—Effect on Exemptions Enjoyed by Predecessor in Title—Dissolution—Sale of Capital Stock.

1. A contract exemption of a street railway company from paving obligations is not a "privilege" within the meaning of N. Y. Laws 1867, chap. 254, as amended by Laws 1879, chap. 503, empowering a railway company, being the lessee of the property of another railway company, to acquire the whole of the latter's capital stock, in which case its "estate, property, rights, privileges, and franchises" shall vest in and be held and enjoyed by the purchasing corporation "fully and entirely, and without change or diminution."

2. A street railway company incorporated under N. Y. Laws 1884, chap. 252, which imposed upon it the duty of paving a portion of the street, cannot claim the benefit of a contract exemption from paving obligations enjoyed by a predecessor in title.

3. A street railway company whose capital stock has been wholly acquired by a lessee corporation, pursuant to N. Y. Laws 1867, chap. 254, which, as amended by Laws 1879, chap. 503, provides that in such case the estate, property, rights, privileges, and franchises of the selling corporation shall vest in the purchasing corporation, to be thereafter controlled by the latter in its own name, cannot be regarded as still having a corporate existence which will enable the purchasing corporation to claim and enjoy, on behalf of the selling corporation, a contract exemption from paving obligations which the latter corporation enjoyed.—(Rochester Railway Company, Plaintiff in Error, vs. City of Rochester, 427 Sup. St. Rep., 469.)

OHIO.—Street Railways—Railroad and Highway Crossing.

An interurban railroad for the operation of cars by electricity and by the tractive friction resulting from their own weight is not within the act of Apil 25, 1901 (97 Ohio Laws, p. 546), "to provide how railroad and highway crossings may be constructed."—(Commissioners of Ross County vs. Scioto Valley Traction Company, 80 N. E. Rep., 176.)

MISCELLANEOUS

ALABAMA. — Pleading — Amendments — Declaration — Carriers—Ejection of Passenger—Complaint—Sufficiency—Election of Remedies—Designation of Conductor—Evidence—Res Gestæ.

1. Under the statute of amendments, any amendment which does not make an entire change of parties or an entirely new cause of action may be allowed.

2. A complaint in an action against a street railway by a passenger, alleging that plaintiff was wrongfully ejected from defendant's street car by defendant's conductor, motorman, etc., was properly amended by adding a count alleging that, while a passenger on one of defendant's cars, plaintiff applied to defendant's conductor for a transfer to another car, and was given a transfer so negligently torn off that it could not be used, and that by reason thereof the conductor of the other car ejected plaintiff therefrom.

3. The complaint as amended was not demurrable, since plaintiff, while not entitled to recover on the ground of a wrongful ejection, had a right of action for the breach of the contract to carry, or for defendant's negligence in not issuing a proper transfer.

4. Where plaintiff was ejected from defendant's street car, while a passenger thereon, because the transfer tendered by him to defendant's conductor had been so negligently issued by the conductor of one of defendant's other cars as to be worthless,

the fact that plaintiff might have sued for a breach of the contract of carriage did not deprive him of the right to sue in case for the negligence.

5. A complaint alleging that, owing to the negligence of one of defendant's conductors in issuing a worthless transfer, plaintiff, a passenger, was ejected from another of defendant's cars by the conductor thereof on tendering to the latter such transfer, sufficiently designated the conductor, without naming him.

6. Where, in an action against a street railway for negligently issuing to plaintiff a torn transfer ticket, on tendering which plaintiff was ejected from another of defendant's cars, one of defendant's witnesses testified that the transfers were cut by a mechanical appliance, which always cut a straight edge, a transfer issued simultaneously to plaintiff's companion, plaintiff having paid for both tickets at the same time, was competent in evidence, as a part of the res gestæ, to show how the ticket would have appeared if properly cut, and to aid in determining how it was torn.—(Montgomery Traction Company vs. Fitzpatrick, 43 S. Rep., 136.)

MISSOURI.—Street Railroads — Leases — Ordinances — Contracts Between Companies—Construction—Creation of Principal and Agent—Creation of Partnership—Operation—Companies and Persons Liable for Injuries.

1. A municipal ordinance authorizing enumerated street railway companies and their successors and assigns to severally sell, convey or lease their property rights, privileges, and franchises to any of the companies enumerated, or to a company designated its successors and assigns, and authorizing the company acquiring the property rights and franchises of the enumerated companies to hold the same during the term of the ordinance, authorizes a purchaser of the property and franchises of the enumerated companies to lease the same to the designated company without the special consent of the municipality, notwithstanding Const. art. 12, Sec. 20 (Ann. St. 1906, p. 309), forbidding a street railway transferring its franchise without first obtaining the consent of the municipality.

2. A street railroad company entered into a contract with another street railroad company, which recited that the former, in consideration of the covenants of the latter, leased its railways, etc. The contract devested the former company of the possession and use of its properties for 40 years in consideration of a specific rent to be paid by the latter company and the performance of other duties in the nature of rent, and provided for the restoration of the property to the former at the end of that term and for re-entry if the latter defaulted in the performance of its covenants during the term. The contract did not provide that the latter should conduct the business in the name or for the benefit of the former, except as in so far as the former was benefited by the consideration to be paid by the latter. Held not to establish an agency, whereby the former company was principal and the latter agent.

3. The contract did not make the two companies partners.

4. The contract was a lease.

5. A contract entered into by one street railway company with another street railway company provided that in consideration of the covenants made by the latter company the former leased its railway to the latter. The latter company agreed to pay an annual rental, to operate the railway of the former at its own expense and make the necessary repairs, to pay all the floating debts of the former, together with assessments of all kinds, and to apply all money not needed for current liabilities or interest turned over to it by the former, or on hand at the date of the lease, or received by the former thereafter from the rent of useless property to the improvement of the demised property. Held, that the former company was not bound to turn over to the latter company any money received by the former from any source, so that whatever rent the latter paid would not be repaid to it.

6. Since Rev. St. 1899, Sec. 1187 (Ann. St. 1906, p. 1001), expressly authorizes a street railway company to lease its property, and since section 4106 (Ann. St. 1906, p. 2252), provides that when technical words having a peculiar meaning are used in a statute they shall be understood according to their technical import, a street railroad company leasing its property and franchises to another street railroad company is not liable for an injury to a passenger resulting from the negligence of the employees of the latter company; the word "lease" importing a contract by which one person devests himself and another person takes possession of property for a term.—Moorshead vs. United Railways Company of St. Louis et al., 100 S. W. Rep., 612.)

NEW JERSEY.—Master and Servant—Torts of Servant—Assault and Battery—Scope of Employment.

In a suit brought against a construction company for assaults committed by its employees upon the plaintiff, upon whose lands, fronting a city street, the company was engaged in erecting, without her consent, a trolley pole for a street railway then in course of construction, it appeared at the trial that the erection of such pole upon plaintiff's premises was an illegal act, and that the employees of defendant company, while so engaged, under the direction of its engineer, formed a circle about the place where the pole was to be set up to protect those engaged in the excavation; and that when plaintiff attempted to go through the circle, in order to prevent the digging and tearing up of her pavement, she was resisted by the men in line, who struck, pushed, or jostled her in such a way as to cause hurts and bruises upon her person. The trial judge charged, among other things: That the placing of the pole on plaintiff's land was an illegal act; that plaintiff did what she had a right to do, if she saw fit, to try to use sufficient physical force to prevent the trespass; that the mere placing of hands upon plaintiff gave her a right to a verdict for nominal damages merely, if no injuries resulted. Upon review, held:

(1) That under the evidence the defendant company was liable for these acts of its employees, as being within the scope of their employment.

(2) That this result was not defeated, because it was testified by one of the employees that, in laying his hands upon the plaintiff, it was done with humane purpose only to save her from impending danger; the principle being that what is essentially a trespass cannot become lawful because having been done with good intent.—(Moore et al. vs. Camden & T. Railway Company et al., 65 Atl. Rep., 102.)

NEW YORK.—Railroads—Construction—Requisites to Exercise of Powers—Application for Certificate of Necessity.

1. Railroad Law, Laws 1892, p. 1395, c. 676, as amended by Laws 1895, p. 317, c. 545, paragraph 59, provides that no railroad company shall begin the construction of its road until the board of railroad commissioners shall have certified that public convenience and necessity require the construction of the road as proposed in its articles of association, and that after the refusal of such a certificate the directors of the applicant may present the application to a term of the Supreme Court, which shall have power in its discretion to order the board to issue the certificate. Held that, on an application to the court under the statute, the burden is not upon the applicant to show affirmatively that the commissioners committed error in their determination, but the matter comes before the court as an original application to be determined on the record made before the board of commissioners, if the parties so elect, or upon such further evidence as the court may deem essential.

2. On an application to the court under the statute, great weight should be given to the decision reached by the board of commissioners.

3. An application to the court, under the statute by a corporation organized to construct a trolley road, should not be denied, though the proposed road will parallel constructed steam railroads and reduce their earnings.

4. Where, on an application to the court under the statute, it appeared that the proposed trolley road practically paralleled a steam railroad, and the roads of other trolley companies to a considerable extent, and that if established it would injuriously affect such other roads, but it was shown that considerable portions of the territory in question had practically no railroad facilities, and a large number of people residing in close proximity to the route of the proposed road testified unqualifiedly that the operation of the road was a public convenience and necessity, and it was shown that such opinions had foundation in the infrequency of trains upon the railroads, and the long distances which it was necessary to travel to reach stattions on such roads, and that no witness residing along 104 miles of the proposed route expressed any contrary opinion, notwithstanding that certain experts testified to the contrary, the facts called for the granting of a certificate.—(In re Rochester C. E. Traction Company, 102 N. Y. Supp., p. 1112.)

NEW YORK.—Carriers—Carriage of Passengers—Ejection From Car.

Though the statute imposes a penalty on any carrier failing to give a pasenger a transfer to which he is entitled, where a passenger received a transfer which showed that it had then expired, but on calling the conductor's attention to the fact he

was assured that it was all right, but the second conductor refused to take it, and on the passenger's refusal to pay fare ejected him from the car, plaintiff was not entitled to recover for the ejection.—(Nicholson vs. Brooklyn Heights Railroad Company, 103 N. Y. Supp., 310.)

NEW YORK.—Carriers—Transportation of Passengers—Transfers—Publication of Rules.

1. Under Railroad Law, Sec. 105 (Laws 1890, p. 1114, c. 565), imposing a penalty for failure of street railroad companies to give transfers, a regulation fixing one point in each trip at which a passenger wishing a transfer must demand it is reasonable and valid.

2. Where a city railroad company gives transfers good at any transfer point, or permitting the passenger to continue to the end of the line without paying an additional fare, a regulation requiring a passenger to demand his transfer at the time of paying fare is reasonable and valid.

3. Where a city railroad company posted conspicuously, and advertised in such a manner as to bring to the notice of the public generally, a rule requiring passengers to demand transfers at the time of paying fare, it is immaterial whether a particular passenger had knowledge of the rule.—(Ketchum vs. New York City Railway Company, 103. N. Y. Sup., 486.)

NEW YORK—Carriers—Street Railroads—Transfers—Long and Short Service Cars.

Under Railroad Law, Laws 1892, p. 1406, c. 676, Sec. 104, requiring a street railroad company to give a passenger a transfer entitling him to a continuous trip to any point of any road in its system, where it runs short-service and long-service cars over the same line, it must give a passenger on a short-service car a transfer entitling him to a ride over the remainder of same line on a long-service car from the terminal point of the short-service cars.—(Baron vs. New York City Railway Company.)

RHODE ISLAND.—Carriers—Ejection of Passengers—Transfers—Rules of Company—Damages.

1. Where a passenger on a street car line presented a valid transfer, which the conductor refused to honor, and, as the passenger refused to pay fare, ejected him from the car, he was entitled to recover damages for the ejection; it not being necessary for him to pay his fare, and then resort to an action to recover it back.

2. Where a street car company, according to its rules, issues transfers from and to certain lines, and the passenger presents a transfer which is not honored by the conductor, and the passenger is ejected, it is no defense to an action for the ejection that the statute does not require the issuance of a transfer between the particular lines in question.

3. In an action by a passenger against a street car company for ejection from a car after presentation of a proper transfer, it appeared that a rule of the company required the giving of tansfers between the two lines in question, but that when the rule was made the cars on the two lines ran in such directions that the point of intersection was other than the intersecting point at the time of the ejection, but it appeared that transfers had been habitually given at the new intersection. Held, that a contention that, under the circumstances, the rule was not applicable, and no transfer required, was without merit.

4. Where, in an action for the ejection of a passenger from a street car after he had presented a valid transfer, it appeared that plaintiff had previously had trouble in regard to transfers at the point in question, and had been assured by the officers of the carrier that he was right in his demands, and that transfers should be honored, a verdict for $175 was not excessive.—(Arnold vs. Rhode Island Company, 66 Atl. Rep., 60.)

LIABILITY FOR NEGLIGENCE

CONNECTICUT.—Carriers—Street Railroads—Loss of Baggage—Liability—Actions—Evidence—Sufficiency.

1. A street car passenger, to recover for the loss of her baggage, must show either that the carrier accepted the baggage under a contract express or implied, to carry and deliver it as a carrier, or that the loss was due to its negligence.

2. In the absence of a special agreement, a street railroad company does not assume control of such baggage as its passengers may bring with them into its cars.

3. Where a carrier does not take full possession of the baggage of a passenger, but the same remains under his control, the carrier, in the absence of a special agreement, does not assume the carrier's liability of an insurer, but becomes responsible only for failing to exercise reasonable care to protect the same from loss or injury.

4. In an action against a street railway for the loss of a passenger's baggage, there was no evidence that the railroad held itself out as undertaking to assume the control of baggage. The conductor was not requested to take the passenger's baggage into his charge, and he took it when it was handed to him, and placed it in the car within sight and control of the passenger, while assisting her. Held insufficient to justify a finding that the conductor assumed the custody of the baggage so as to render the railroad liable for its loss.

5. In an action against a street railroad for the loss of a passenger's baggage, it appeared that the first conductor in charge of the car assisted the passenger and carried her baggage into the car, and deposited it in a place where the passenger could see it. Nothing was said or done which led the conductor to believe that the baggage was intrusted to his care. The first conductor did not notify the second conductor that the baggage belonged to the passenger, and the second conductor observed the baggage, and a fellow passenger sitting near it, and he, on leaving the car, took it. Held insufficient to support a finding that the railroad was negligent in permitting the fellow passenger to take the baggage.—(Sperry et ux. vs. Consolidated Railway Company et al., 65 Atl. Rep., 962.)

INDIANA—Appeal—Presentation of Objections in Trial Court—Pleading—Complaint—Designation of Parties—Negligence—Trial—Directing Verdict—Street Railways—Injuries to Person on Track—Action—Instructions.

1. Where a complaint stated facts sufficient, so that a judgment rendered thereon would bar a second suit for the same cause, an objection to the complaint for the first time on appeal because it did not name defendants in the body of the complaint, though they were properly named in the caption, was unavailable.

2. Under Burns' Ann. St. 1901, Sec. 359a, making contributory negligence an affirmative defense, a peremptory instruction on contributory negligence can only be given in favor of plaintiff.

3. In an action against a street railroad for injuries sustained by plaintiff in a collision between his vehicle and a car, an instruction on contributory negligence, that if defendant suddenly and without warning increased the speed of its car, so that plaintiff could not by ordinary care avoid being struck by it, and that if the collision was wholly because of such increase of speed, plaintiff could not be guilty of contributory negligence, was proper, though the instruction did not state why the car started, nor include other circumstances which might have existed, nor was the instruction objectionable as a peremptory one.—(Indianapolis Street Railway Company vs. Coyner (No. 5,624), 80 N. E. Rep., 168.)

INDIANA—Master and Servant—Injuries to Servant—Defective Appliances—Pleading—Negligence of Master.

1. It is the duty of the master to exercise ordinary care to furnish or provide machinery and appliances reasonably safe and suitable for his employees, and to exercise a reasonable supervision in keeping them in a reasonably safe condition for use.

2. In an action for personal injuries while employed as a motorman, the first paragraph of the complaint alleged that it was necessary for the safe operation of the car and the safety of the employees in charge that the brake rod should be sound and in good condition; that at the time of the injury said brake rod was in a dangerous and defective condition, which was unknown to plaintiff, but was well known to defendant. The second paragraph was the same as the first, except that it stated that it was necessary that the brake rod should be of sufficient size and to stand the pressure of the brakes, and that said rod was defective, in that it was too small and insufficient to stand such pressure, which was unknown to plaintiff, but was well known to defendant, or could have been known by it by reasonable diligence. There was no charge that the rod was in a defective condition when placed in the car, but the theory was that it became defective by wear. Held, that no actionable negligence was alleged; it not being charged that defendant had knowledge of the defect a sufficient length of time to have repaired it.—(Kentucky & Indiana Bridge & Railroad Company vs. Moran (No. 20,946), 80 N. E., 536.)

INDIANA.—Appeal—Former Decision—Law of the Case—Disposition of Cause—Successful Reversals—Trial—Special Interrogatories—Conflict—Uncertain Verdict—Trial de Novo—Prejudice—Evidence—Weight and Sufficiency—Street Railways—Crossing Accident—Care Required—

Headlight—Contributory Negligence — Hearing — Instructions—Refusal Prejudice—Injuries to Travelers—Interrogatories—Answers—Harmless Error.

1. The decision of the Supreme Court in a given case becomes the law in the case in so far as it declares the law, but not as to matters not presented or decided.

2. The fact that a judgment in favor of plaintiff has been twice reversed on appeal will not prevent subsequent reversals, if it appears that defendant has been denied a fair trial and a correct application of the law to the facts.

3. In an action for injuries in a collision with a street car, an answer to an interrogatory, that defendant's motorman, because of a deliberate and willful purpose on his part, ran the car against the plaintiff, was in irreconcilable conflict with the answer to another interrogatory, that the motorman did not see plaintiff as he was about to cross the track.

4. Where a complaint for injuries in a street car collision contained two paragraphs based on simple negligence and one on an alleged willful injury, and it could not be determined from the answers to the interrogatories on what paragraph the general verdict was based, the answers to the interrogatories not being inconsistent with the general verdict on the first two paragraphs, defendant's motion for judgment on such paragraphs was properly denied.

5. Where there was no uncertainty or inconsistency in the verdict, a motion for a venire de novo was properly denied.

6. Where all of the paragraphs of a complaint were for the same injury, defendant was not harmed by the overruling of its motion to modify the judgment by indicating the paragraph on which the judgment was rendered.

7. Where plaintiff was injured in a collision with a street car which approached a street crossing at night at a high rate of speed without any headlight, plaintiff's positive testimony that he looked for the car as he approached the crossing, and did not see it, was not so unreliable as to require its rejection, though a numberf of other witnesses for both parties testified that they were able to see the car some distance away.

8. Where plaintiff approached a street railway crossing at night on a bicycle, he was not bound as a matter of law to stop, alight from his wheel, and look intently for cars before attempting to cross in order to relieve himself of the charge of contributory negligence.

9. A pedestrian crossing a street railway track at night is entitled to assume that the street cars would not be run at a reckless rate of speed over street crossings, and without any headlight.

10. The same degree of care is not required of persons crossing a street railway track as is required by travelers crossing steam railroads at crossings.

11. Plaintiff, as he approached a street railway crossing at night on a bicycle, saw a car pass in one direction and looked in the opposite direction for the approach of a car by which he was struck. He did not see such car, which was without a headlight, and endeavored to cross, believing that the noise that he heard emanated from the car he had seen pass the crossing. Held, that plaintiff was not negligent as a matter of law in failing to hear the noise of the car by which he was struck.

12. Where, in an action for injuries, the jury were properly instructed as to what proof was necessary to make out a case of negligent injury and also to make out a case of willful injury, defendant was not prejudiced by the refusal of an instruction that willfulness could not exist if negligence existed.

13. Where plaintiff was struck at night by a street car as he was crossing a street, proof that the motorman stood in the front vestibule of the car, where he could see in front thereof, and that there was no headlight on the car, was sufficient to show that the motorman had knowledge that the headlight was not burning.

MICHIGAN.—Street Railroads—Operation—Injuries to Person on Track—Contributory Negligence.

1. Whether plaintiff's decedent, who was struck by a car, was guilty of contributory negligence in going upon the track, held on the facts to be a question for the jury.

2. Even though one could see an approaching car, if in the exercise of common prudence he may reasonably think there is time to cross safely, he is not chargeable with negligence in attempting to do so.—(McQuisten vs. Detroit Citizens' St. Ry. Co., 110 N. W. Rep., 118.)

MISSOURI.—Street Railways—Injuries to Pedestrians—Negligence—Speed—Trial—Signals—Issue of Fact—Contributory Negligence—Last Clear Chance—Burden of Proof—Evidence.

1. Where, in an action for injuries to a pedestrian in a collision with a street car, all the witnesses agreed that the car was moving at about half speed, owing to the presence of numerous workmen on or near the track, and plaintiff contended that the car could have been stopped within 10 or 12 ft., a charge of negligence with respect to the rate of speed at which the car was running was not sustained.

2. Where, in an action for injuries to a pedestrian by being struck by a street car, all of the witnesses who were listening testified that the bell was rung prior to the accident, the statement of plaintiff, who was partially deaf, and was not listening, that he did not hear the bell, was no evidence on which to raise an issue of fact as to whether the bell was rung.

3. Plaintiff, a man 75 years old, and partially deaf, had knowledge that, owing to repairs on a street car track, cars going in both directions used the same track. Plaintiff approached the track several minutes before he was struck and stopped to watch the men at work. He stood on or near the track in which cars were being run, with his back to the south, until he was struck by a car approaching from that direction. Plaintiff neither looked nor listened for cars approaching from the south, and, if he had looked, he could have seen for a distance of five or six blocks. Held, that plaintiff was negligent as a matter of law.

4. Where plaintiff was clearly negligent in failing to observe an approaching car by which he was struck, the burden was on him, in order to recover, to show that the motorman was negligently indifferent to plaintiff's safety and failed to exercise the care of an ordinarily careful person in his situation, mere proof that the motorman committed an error of judgment being insufficient.

5. Where the motorman of a street car by which plaintiff was struck had no knowledge that plaintiff was deaf, and did not hear warning signals given, and would not step from the track until the car was only 6 or 8 ft. away from him, when the motorman, being then unable to stop the car, redoubled his efforts to warn plaintiff by vigorously clanging the bell, the motorman was not negligent, either in failing sooner to discover plaintiff's peril, or in the effort made after he realized it to avoid injuring him.—(Bennett vs. Metropolitan St. Ry. Co., 99 S. W. Rep., 480.)

MISSOURI. — Carriers — Passengers — Trespassers — Duty Toward Trespassers—Negligence—Damages—Loss of Services—Injuries to Minor Child—Instructions—Trial—Applicability to Evidence—Damages—Injuries to Child—Expenses for Nursing.

1. A boy boarding a street car with the consent of the gripman in charge thereof, who had no authority to grant the boy permission to ride on the car, is a tresspasser, and not a passenger.

2. A street railway company owes to a trespasser on a car the duty of exercising ordinary care to prevent injury to him while removing him from the car.

3. A boy twelve years old recklessly boarded a street car, while in motion, with the permission of the gripman. The conductor, while the car was in motion, ordered the boy to leave the car, and seized a broom and advanced toward him in a threatening manner, repeating the order to leave. The boy dodged, lost his equilibrium, and fell from the car. Held, that the company was liable for the injuries received; the act of the conductor being in disregard of the rule requiring him to exercise ordinary care to prevent injury to the boy.

4. Where, in an action by a parent for injuries to a minor child, the evidence showed the boy's age, that he lived at home, and the extent of his injuries, an instruction authorizing a finding for the value of the loss of the child's services was not erroneous.

5. A boy twelve years old boarded a street car with the permission of the gripman, who had no authority to permit him to do so. The conductor, while the car was in motion, ordered the boy to leave, and seized a broom and advanced toward him in a threatening manner, repeating the order. The boy dodged, lost his equilibrium, fell from the car, and was injured. Held, that the court properly refused to charge that, as the boy was not a passenger, it was the duty of the conductor to prohibit him from riding, and, if the boy stepped from the car at the command of the conductor, there could be no recovery, for the act of the conductor was in violation of the rule requiring him

to exercise ordinary care to prevent injury to the boy, though he was a trespasser.

6. The instruction was properly refused, because of want of evidence to support it.

7. A parent, suing for injuries to a minor child, is entitled to recover for the services of himself and family in nursing the child, though there is no evidence of the value of such services; the presumption being that the jury are reasonably familiar with the value thereof.—(Drogmund vs. Metropolitan St. Ry. Co., 98 S. W. Rep., 1091.)

NEW YORK.—Carriers—Injuries to Passenger—Evidence—Sufficiency—Municipal Corporations—Defects in Street—Injuries—Appeal—Review—Questions of Fact—Findings by Court—Injuries to Passenger—Evidence—Admissibility.

1. In an action against a street railway for injuries to a passenger owing to her having stepped into a hole in a street when alighting from a car, the facts held to sustain a finding that defendant was negligent.

2. In an action against a city for injuries to one who stepped into a hole in a street, evidence held to sustain a finding that defendant was negligent.

3. Where, in a cause tried to the court without a jury evidence was heard on behalf of both parties, though it appeared by the return on appeal that the court rendered a judgment of "non-suit," it must be treated on appeal as a judgment on both the law and the facts, as if rendered on the verdict of a jury.

4. In an action against a city and a street railway company for injuries sustained by plaintiff owing to her having stepped into a hole in the street on alighting from a car, it was not error to exclude the testimony of a witness that conductors on former occasions had warned her to look out for the hole.—(Miller vs. International Ry. Co. et al., 102 N. Y. Sup., 254.)

NEW YORK.—Master and Servant—Injuries to Servant—Safe Appliances—Street Railways.

In an action for injuries to a motorman, it appeared that plaintiff's car had been equipped with a new plow, a device passing through the slot rail to take up the electric current, that his car was a light one, and that it stopped suddenly, whereby he was injured, but that he succeeded in starting the car, and on a subsequent trip discovered that at the point where the car stopped the slot rail was closed up for about 2 feet, so that the opening was about a half an inch wide, whereas, elsewhere it was about three-fourths of an inch. It was shown that the plow was half an inch wide, and that, if the car had been a heavy one, or if the plow had been worn slightly, there would have been no trouble. It did not appear that plaintiff had any difficulty at such point thereafter. There was some evidence that an inspector had stated that there was a defect in the slot rail in the vicinity of the accident. Held, that the evidence showed no negligence.—(McCann vs. Interurban St. Ry. Co., 102 N. Y. Sup., 296.)

NEW YORK.—Trial—Course and Conduct of—Remarks of Judge—Instructions Invading Province of Jury.

1. Where plaintiff's physician, on cross-examination in a personal injury case, said that he hoped plaintiff would in time be able to walk without a cane, a remark of the judge: "You expect what is probable. Your hope may be very improbable"—was not error, on the ground that it showed bias for plaintiff.

2. Where plaintiff was injured in attempting to get on a street car, and the evidence was conflicting as to whether or not the car was moving, and, if so, whether slowly or at the rate of 3 or 4 miles an hour, it was error for the court to instruct that the jury must either find that the car was not moving or was moving at the rate of 3 or 4 miles an hour.—(Devlin vs. New York City Ry. Co., 102 N. Y. Sup., 430.)

PENNSYLVANIA.—Carriers—Injury to Passenger—Pleading and Proof—Variance—Appeal—Assignment of Error—Sufficiency.

1. Plaintiff alleged in her statement of claim that, while a passenger in a street car in passing down the aisle, she fell into an opening in the floor of the car, and testified that her movement was affected by the sudden starting of the car. The statement of claim did not allege any negligence in that respect. Held, that there was not sufficient variance between the statement and the proof to defeat the action.

2. An assignment of error to the admission of evidence will not be reviewed where the page of the paper book where the matter may be found is not referred to.—(Cameron et al. vs. Citizens' Traction Co., 65 Atl. Rep., 534.)

TEXAS.—Street Railroads—Action for Injuries—Sufficiency of Evidence—Operation—Injuries to Persons on Track—Duty on Seeing Person on Track—Damages—Permanent Injuries and Future Expenses—Pleading—Amendment—Right to Amend—Discretion of Court—Injuries to the Wife—Loss of Society—Measure.

1. In an action for injuries sustained by reason of plaintiff's wife being struck by an interurban car, evidence examined, and held to sustain a judgment for plaintiff.

2. A motorman upon discovering the perilous position of a person upon a trestle must use every means then reasonably within his power, consistent with safety to himself and others on the car, to avoid running such person down.

3. If a motorman, upon discovering the perilous position of a pedestrian upon a trestle, could not, in the exercise of ordinary care, have foreseen or anticipated that the pedestrian would not probably leave the track in time to avoid injury, the railway company is not liable for injuries sustained by the pedestrian in being run down.

4. Where, in an action for injuries received by being run down by interurban car, it appears that the plaintiff, having been permanently injured, will necessarily have to expend money for medical or surgical treatment in the future, this fact may be considered together with the other circumstances in estimating damages.

5. It is within the discretion of the court to permit a petition to be amended where it will not occasion surprise to the other party.

6. Where a husband sues to recover for the loss of society of his wife caused by her injuries received through defendant's negligence, specific proof of the value of her society is not necessary, but, the loss of her society being established, the assessment of damages is within the sound discretion of the jury.—(Northern Texas Traction Co. vs. Mullins, 99 S. W. Rep., 433.)

TEXAS.—Trial—Instructions—Necessity for Request—Further Instructions—Damages—Personal Injuries — Negligence—Injuries—Contributory Negligence—Instructions—Carriers—Injury to Passenger—Evidence—Evidence at Former Hearing—Absent Witness—Preliminary Proof—Sufficiency.

1. In an action by a mother for injuries to her minor son, an instruction authorizing the allowance to plaintiff of such damages as would constitute reasonable compensation for the boy's services, if any, which plaintiff would probably be deprived of by reason of the boy's inability to labor for her prior to his majority was not erroneous for failure to authorize a deduction of a fair discount because of a present payment for such loss of service, in the absence of a request for further instruction as to the right to such deduction.

2. In an action for injuries to a child, the court charged that the burden of proof was on the plaintiff to establish by a preponderance of the evidence that the alleged accident, if any, was caused by defendant's negligence as alleged by plaintiff, and that, if that had been done, the burden shifted to defendant to show that the accident was caused by the contributory negligence of plaintiff's son. Held that such instruction was not objectionable as requiring defendant to prove that the accident was not caused by its negligence, nor as requiring defendant to show, by a preponderance of the evidence, that it was caused by the contributory negligence of the son.

3. In an action against a street car company for injuries to plaintiff's son, defendant alleged that he was injured by his own negligence in that he negligently hung his foot down from the running board whereupon it was caught by the wheel of the car, or that he recklessly and negligently jumped from the running board and back to the running boarl while the car was in motion, and in so jumping threw his foot in front of the wheel and in some manner it was injured. Held that an instruction that if the boy's negligence caused or contributed so directly and proximately to the accident as alleged by defendant in its answer, and that but for his own negligence he would not have been injured, defendant was not liable, etc., was not objectionable as imposing too great a burden on defendant.

4. Where the transcript of the testimony of a witness, who was beyond the jurisdiction of the court, was offered and excluded, but the bill of exceptions did not show that any offer was made to prove the correctness of the transcript by the testimony of the stenographer who took it down, no error was disclosed.—(El Paso Electric Ry. Co. vs. Kitt, 99 S. W. Rep., 587.)

FINANCIAL INTELLIGENCE

WALL STREET, May 15, 1907.

The Money Market

The feature of the money market during the past week has been the increasing demands for fresh capital on the part of railroads and other corporations. Following the decision of the Atchison directors to issue about $26,000,000 5 per cent convertible bonds, comes the announcement that the Southern Pacific Company will issue $36,000,000 new preferred stock, and that the Union Pacific will issue $75,000,000 4 per cent bonds, the latter being convertible into common stock at 175 at any time within three to five years. In addition to the above several other flotations were announced during the week but the amounts were comparatively small. As yet these borrowings have not been reflected in any decided hardening of money rates, but the point is made that the bulk of the payments for the Harriman issues will fall due at a time when the outflow of money to the interior for crop-moving purposes will be well under way, and which may result in more or less disturbance in the money market at that time.

The market during the week has been somewhat firmer in tone, rates for time loans ruling about ¼ per cent above those prevailing at the close of last week. The firmer tendency was due largely to an increased demand from stock houses and to the reports that the Secretary of the Treasury would call in part of the $30,000,000 special deposits made with the banks last winter. Although no definite information has been received regarding the Secretary's intention, it is believed in banking circles that part of this money will probably be called in should the present easy conditions of the market continue. Other factors working in favor of higher rates were the reports of further heavy borrowings by corporations in the near future. Since the beginning of the week the banks have gained about $300,000 from the Sub-Treasury as compared with a loss of $500,000 in the corresponding period of last week. Government disbursements for pensions, etc., will be larger from now on, and will undoubtedly be reflected in the cash holdings of the New York banks. A favorable development has been the weakness in sterling exchange, rates for prime demand bills declining sharply to a point which eliminate all possibilities of exports of gold to Europe. Money on call has loaned at 3 and at 2 per cent, the average rate for the week being slightly in excess of 2½ per cent. Time money, as stated above, has ruled slightly firmer; sixty-day money, which a week ago was available at 3¾ per cent, now commands 4 per cent, while four and six months money has loaned at 4½ and 4¾ per cent, respectively. The European money markets remained easy. The Bank of France continues to draw gold from London, and it is not likely that the Bank of England or the Bank of France will reduce the official rates of discount until the latter institution has recovered all of the gold sent to London earlier in the season.

The bank statement published last Saturday was rather favorable, inasmuch as loans decreased more than $14,000,000, and deposits fell off $16,180,800. Cash decreased $2,383,600, but as the reserve required was $4,045,200 less than last week the surplus reserve of the banks was increased by $1,661,600. The surplus now stands at $8,486,225, as against $12,894,600 in the corresponding week of last year, $12,712,575 in 1905, $12,827,250 in 1904, $8,992,625 in 1903, $8,346,525 in 1902, $8,127,475 in 1901 and $15,332,725 in 1900.

The Stock Market

There has been no decided change in the stock market during the past week. Trading was upon a somewhat smaller scale and prices moved with considerable irregularity. Speculation continued largely professional, the volume of commission house business indicating a very small public interest in the market. During the first half of the week prices yielded rather sharply, but the early depression was followed by sharp recoveries from the low levels, due chiefly to the coverings by shorts. The principal influences were the unfavorable crop reports and apprehension regarding the immediate future of the money market. The private reports of damage to the winter wheat crop received early last week were fully confirmed by the Government report made public on the 10th. According to the Government figures the area of winter wheat remaining in cultivation on May 1 was about 28,132,000 acres. This is 11.2 per cent, or about 3,533,000 acres less than the area sown last autumn, and 5 per cent, or about 1,468,000 acres less than the area of winter wheat reported as harvested last year. The average condition of the growing winter wheat crop on May 1 was 82.9, as compared with 89.9 on April 1 last, 90,9 on May 1 last year, and 92.5 on May 1 two years ago. The publication of the report was followed by a violent rise in wheat, prices for the nearby options advancing to the highest prices in two years. Sentiment was chilled also by the heavy demands for fresh capital by corporations, but as yet their borrowings have not been reflected in any decided hardening in the rates for money. Underlying conditions, however, continue sound. Business all over the country is active. The traffic managers of the Eastern and Western lines report a heavy movement of freight; railway traffic returns are good, those for the first week of May coming to hand showing gratifying increases over the corresponding period of last year. Activity in the iron and steel trade continues, the sales of iron the last week for del[illegible] during the last half being more numerous than in any we[illegible]ng the year.

The local traction stocks moved in sympathy with the general market. Early weakness was followed by sharp recoveries in prices, due to short covering on the belief that the early passage of the utilities bill had been pretty well discounted.

Philadelphia

Very little interest was manifest in the local traction issues during the past week. Dealings were upon a reduced scale, but apart from Philadelphia Rapid Transit, which was again under pressure, the general tone of the market was firm. Philadelphia Rapid Transit was again the prominent feature of the trading, both as regards activity and price movements. During the early part of the week it displayed firmness, advancing to 25⅝ on purchases by commission houses, but subsequently selling developed which carried the price off 1⅜ to 24¼. In all about 7500 shares were traded in. In some of the less active issues, however, pronounced strength was displayed. Consolidated Traction of New Jersey advanced to 74 on light purchases, and Union Traction, after selling at 59⅝ rose to 60. Philadelphia Company common advanced from 43½ to 44. Other transactions included Philadelphia Traction at 94 and 93¼, American Railways at 49½, United Companies of New Jersey at 250, Inter-State Railways at 136, and Lehigh Valley Transportation preferred at 23.

Chicago

There were no important developments in the local traction situation during the past week. While the deposits of stock of the Chicago Union Traction Company have been rather light thus far, there is no doubt that the required two-thirds of the capital stock of the company will be deposited before the time expires this week. Transactions during the week included City Railway at 107¼ to 108, Chicago Union Traction common at 4¾ and 2⅞ Metropolitan Elevated preferred at 77¼, and Northwestern Elevated at 23.

Other Traction Securities

Increased dullness was the principal feature of the traction issues at Baltimore. United Railway securities, which have figured prominently in the trading for some weeks past, were quiet. The 4 per cent bonds changed hands at 87¾ and 87½, while the incomes, after an early rise to 55, reacted to 54¼ on transactions aggregating about $50,000 bonds. The refunding 5s sold at 82½ and 82¼. The stocks were entirely neglected. Macon Railway & Light 5s sold at 94½, Knoxville Traction 5s at 105, and City & Suburban 5s at 109. In the Boston market prices continued to move with considerable irregularity. Boston Elevated broke from 137½ to 135, but subsequently recovered a point. Massa-

chusetts Electric common sold at 16 and 16½, but the preferred fell from 57½ to 56¼. Boston & Worcester ran off from 26½ to 26, but at the close it advanced to 26¾, and the preferred brought 72. West End common sold at 88 and 87½, and the preferred, after early weakness with sales as low as 103½, rose sharply to 105.

Security Quotations

The following table shows the present bid quotations for the leading traction stocks, and the active bonds, as compared with last week:

	May 8	May 15
American Railways	49¼	49½
Boston Elevated	a138	136
Brooklyn Rapid Transit	60⅜	60
Chicago City	180	180
Chicago Union Traction (common)	4½	3
Chicago Union Traction (preferred)	14½	13½
Cleveland Electric	51½	50
Consolidated Traction of New Jersey	74	74
Detroit United	70	70
Interborough-Metropolitan	24½	22½
Interborough-Metropolitan (preferred)	58½	56⅞
International Traction (common)	—	50
International Traction (preferred), 4s	—	71¾
Manhattan Railway	138½	138½
Massachusetts Elec. Cos. (common)	16	17
Massachusetts Elec. Cos. (preferred)	57	57½
Metropolitan Elevated, Chicago (common)	a26	23
Metropolitan Elevated, Chicago (preferred)	a65	63
Metropolitan Street	92½	—
North American	72½	72½
North Jersey Street Railway	40	40
Philadelphia Company (common)	44	43½
Philadelphia Rapid Transit	†25¼	24¼
Philadelphia Traction	94	93½
Public Service Corporation certificates	61	64
Public Service Corporation 5 per cent notes	92	94
South Side Elevated (Chicago)	81	83
Third Avenue	108	109
Twin City, Minneapolis (common)	94	94
Union Traction (Philadelphia)	59¾	59¾

a Asked. † Assessment paid.

Metals

According to the "Iron Age," Eastern steel makers have been heavy buyers of basic pig iron during the last two weeks, and sales during the movement thus far aggregate close to 100,000 tons. The market has hardened and some of the sales were made on the basis of $23 at furnace. There has been some lively buying in the Eastern territory of foundry iron, mostly in fair sized lots, which has strengthened the market and checked the downward tendency. Steel orders for 1908, already booked, foot up to 500,000 tons, and negotiations are under way for 100,000 tons additional.

Copper metal continues active and strong. Prices are unchanged at 25½c. for Lake, 25¼c. for electrolytic.

PAPER ON HEAVY ELECTRIC RAILROADING BEFORE THE INSTITUTE

At the annual meeting of the American Institute of Electrical Engineers to be held in the auditorium of the Engineers' Building, 33 West Thirty-Ninth Street, New York, on Tuesday, May 21, at 8:15 p. m., the following paper will be presented: "Some Facts and Problems Bearing on Electrical Trunk Line Operation," by Frank J. Sprague.

ANNUAL MEETING OF THE STREET RAILWAY ASSOCIATION OF THE STATE OF NEW YORK

J. H. Pardee, secretary of the New York State Street Railway Association, says that the details of the twenty-fifth annual convention of the association to be held at Hotel Champlain, Lake Champlain, June 25 and 26, 1907, are now being arranged, and that about June 1 full information will be available about the program, hotel accommodations, railroad rates and other matters of interest.

INTERBOROUGH RAPID TRANSIT EARNINGS FOR QUARTER ENDED MARCH 31

The income account of the Interborough Rapid Transit system as reported to the Railroad Commissioners (including both subway and Manhattan divisions) for the quarter and nine months ended March 31, 1907, compares as follows:

Jan. 1 to March 31:	1907.	1906.
Gross receipts	$6,031,899	$5,318,729
Operating expenses	2,496,657	2,171,396
Net earnings	$3,535,242	$3,147,333
Other income	233,711	206,786
Total income	$3,768,953	$3,354,119
Fixed charges	2,514,677	2,244,980
Surplus	$1,254,276	$1,109,139
July 1 to March 31:		
Gross receipts	$16,339,151	$14,405,428
Operating expenses	6,994,121	6,276,197
Net earnings	$9,345,030	$8,129,231
Other income	577,439	592,420
Total income	$9,922,469	$8,721,651
Fixed charges	7,218,791	6,539,411
Surplus	$2,703,678	$2,182,240

The separate income accounts of the subway and Manhattan divisions for the quarter and nine months ended March 31, 1907, compare as follows:

Manhattan Division.

Jan. 1 to March 31:	1907,	1906.
Gross receipts	$3,622,978	$3,266,088
Operating expenses	1,472,932	1,398,635
Net earnings	$2,150,046	1,867,453
Other income	117,953	98,691
Total income	$2,267,999	$1,966,144
Fixed charges	1,831,744	1,741,401
Surplus	$436,255	$224,743
July 1 to March 31:		
Gross receipts	$10,350,081	$9,363,848
Operating expenses	4,192,205	4,105,857
Net earnings	$6,157,876	$5,257,991
Other income	307,233	284,708
Total income	$6,465,109	$5,542,698
Fixed charges	5,389,685	5,276,094
Surplus	$1,075,424	$266,604

Subway Division.

Jan. 1 to March 31:	1907.	1906.
Gross receipts	$2,408,921	$2,052,641
Operating expenses	1,023,725	772,762
Net earnings	$1,385,196	$1,279,879
Other income	115,759	108,096
Total income	$1,500,955	$1,387,975
†Fixed charges	682,936	503,580
Surplus	$818,019	$884,395
July 1 to March 31:		
Gross receipts	$5,989,069	$5,041,578
Operating expenses	2,801,915	2,170,341
Net earnings	$3,187,154	$2,871,237
Other income	270,208	307,712
Total income	$3,457,362	$3,178,949
†Fixed charges	1,829,110	1,263,316
Surplus	$1,628,252	$1,915,633

†Includes rentals due city, which are measured by interest and sinking fund on city bonds issued for construction of Rapid Transit system.

RAPID TRANSIT MATTERS IN NEW YORK

The chief engineer of the New York Rapid Transit Commission has laid before that body a scheme for a tri-borough elevated and subway line from Pelham Bay Park to Fortieth Street in South Brooklyn, with possible extensions to Coney Island and Fort Hamilton, crossing the East River by the Manhattan Bridge, yet to be built, with projected spurs forming a loop to Brooklyn Bridge. It would be an elevated structure from Pelham Bay to 138th Street in the Bronx, and thence proceed under the Harlem and through a subway in Third Avenue and the Bowery, to emerge in crossing the bridge and continue underground on the other side. It would at first have only two tracks from One Hundredth Street to Twenty-Third Street, under Third Avenue and without sundry extensions and spurs contemplated for the future. The engineer's estimate is that it would cost $40,000,000 for construction in the course of three years, and when the whole project was completed the cost would reach $60,000,000. The report has been turned over to the committee on plans for consideration.

The Rapid Transit Commission has practically told Mr. Behr, who proposes to build a monorail system from the Atlantic Avenue Ferry, Brooklyn, to Coney Island, to prepare a proposal to the city for a franchise. Mr. Behr will have to satisfy the city with reference to his financial responsibility and give a guarantee as an evidence of good faith before bids will be asked for by the Commission. At the meeting of the Rapid Transit Commission the special committee reported on the application of Mr. Behr and his associates. The committee recites the application of Mr. Behr for the right to build a line to Coney Island from the foot of Atlantic Avenue, and thence through Rogers and Nostrand Avenues, Brooklyn, and points out that under the law no franchise can be given, but that it is possible to frame a route and general plan of construction and operation which would give Mr. Behr, in competition with others, an opportunity to offer for construction a road built according to his system.

Theodore P. Shonts, as president of the Interborough Company, refuses to make any concessions from what he wrote to the Rapid Transit Commission as to the terms on which the company is willing to undertake the construction of new subways, and in a letter sent Monday, April 13, to the president of the Commission, Alexander E. Orr, he reiterates these conditions in part, and intimates that the company is not willing even to consider the proposition to build subway extensions with its own money in return for franchises for additional tracks on the East Side elevated lines, as suggested by John H. Starin. In addition to writing to Mr. Orr. Mr. Shonts sent a letter to Edward P. Hatch, of the Retail Dry Goods Association, inviting that organization to make a thorough examination of the Interborough's books, with a view to learning whether or not the estimates submitted by the company to the Commission as to the cost of the existing subway and the estimated cost of new subways are correct. With Mr. Shonts maintaining the attitude assumed when the bids for new subways were to be submitted, and with the Commission unwilling to accept the offer made them, the transit situation is absolutely deadlocked, and will remain so until the new Public Utilities Commission comes into being, unless the present board makes some arrangement for the construction of the so-called tri-borough route, or at least part of it, as proposed by Chief Engineer Rice at the meeting last Thursday. Bids were opened Tuesday, May 14, in the office of the Rapid Transit Commission for the second section of the so-called bridge loop subway which is to connect the bridges crossing the East River. The city is to pay for the construction of the line and will lease it to an operating company on completion. Only two bids were received for this section of the work, which extends from Canal Street to Broome Street, under Centre. The bids were from the Cranford Company, of Brooklyn, and the Degnon Construction Company. The former concern's bid for the construction of the railroad was $2,150,000, and for the pipe galleries $60,000 additional. The Degnon Company bid $2,800,000 for the railroad and $75,000 for the construction of the pipe galleries. As in the case of the first section, extending from Pearl and Canal Street, for the construction of which the Degnon Company got the contract, the bids are somewhat higher than the estimates of the cost prepared by Chief Engineer George S. Rice. If the Cranford Company is awarded the contract for the second section the total cost of the two sections will be a trifle more than $5,000,000.

THE SITUATION IN CLEVELAND

Aside from the trial involving consents in Quincy Street and Central Avenue, nothing of very great interest has developed in the situation at Cleveland the past week. In Judge Philips' court the attorneys for the Cleveland Electric stated that the claim was made that the Forest City Traction Company had the consents of a majority of the property owners on those two streets when its franchise was granted. The same thing is claimed by the Low Fare Railway Company. If the Forest City did have the consents, then there is no possibility of the Low Fare Railway Company having a majority. Either the Forest City Traction Company must be declared an illegal corporation, or the Low Fare Company must be admitted to be without the necessary consents to give it a franchise. The decision of the court on this matter will go far toward the settlement of the final question as to the matter of consents, and will decide whether the Forest City Traction Company has any rights at all where grants have been made.

The Low Fare Railway Company, in an answer filed to the Isom injunction suit, states that there was an agreement between the property owners on Central Avenue and Quincy Street and the Forest City Railway Company that the consents could not be revoked, because a valuable consideration had been given for them. If the court should uphold this contention, the ruling might be against the Cleveland Electric, but it would place the Low Fare Company in a predicament as long as the Forest City Railway Company is in litigation on the allegation that the Mayor is financially interested in it, and this has practically been admitted. If, on the other hand, the court should not uphold the contention, then the work of securing consents would have to be repeated by the Cleveland Electric, as it followed the rule of agreeing to pay a certain sum per front foot for the consents, with the condition that it be given power of attorney for six years. Such a decision would leave the matter open for a new fight, it would seem.

Attorneys are of the opinion that the grants made to the Low Fare Company on the West Side last week are invalid, because that company did not have the proper consents. On the other hand, City Solicitor Maker has stated that the consents are not needed.

The work of tearing up the tracks on the two streets has proceeded rapidly the past week. It is said that President W. B. Colver, of the Low Fare Railway Company, has been negotiating with the officers of the Cleveland Electric for the joint use of the tracks, and in some places, separate use. While there may be something in the stories, they have not been confirmed at all. It is supposed that if the two companies can not agree upon a price for this use of tracks, the matter will be submitted to an arbitration committee of either one or three men.

The meeting arranged by Councilmen favorable to a settlement with the Cleveland Electric on Central Avenue and Quincy Street last Wednesday evening was broken up by a crowd, which, it is said, was made up of city employees. After the speakers had been howled down, one of the Mayor's henchmen took possession of the hall and conducted the meeting. The Councilmen had paid for the room to have a meeting at which they expected to get an expression from their constituents.

In Judge Phillips' court Monday, City Solicitor Newton D. Baker admitted that, if the Cleveland Electric has the consents of a majority of the property owners on Central Avenue and Quincy Street, the franchise of the Low Fare Company is not valid under the present construction of the law, but argued that the Supreme Court ought to review this law again. Power of attorney for six years goes with the consents the company secured and for this reason the Low Fare Company would be barred from the streets that length of time, should the court decide in its favor. The matter now hinges on the question as to whether the old company has sufficient consents to establish its claim. The Low Fare Company then sent a communication to the Council, proposing to rebuild the track on the two streets and operate 3-cent cars over the lines until the legal fight is ended. In return for the use of the tracks belonging to the Cleveland Electric, the company offers to pay 6 per cent interest on the value of the property, and, after deducting 6 per cent from the gross receipts for its own investment, turn the remainder over to the city, the portion of the tracks restored to go to the Cleveland Electric at actual cost if it wins

the suit. Or, the Low Fare Company agrees to restore the tracks and allow the Cleveland Electric to operate cars over the two lines at any fare it sees fit until the cases in court are settled free of charge. The tracks restored are to be sold to the Cleveland Electric or any other company declared to have the franchise on these streets.

The Council passed ordinances giving the Low Fare Railway Company joint use of the Forest City tracks on Fulton Road and Denison Avenue, and of the Cleveland Electric tracks around the Public Square.

On Wednesday, May 15, the Cleveland electric offered to rebuild the tracks on the abandoned streets and operate over them, pending the decision of the courts. If granted the franchise, seven tickets for a quarter will be given. The company further agrees to sell the equipment at cost if courts decide franchises of other companies are valid.

AFFAIRS IN CHICAGO

The estimate given the Chicago City Railway Company by the board of supervising engineers calls for the expenditure by the company of $16,000,000 to carry out the rehabilitation of its lines during the next three years. It is estimated that it will cost the Union Traction Company $24,000,000 to rehabilitate the service on the north and west sides. The board made its estimate for the South Side Company in response to the inquiry of President Thomas E. Mitten. The engineers reserved the right to call for the $16,000,000 as rapidly as the progress of the work warrants. It is considered likely that improvements costing between $4,000,000 and $5,000,000 will be completed within the next year. Bonds will be issued to cover the amount needed.

Dissatisfied with the refusal of the Chicago City Railway Company to grant their wage demands, a committee of car employees will call on President T. E. Mitten with a new petition. They will ask that a "specific" answer to each point in their demands be given by the company. President Mitten would not indicate whether he will consent to further negotiations with the employees. It is thought he will receive the committee and listen again to its arguments, but it is said that the probability of the company making any additional concessions beyond the 7 per cent increase already proposed is slight. In case President Mitten declines to treat with these employees, it is said, they will proceed under a clause in the existing agreement which binds both sides to submit differences to arbitration when they cannot be settled otherwise.

President F. H. Rawson, of the Union Trust Company, says regarding the traction situation: "We are getting the deposits as rapidly as I expected and I may say that I am satisfied with the results so far."

A call for the $624,900 of stocks of the Chicago West Division Street Railway Company guaranteed 35 per cent dividends by the lease between that corporation and the West Chicago Street Railway Company, has been issued by a committee of the following stockholders: Cyrus H. McCormick, Thomas Templeton, Charles W. Ware and John F. Bass. It is required that the Merchants' Loan & Trust Company be authorized to deposit shares of the company with the Chicago Title & Trust Company, as directed by the traction settlement ordinance and upon the approval of Chauncey Keep and Byron L. Smith.

The Northwestern Elevated's Ravenswood extension, to be opened the end of this month, is 3½ miles long and has eight stations. Work was begun last fall. The cost is $2,500,000. Loans were secured by the company's bonds. The Fortieth Street extension of South Side Elevated was begun nearly three years ago and is far from completion. This project, however, was handicapped badly by labor troubles.

Notice has been served on all the elevated road companies, except the south side line, that the employees will demand an increase in wages within the next thirty days. The Northwestern, Oak Park, and Metropolitan roads had agreements with the union, which expired May 1, and the men are working under a tentative arrangement until June 1. No fears of a strike are entertained, since the agreements in each case provide for arbitration.

The traction board has organized its work into various branches, as follows:

Division of trackage and roadbed, to carry out the reconstruction of the tracks under the direction of an assistant engineer.

Division of electrical power, to work out the problem of the distribution of the power required for the new system under the direction of an electrical engineer.

Division of power house construction, to supervise the building of new power houses if it is decided to manufacture instead of purchase current.

Division of cars and operation, to supervise the rehabilitation of all rolling stock and put into effect through routes and other service regulations.

Division of subways, to have charge of the construction of the underground street railway system as soon as authorized by the City Council, and in the meantime to supervise the rebuilding of the river tunnels in conformity with that plan.

Division of accounting and auditing, to have charge of all bookkeeping, including the division of receipts between the city and the company.

MEETING OF THE CENTRAL ELECTRIC RAILWAY ASSOCIATION

The following program has been adopted for the May meeting of the Central Electric Railway Association, to be held at Indianapolis, May 23:

10:30 a. m. Call to order.

11:30 a. m. The Issuing of Supplies. How to Prevent Leaks. Paper by S. R. Dunbar, purchasing agent Indiana Union Traction Company, Anderson, Ind.

AFTERNOON SESSION

2:00 p. m. Modern Train Dispatching. Paper by J. K. Gray, trainmaster Western Ohio Railway Company, Lima, Ohio. Paper by M. C. Stern, General Systems Company, Dayton, Ohio. Paper by J. B. Crawford, superintendent transportation, Fort Wayne & Wabash Valley Traction Company, Fort Wayne, Ind. Demonstration, Chauncy P. Button, general manager Telegraph Signal Company, Rochester, N. Y.

3:30 p. m. Report of committee on standardization. Report of committee on express contracts. General discussion.

CARS RUN IN SAN FRANCISCO

Cars are being run with increasing regularity in San Francisco. The early attempts made by the United Railways to resume operation were recorded last week. They were followed on Saturday by a service open to the public, which was quite liberal, considering the threatening attitude of the labor element and their sympathizers. On Saturday Governor Gillette came to San Francisco to investigate the strike situation and determine whether the calling out of the militia was required. The Governor held a conference with Mayor Schmitz and others, and received signed statements from President Calhoun, of the United Railroads, and President Cornelius, of the Car Men's Union, setting forth their respective sides of the controversy. Subsequently, the Governor and Mr. Calhoun had a private conference which lasted over an hour. As a result of this conference the Governor announced that he would judge the San Francisco situation by the acts of the people and would not hesitate a moment to call out the militia if rioting should be continued, had a sobering effect. Five hundred police guard the streets through which the cars run, but they have little to do. Isolated instances of misconduct are reported, but on the whole, the situation is quiet.

NEW YORK ASSEMBLY PASSES UTILITY BILL

By the unanimous vote of the members in attendance the Assembly, Wednesday, May 15, after a 3-hour debate, passed the public utilities bill in the form approved by Governor Hughes. The Democrats in the lower House made a general attack on certain features of the bill, and offered a dozen or more amendments, which were defeated by a strict party vote of 98 to 51. On the final roll call, however, they all fell in line with the Republicans and voted for the bill.

SURVEYS COMPLETED FOR BALTIMORE, FREDERICK & HAGERSTOWN LINE

Surveys for the line of the Baltimore, Frederick & Hagerstown Electric Railway, which have been in progress for several months, under the direction of Westinghouse, Church, Kerr & Company, of New York, are about completed. The line will be 52 miles long and will connect with the system of the United Railways & Electric Company, in Baltimore. The company was chartered several years ago with a capital stock of $15,000,000, and has a like amount of first mortgage 5 per cent bonds authorized. It is understood to be the intention of the company to issue only about $10,000,000 of its bonds at this time. The officers of the company are: James E. Ingram, Jr., Baltimore, president; J. Roger McSherry, Frederick, vice-president; Henry Coblentz, Frederick, secretary; Thomas H. Howard, Frederick, treasurer; Robert P. Graham, Baltimore, counsel; James E. Ingram, Sr., James E. Ingram, Jr., Thomas H. Haller, John C. Beasman, Frank H. Callaway, J. Roger McSherry, E. L. Coblentz and Robert P. Graham, directors.

The route from Baltimore to Hagerstown will be about 78 miles, and the original plans called for two tunnels—one at Braddock Heights, about 5 miles from Frederick, 4000 ft. long, and the other at South Mountain, about 6000 ft. long.

It is the intention of the company to move freight as well as passengers. The surveys which have been made between Baltimore and Hagerstown call for a low-grade line, and for this reason the impression has prevailed in some quarters that perhaps steam might be used as the motive power. President Ingram, however, says that these reports are not correct, and that the road will be operated entirely by electricity, and that freight as well as passengers will be carried.

The route surveyed between Baltimore and Frederick passes through a country, of which a considerable portion is at present without transportation facilities. This belt has on its south side the Baltimore & Ohio, and on its north side the Western Maryland. Its widest span between these two railroads is about 17 miles. The details of the route have not been announced, but it is said that the road will pass through several towns and villages, and that both private rights of way and turnpikes will be used between Baltimore and Frederick.

A deed of trust from the Washington, Frederick & Gettysburg Railroad Company to the Baltimore Trust & Guarantee Company to cover an issue of $400,000 worth of bonds on the Thurmont line was filed in Frederick recently.

The road has entered into a traffic arrangement with the Western Maryland whereby the latter's cars will be hauled from Thurmont to Frederick and return. This will enable the Western Maryland to get into Frederick and compete with the Baltimore & Ohio and Pennsylvania for local business.

THE TRAFFIC SQUAD IN STREET RAILWAY WORK IN NEW YORK

President Shonts, of the Interborough-Metropolitan Company, of New York, is an enthusiastic believer in the efficiency of the police traffic squad in helping in the handling of street railway traffic. Several times recently has he acknowledged the work these men are doing in the streets, and at the dinner of the men at the Waldorf on Saturday, again publicly commended them. Mr. Shonts asked for the continued co-operation of the men in working with the transit companies for the betterment of the service. The street car men are working along lines, with reasonable prospect of success, he said, which, when operative, would put them in a position to serve the public with greater safety and comfort than at present. He pleaded for the reasonable use of the surface car tracks by the company that owned them. He said that at present too many vehicles which are waiting, like Micawber, for something to turn up, are allowed to clutter the main streets, and that in many of the side streets long lines of trucks are allowed to back up against the curbs and to stop almost all sorts of traffic until their drivers got ready to get them out of the way. No matter how many subways may be built, he went on, the surface car lines will always have to take care of local and short-distance travel, and this traffic, he maintained, was entitled to every possible consideration, not so much for the transit companies, but for the general public.

PURCHASE OF TROLLEY LINES BY D. & H. CRITICISED

At the annual meeting of the Delaware & Hudson Railroad Company, held in New York May 14, several stockholders criticised the action of the company in purchasing the Hudson Valley Railway Company. It was said that the receivers of the line had valued the securities at $1,600,000, whereas the railroad company has paid $5,000,000 for the control of the property. President Loree, in reply, explained that the purchase had been made previous to his election to the presidency, and doubted the advisability of imparting detailed information until the whole transaction was closed up. He said, however, that the Company has acquired practically all the securities of that company and not merely of a controlling interest in them. He also said that such purchases had been forced upon the steam railroads as a matter of self-protection. When the New Haven began to acquire trolley lines, he pointed out, the New York Central regarded such acquisitions unnecessary in its own territory, yet was obliged a little later to do as the New Haven had done. The Delaware & Hudson pursued the same policy, he said, as it seemed the best way of protecting the road from costly competition, in addition to which the electric lines can serve as valuable feeders for the steam line.

CHANGES IN THE LANCASTER COMPANY

On May 6, as briefly noted in the last issue of the Street Railway Journal, a number of important changes were made in the management of the Lancaster County Railway & Light Company and constituent companies, the outcome of the purchase of the common stock by Bertron, Storrs & Griscom. George Bullock, president of the United Gas & Electric Company, of New York, succeeds W. W. Griest as president; R. E. Griscom, of Philadelphia, takes the place of Charles B. Keller as vice-president, and M. E. Dodge, of the firm of Bertron, Storrs & Griscom, was made secretary and treasurer in place of John S. Grabill, Jr. C. Edgar Fitzel, who has been superintendent, has been made manager and will have charge of all the lines. Mr. Bullock will visit Lancaster once a month to look after the company's interests.

At the annual meeting of the Conestoga Traction Company Mr. Keller presented his resignation as vice-president and also resigned the same office in the Lancaster Gas Light & Fuel Company, the Edison Electric Illuminating Company and the Columbia Electric Light, Heat & Power Company. Mr. Bullock was elected his successor in each company. Mr. Griest still retains the presidency of all these companies and the boards of directors all remain the same.

Mr. Keller's resignations were tendered on account of ill health, and the following resolution presented by P. B. Shaw was adopted:

"Whereas, Charles B. Keller announces his retirement as vice-president of the Lancaster County Railway & Light Company, the Conestoga Traction, the Edison Electric Illuminating Company, the Lancaster Gas Light & Fuel Company, and the Columbia Electric Light, Heat & Power Company,

"Therefore, Be it resolved by the respective boards of directors of these corporations, that a minute be made of the faithfulness, sterling integrity and great ability with which Mr. Keller served these corporations during a very critical period of their history.

"In behalf of the stockholders and directors, we extend to him the assurance of sincere appreciation for the manner in which his arduous duties have been discharged."

President Griest, on behalf of a large number of stockholders of the Lancaster County Railway & Light Company, then presented Mr. Keller with a costly and handsome Swiss gold watch of the latest pattern, which was inscribed as follows:

"To Charles B. Keller, from many friends, for faithful services. May, 1907."

The directors of the Conestoga Traction Company, which operates all the trolley lines, were as follows: Geo. Bullock, New York; R. E. Griscom, Philadelphia; J. C. Storrs, New Jersey; David A. Howe, P. B. Shaw, Williamsport; W. W. Griest, Charles B. Keller, Dr. T. C. Detwiler, R. H. Brubaker, P. E. Slaymaker, John Hertzler, J. Fred Sener, Dr. E. S. Snyder, J. W. B. Bausman, Lancaster, and H. C. Schock, Mount Joy.

LEGISLATION IN PENNSYLVANIA

All the efforts of the opposition to the State Railroad Commission and trolley eminent domain bills, prior to final adjournment of the Legislature, May 16, were confined to the members of the Senate, who will be compelled to bear the responsibility for any failure to fulfil the promises made in the Republican State platform last fall with respect to these two measures. When the Homsher eminent domain bill came up in the Senate on second reading, May 8, Senator Roberts, of Montgomery, offered several amendments, which were adopted without opposition. They provide that trolley companies before taking property for proposed lines must file two separate bonds as surety for damages. The original bill provides only one.

The following amendment offered by Walton was finally adopted and the bill passed on second reading:

Whenever the right of way of any street railway company authorized to exercise the right of eminent domain under this act shall cross private lands, the Court of Common Pleas of the county in which such lands are situated may upon petition of the owner of such lands, and proof of the necessity thereof, order and decide that said railway company shall properly fence in the right of way of said company and erect gates at all private ways and farm crossings and keep said fences and gates in good order and repair and shall file a bond with surety to be approved by the court for its faithful compliance with said decree.

Mr. Dunsmore, the father of the State Railroad Commission bill will have difficulty in recognizing his offspring in the bill as reported from the Senate railroads committee last week. The Pennsylvania and Philadelphia & Reading Railroad Company are quite well satisfied with the measure in its present form, inasmuch as the Commission will have no power to enforce its demands, but simply to suggest and advise the railroads. As amended, the proposed Commission is to have no power to fix rates or routes. It will not be vested with inquisitorial powers to ascertain the truth or falsity of complaints filed against railroads. It will not have the right to supervise increases in the capital or indebtedness of railroads. It will not be burdened with the duty of compelling railroads to increase terminal facilities, improve train service, etc. The Commissioners will be empowered to receive $8000 salary annually. This is not to be paid by the railroads as the bill originally provided. There are to be two Commissioners, in addition to the Secretary of Internal Affairs. There will be a secretary at $4000. All the expense of the Commission, including salaries, is to be borne by the State.

Entire sections of the original bill have been eliminated and one new section substituted. It reads as follows:

No railroad, electric railway or street railway corporation hereafter formed under the laws of this State, shall exercise the powers conferred by law upon such corporations or begin the constructions of its road until the directors shall cause a copy of the articles of association to be published in one or more newspapers in each county in which the road is proposed to be located, at least once a week for three successive weeks, and shall file satisfactory proof thereof with the State Commerce Commission, nor until the said commission shall certify that the foregoing conditions have been complied with; and also that public convenience and necessity require the construction of said railroad, electric railway or street railway as proposed in said articles of association.

The foregoing certificate shall be applied for within six months after the completion of the three weeks' publication hereinbefore provided for. If a certificate is refused no further proceedings shall be had before said commission, but the application may be renewed after one year from the date of such refusa..

Prior to granting or refusing said certificate the said commission shall have a right to permit errors, omissions or defects to be supplied and corrected. After a refusal to grant such certificate the said commission shall certify a copy of all maps and papers on file in its office and of the findings of the said commission when so requested by the directors aforesaid. Such directors may thereupon present the same to the Superior Court of this Commonwealth and said court shall have power in its discretion, to order said commission for reasons stated to issue said certificate, and it shall be issued accordingly. Such certificate shall be filed in the office of the Secretary of the Commonwealth and a copy thereof, certified to be a copy by the Secretary of the Commonwealth of his deputy, shall be evidence of the facts therein stated. Nothing in this section shall prevent any such corporation from causing such examinations and surveys for its proposed line to be made as may be necessary to the selection of the most advantageous route and for such purpose by its officers or agents or servants, to enter upon the lands or water of any person, but subject to the responsibility for all damages which shall be done thereto.

The new section is practically the same proposition which Senator Roberts tried to inject into the Homsher eminent domain bill. If it goes through in the Dunsmore bill, the Commerce Commission will have the right to determine whether trolley companies may have eminent domain.

Some Philadelphia Senators made an effort, but failed, to insert an amendment which would have exempted from the provisions of this bill the Philadelphia system, which is being established under the new trolley law. The Senate judiciary general committee negatively refuted the McCullagh initiative and referendum bill.

The Senate, on May 13, redeemed the Republican party pledge with respect to granting trolley companies the right of eminent domain by passing finally the Homsher bill practically as it left the House. The vote was 41 to 2. Attempts to amend the bill were defeated. On May 15 the House passed the bill without a dissenting vote. The bill is now ready for the Governor. That he will sign it is anticipated from his attitude toward the measure from the first.

The Governor, on May 13, had signed 153 bills and had several hundred others on his desk.

INDIANA VALUATIONS FIXED

The Indiana State Board of Tax Commissioners, having completed its preliminary hearing in the case of the public service corporations, has adjourned until July. The board will now fix valuations and notify the companies of its findings. At the next meeting the companies will be heard again, and then the final assessments will be fixed.

The following interesting excerpts are from the remarks made before the board by prominent traction and steam railroads:

Charles L. Henry, president of the Indianapolis & Cincinnati Traction Company: "The first expensive mistake the Indiana traction interests made was in constructing lines having in view the mere idea of transit between large cities and suburbs. It has been clearly shown that they are a means for through transit, and the old construction is not suitable for lines carrying long-distance traffic, and the companies are compelled to reconstruct their roadways. For this reason the taxes should not be so high as last year."

J. Levering Jones, representing the Ft. Wayne & Wabash Valley Traction Company: "Our lines showed a net increase in earnings of about 8 per cent, but that did not provide a surplus. If the net earnings of any of the roads should shrink 8 per cent it would mean receiverships. When a road shows a small increase it is not a sign of its prosperous condition. Wages have increased 5 per cent and material is much higher. The Indiana interurban roads are just now going through the transition from infancy to maturity, and the process is expensive. They were first built independently, each line with its own expensive management and individual power house. They are now being merged and the management simplified. This will prove their salvation and also a greater convenience to the public."

George F. McCulloch, representing the new line of the Muncie & Portland Traction Company, said the road had been constructed at a high cost. Poles that cost $7.85 each last year are worth $9.40; ties that were 56 cents are now 75 cents. Copper wire for the line would now cost the company $30,000 in excess of the price last year. Labor is $2 a day against $1.25 to $1.50 a year ago. For these reasons the line would not be extended to Celina, Ohio, he said. "The interurban people are living on hope," he continued. "Improvements and changes in the equipment of interurbans are coming so rapidly that a road can scarcely keep abreast of the times. Under such circumstances a road soon becomes antiquated and must be rebuilt and re-equipped at enormous cost."

W. D. Tucker, auditor of the Clover Leaf Steam line, said that the gross earnings of the road had decreased $66,000 during the past year. This was due to the 2-cent rate and interurban competition.

W. H. McDoel, president of the Monon steam line, said that adverse legislation, 2-cent rate, increased cost of material and advance in wages and interurban competition were responsible for the decreased earnings of his road.

CALIFORNIA DEAL REPORTED

Richard Hotaling, W. M. Rank and their associates are said to have made a deal with a Baltimore syndicate by which a large electric railway system is to be built in Marin, Sonoma, Napa and Lake Counties, with ferryboat connection with San Francisco. The deal includes the purchase of the Petaluma & Santa Rosa Electric road. The proposed system will invade the territory of the Northwestern Pacific in Marin and Sonoma Counties and that of the Southern Pacific in Sonoma and Napa Counties. The undertaking involves an expenditure of between $10,000,000 and $15,000,000. Hotaling, Rank and their associates already have a terminal on Richardson's Bay, just across from Sausalito, and they have made surveys from it to San Rafael; thence to Novato and Napa, and thence to Lakeport. The proposed road will embrace an extension of the Petaluma line northward into the Healdsburg and Cloverdale country. Ultimately it will be extended over into Lake County, thus forming a double line covering a great sweep of country between Lake County and the Marin County bay shore.

COMBUSTION AND SMOKE CONSUMERS TO BE TESTED

With a view to studying coal combustion at several large plants in Indiana, and to experimenting with devices for consuming smoke, H. W. Weeks, an engineer connected with the coal testing plant at St. Louis, which was established by the United States Geological Survey, is in Indiana for an indefinite stay. Mr. Weeks has pursued his investigation in several American cities. He expects to be in Indianapolis and Indiana for some time and to visit many plants there. He is interested in the kind of coal burned, the character of the load, the percentage of horse-power developed, the draft carried and the kind of furnaces and boilers employed in the electric railway and other large power plants; also take particular note of the completeness of combustion, a thing in which the survey is especially interested.

For some time the Commercial Club has been urging the managers of the coal testing plant at St. Louis to locate it in Indianapolis. The plant was established at St. Louis during the Louisiana Purchase Exposition, and it was understood that a permanent location should be decided on at the close of the exposition. Mr. Weeks says that part of the plant is now at Denver and another part at the Jamestown Exposition, while the rest remains at St. Louis. At the close of the Jamestown Exposition a commission will visit a number of cities, Indianapolis among them, for the purpose of getting data to aid it in reaching a decision as to where the plant shall be permanently located.

EXTENSIVE WASHINGTON PROJECT

The announcement is made by P. P. Carroll, of Seattle, representing a syndicate, which, he says, has begun work on three lines, that about $40,000,000 will be spent in building electric railways in Washington. The plan includes the completion of the proposed Puyallup Valley Northern Rapid Transit Railway at a cost of $2,500,000, and the completion of the Snohomish Valley Railroad, upon which construction work has started. This line will cost $3,000,000. A third line is the Seattle, Chelan & Spokane Railway, for which a company was recently chartered. The cost of this line is placed at $7,500,000.

The Puyallup Valley Northern Rapid Transit Company has been incorporated nearly two years. Fred Chamberlain, of Puyallup, is its president, and John Mills is a prominent promoter of the line. A few months ago the incorporators of the company closed a deal with an Eastern firm of contractors whereby the line will be built in exchange for $2,500,000 worth of stock in the enterprise. Under the present plan it is understood that when these independent lines are consolidated this $2,500,000 in stock will be transferred to the consolidated company, and a like amount of the other company's stock issued to the railway builders.

The Puyallup Valley line will extend from Tacoma to Puyallup, Sumner, Renton and other towns. It will traverse the valley between Tacoma and Renton, but will be constructed along the foot hills, on an elevation high enough to remove the line from the flood district. The line will connect at Renton with the Snohomish Valley Railroad, which runs through Cherry Valley to Snohomish and north to Bellingham. The line passes through Monroe. It is being built by the same interests who have taken charge of the construction of the Puyallup Valley Railway, and construction work on the line is now in progress.

From the Sound, through Renton and east to Spokane, the Seattle, Chelan & Spokane Railway will be constructed. The application for a charter for this line was filed a few weeks ago. This is a sister proposition to the Puyallup and Snohomish Valley Railways.

REPORT OF CONSOLIDATED RAILWAY COMPANY

The report of the Consolidated Railway Company, of New Haven, Conn., and controlled lines for the eight months ended Feb. 28, 1907, shows as follows:

Gross earnings		$4,027,135
Operating expenses		2,516,371
Net earnings		$1,510,764
Add income from other sources		682,828
Total income		$2,193,592
Deductions from income:		
Taxes	$236,264	
Rentals of leased lines	588,649	
Interest on current liabilities	76,588	
Interest on mortgage debt	312,431	
Interest on debentures	627,864	
Discount on debentures	9,037	
Guarantee N. E. I. & S. Co.	115,704	$1,966,534
* Net income		$227,058
* Against net income there was charged:		
Six months' dividend, paid Dec. 31, 1906	$200,000	
Accrued dividend for Jan. and Feb. 1907	66,666	$266,666

Consolidated Railway's general balance sheet as of Feb. 28, 1907, compares with that of Oct. 31, 1906, as follows:

	Feb. 28, '07.	Oct. 31, '06.
Cost of road and equipment	$35,044,129	$30,261,058
Due from leased companies	589,074	......
Miscellaneous investments	948,367	2,273,293
Water and supplies	545,673	235,141
Cash and current assets	13,391,800	12,765,100
Discount on debentures	654,900	657,805
International Trust Company, trustee	22,132	19,132
Rhode Island Hospital Trust	5,000	......
Imp. susp. account	1,011,140	454,339
Total	$52,212,214	$46,665,869
Liabilities.		
Capital stock:		
Consolidated Railway	$10,000,000	$10,000,000
Leased and controlled lines	76,758	59,125
Mortgage debt	10,706,667	9,107,000
Consolidated Railway debentures	23,500,000	23,474,400
Hartford Street Railway debentures	310,000	310,000
Current liabilities	5,751,396	2,337,150
Accrued liabilities	697,741	760,778
Res. for disc. on ltg. accounts	25,189	......
Accident and casualty fund	58,258	46,842
Skg. fd. Wor. & Web. bonds	22,132	19,132
Ct. Ry. & Lgt. Co. cont. liab	262,747	......
Profit on securities sold	71,012	71,012
Profit and loss surplus	730,314	480,431
Total	$52,212,214	$46,665,869

Of the item "cash and current assets," $9,369,243 is a note of the New England Investment & Security Company, given in payment for securities of certain street railways in Massachusetts. The item also includes notes for advances made to controlled companies.

GENERAL ELEC' 'RIC REPORT

The report of the General Electric Company for the year ending Jan. 31, 1907, was made public last week. It shows profits of $8,427,842 (including $329,702.55 from securities sold, $675,000 increased value of security holding companies, and $417,586.19 from royalties, dividends, sundry profits, etc.), after deducting all patent, general and miscellaneous expenses and allowances for depreciation and losses and writing off $2,834,123.80 from factory plants. There was paid in dividends during the year $4,344,342, and $999,999 were written off the patents, franchises and good will account, which, on Jan. 31, 1897, stood on the books of the company at $8,000,000, to reduce it to the nominal sum of $1. The amount carried to surplus account was $3,083,501.68, making the total surplus Jan. 31, 1907, $15,110,796.

The total sales for the year, or amount billed to customers, were $60,071,883. Last year they were $43,146,902.

A considerable portion of the report is devoted to turbines and railway work. During the past year turbo-generators of an aggregate capacity of more than 350,000 hp. have been sold. An account is given of a test conducted on Jan. 29, 1907, by the engineers of the Boston Edison Company of one of the 5000-kw turbines of that station. Under the normal operating conditions the test showed a steam economy of 13.586 lbs. of steam per kilowatt-hour. On Feb. 25, 1907, one of four 8000-kw turbines in operation at the Fiske Street station of the Chicago Edison Company was unofficially tested under the regular operating conditions, and showed a steam economy of less than 13 lbs. of steam per kilowatt-hour, as well as less than 1 lb. steam consumption per kilowatt output between 5000 kw and 14,000 kw. The report also refers to the electrical equipment of the New York Central & Hudson River Railroad, and states that on April 1, 1907, there were 110 multiple-unit electric trains and thirty electric locomotives in daily service. The total daily multiple-unit train mileage at that time was 1250 miles, and the daily train mileage was 692 miles. The electrical equipment of the West Jersey & Sea Shore Railroad (Pennsylvania system) is also working very successfully.

In speaking of new work the third vice-president reports that in its high tension department the company is now building on order a number of transformers of 7500 kw capacity, for operation at 104,000 volts, and has designed and successfully tested a switching device for 100,000-volt operation. A reference is made to interpole motor design for railway work, and the report says that practical tests have shown these new motors to be superior to existing standards in economy, commutation and ability to operate at higher and more economical voltages. The company is also applying the vertical shaft design which has proved so successful in large turbines to the design of motor generators and rotary converters. This vertical arrangement effects a considerable saving of space and money, and is particularly desirable for use in sub-stations in large cities. The company has sold a number of such vertical sets for operation in Chicago and other places.

STREET RAILWAY PATENTS

[This department is conducted by Rosenbaum & Stockbridge, patent attorneys, 140 Nassau Street, New York.]

UNITED STATES PATENTS ISSUED APRIL 30, 1907

851,665. System of Control; Ray P. Jackson, Wilkinsburg, Pa. App. filed April 13, 1905. Means whereby a plurality of voltage regulators will operate synchronously so that all the regulators will supply approximately the same voltage to the motors or other translating devices.

851,692. Automatic Block Signal System; Frank P. J. Patenall and George H. Dryden, Baltimore, Md. App. filed Dec. 4, 1906. Relates to that type of block signal system in which the track rails are energized by direct current of low voltage and circuits including relays for the operation of the signals are adapted to be short-circuited by the wheel axles of the trains.

851,794. Method of Speed Regulation; Norman W. Storer, Pittsburg, Pa. App. filed July 24, 1905. Provides a system of control of electric vehicles having a plurality of motors by which efficient operation is secured at the low, as well as the high, speed.

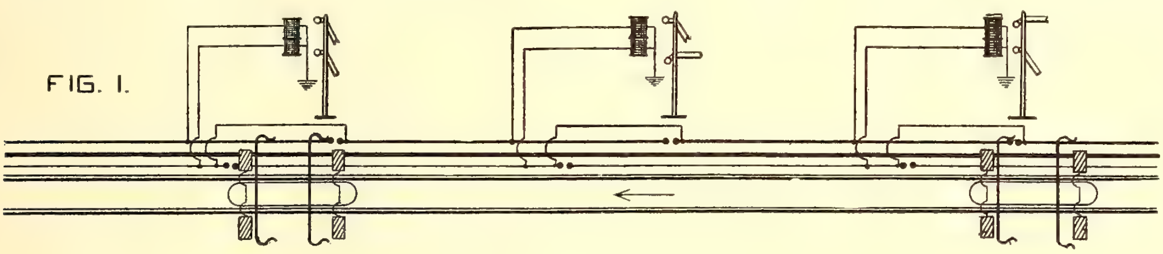
851,776. Automatic Train Blocking System; Charles E. Roehl, Brooklyn, N. Y. App. filed Dec. 16, 1903. Details of construction of the trolley rails and insulators of a block signal system, designed to prevent collisions by shutting off the power and applying the brakes automatically on the engine.

851,799. Electric Traction System; Alexander Churchward, Schenectady, N. Y. App. filed June 1, 1906. The invention relates to features of the trolley system in a trackless trolley in which the car runs part of the time from an overhead trolley and thereafter runs for short distances on branch roads from storage batteries.

851,800. Automatic Train Stop; Fred B. Corey, Schenectady, N. Y. App. filed Sept. 19, 1906. An automatic train-controlling device comprising a stop-arm on the roadway, a lever on the car possessing high inertia and adapted to be engaged by the stop-arm, and a controlling device on the car arranged to be operated by the movement of the lever beyond predetermined limits, whereby a slowly moving car may pass into the block, but a rapidly moving car arrested.

851,818. Air-Brake System and Engineer's Valve; George Macloskie, Schenectady, N. Y. App. filed Nov. 9, 1905. In order that the air brakes may be operated from either end of an electric locomotive or car, means are provided for automatically rendering the equalizing discharge valve inoperative upon a removal of the handle of the engineer's valve.

FIG. 1.



PATENT NO. 851,776

851,839. Switch Mechanism; Theodore Rundorff, Burlington, Iowa. App. filed Aug. 23, 1906. A centrally pivoted lever has lugs at each end, adapted to be engaged by a projection on the car. At one end of the lever a rod is pivoted, which is in turn pivoted to the switch-point.

852,007. Air-Brake Apparatus; Robert J. Wilson, Pittsburg, Pa. App. filed Nov. 16, 1905. An automatically acting ball valve in the passage from the auxiliary reservoir to the brake cylinder, seating toward the brake cylinder, and being normally open and arranged to throttle said connection on an excess rush of air.

852,092. Electrically Controlled Semaphore Signal; Harry M. Abernethy, Cleveland, Ohio. App. filed Dec. 7, 1905. Relates to means for cushioning the shock or jar of semaphore mechanism of the type controlled by reduction gear connection from an electric motor.

852,093. Railway Semaphore Signal; Harry M. Abernethy, Cleveland, Ohio. App. filed Dec. 7, 1905. Relates to modifications of the above.

852,094. Railway Semaphore Signal; Harry M. Abernethy, Cleveland, Ohio. App. filed Dec. 7, 1905. Further modifications.

852,117. Pneumatic Appliance for Cars; George H. Hollingsworth, Belmont, Mass. App. filed Feb. 12, 1907. A pneumatic emergency appliance for street cars adapted to drop the fender, set the brakes and raise the fender.

852,212. Switch Structure; Victor Angerer, Ridley Park, Pa.

App. filed Nov. 3, 1906. Relates to means for locking the switch in either of its positions by a weighted lever.

852,386. Hand-Operated Electric Circuit Controller; Ray P. Jackson, Wilkinsburg, Pa. App. filed Dec. 18, 1905. Means for automatically returning a control drum to a predetermined position and exerting a substantially constant return force whatever the angle or direction through which the drum is moved.

852,405. Railway Signaling Apparatus; Edson R. Wolcott, Golden, Col. App. filed Dec. 27. Signal apparatus in which electric impulses are transmitted between stations and trains by magnetic induction. The car has a transmission circuit normally open when the train is in motion and means for automatically and permanently closing the circuit when the train stops.

NEW PUBLICATION

"Manual of Examinations for Engineering Positions in the Service of the City of New York." By Myron H. Lewis and Milton Kempner. New York: Engineering News Publishing Company. 750 pages (approx). Price, $5.00.

In this volume the compilers, both of whom are connected with engineering departments of New York City, have gathered together a number of examination papers actually used in civil service examinations in New York. The body of the book is divided into three parts, viz.: (1) Axeman, chainman and rodman, leveler, transitman and computer; (2) assistant engineer; (3) draftsman. In a number of cases the questions are accompanied by answers to give the reader an idea of the extent and character of the replies expected. Blank pages for notes are scattered through the book, and there is an introduction giving rules from the Municipal Civil Service Commission regarding the methods of conducting examinations and making appointments.

PERSONAL MENTION

MR. ALBERT THODE, of Albert Thode & Company, of Hamburg, who are well-known dealers in electrical supplies in Germany, is on a visit to this country to study the latest and most approved electric railway devices used here.

MR. E. R. KELSEY has been appointed publicity manager of the Toledo Railways & Light Company. His principal work will be in connection with Toledo Beach, which the company will endeavor to make a household word in Toledo. Mr. Kelsey, who is a newspaper man, was for a time manager of the Lyceum Theater in Toledo.

AT A MEETING of the stockholders of the General Electric Company, held Tuesday, May 14, Mr. Marsden J. Perry was elected a director to succeed the late Gen. Eugene Griffin, and Mr. S. L. Henderson to succeed Mr. T. K. Henderson, resigned. Subsequently at a meeting of the directors of the company, Mr. B. E. Sunny, of Chicago, and Mr. J. R. Lovejoy, of Schenectady, were elected vice-presidents of the company.

MR. ALEXANDER SHANE and MR. DAVID E. MATTHEWS, both experienced railroad men, have been appointed by the Railroad Commissioners of Indiana as inspectors under the provisions of the new law. It is the duty of inspectors to keep informed as to the condition of steam and interurban railways and the manner in which they are operated with reference to physical conditions, the adoption of lawful devices for the safety of the employees and the traveling public.

AT THE ANNUAL meeting of the stockholders of the Interborough Rapid Transit Company the four directors whose terms had expired were re-elected for three years. They are: Mr. Gardiner M. Lane, Mr. Alfred Skitt, Mr. George W. Young and Mr. John Pierce. Mr. Theodore P. Shonts, president of the Interborough-Metropolitan Company, has been elected a director of the New York City Interborough Railway Company, succeeding Mr. Arthur Turnbull.

MR. BENJAMIN F. TILTON, engineer of the Pennsylvania Company, in charge of the grade crossing work in Cleveland, has been chosen as engineer in charge of maintenance of way by the Cleveland Electric Railway Company, to succeed Mr. Charles H. Clark, who recently resigned to take a similar position with the International Traction Company. Mr. Tilton will take up the work on May 20 and will work with Mr. Clark for ten days, the latter's resignation becoming effective on June 1. Mr. Tilton is a Cornell graduate, and has had an extended experience in the work he will undertake.

MR. C. E. FLYNN, vice-president and general manager of the Conneaut & Erie Traction Company, of Erie, Pa., has resigned, and will retire from the active management June 30. He has appointed Mr. B. E. Walker, his present superintendent, as manager, to take effect July 1. Mr. Flynn, who is a specialist in placing non-paying electric railway properties on a self-sustaining or dividend-paying basis is also a director and large stockholder in the Conneaut & Erie Traction Company and has consented to remain with the company in an advisory capacity and as consulting electrical engineer.

MR. C. J. HIXSON has returned to this country after spending some time abroad, and has joined the railway engineering department of the General Electric Company. He left the General Electric Company in 1901, to take the position of the engineer for controller and railway equipment work offered him by the Allgemeine Elektricitäts Gesellschaft, of Berlin. During the three years that he remained with that company entirely new lines of apparatus were developed and placed upon the market in that department. Mr. Hixson was also closely identified with the experimental work in connection with the Berlin-Zossen high-speed tests conducted by the Allgemeine Elektricitäts Gesellschaft and Siemens & Halske Company. He left the Allgemeine Elektricitäts Gesellschaft in 1904 to organize the control division of the British Westinghouse Company, at Manchester, where, in addition to railway work, apparatus for the control and equipment of cranes, mines, rolling mills and general industrial purposes was designed and developed under his supervision. His work with the General Electric Company will be largely along the same line of work.

MR. CHAS. H. BIGELOW, superintendent of construction for the Stone & Webster Engineering Corporation, at Dallas, Tex., having completed the erection of the large power station in that city for the Dallas Electric Corporation, as described elsewhere in this issue, has resigned to accept a position with Mr. L. B. Stillwell, of New York.

CHAS. H. BIGELOW

Mr. Bigelow will be located for the present at Baltimore, as chief inspecting engineer on the extensive power station construction being carried on for the United Railways & Electric Company by Mr. Stillwell. Mr. Bigelow is a member of the American Society of Mechanical Engineers, the American Street Railway & Interurban Engineering Association, as well as several other engineering and fraternal societies. He has had an extended experience in electrical and mechanical work, both before and after graduating from the Massachusetts Institute of Technology in 1892, having been with the Bell Telephone Company, of Canada, for four years before entering the Institute. After graduation he entered the employ of Stone & Webster, of Boston, engaging in the installation of electrical plants, power stations, etc. He remained with them for about two years, when he resigned to go with the West End Street Railway Company of Boston, Mass., in 1894, as superintendent of construction of the East Boston power station. He remained with this company until 1905, holding the positions of inspector of power stations, inspecting engineer and chief mechanical draughtsman of the department of motive power and machines, resigning at that time to go again with Stone & Webster. He was sent by them to Dallas, Tex., to erect the power station which the Columbia Improvement Company, afterward succeeded by the Stone & Webster Engineering Corporation, had contracted to build for the Dallas Electric Corporation. Mr. Bigelow leaves a host of friends at Dallas, who wish him success in his new undertaking.

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NOTICE TO SUBSCRIBERS

REMITTANCES.—Remittances should be made by check, New York draft, or money order, in favor of the STREET RAILWAY JOURNAL.

CHANGE OF ADDRESS.—The old address should be given, as well as the new, and notice should be received a week in advance of the desired change.

BACK COPIES.—No copies of issues prior to September, 1904, are kept on sale, except in bound volumes.

DATE ON WRAPPER shows the month at the end of which the subscription expires. The sending of remittances for renewal prior to that date will be much appreciated by the publishers.

NOTICE TO ADVERTISERS

Changes of advertising copy should reach this office by 10 a. m. Monday preceding the date of publication, except the first issue of the month, for which changes of copy should be received two weeks prior to publication date. New advertisements for any issue will be accepted up to noon of Tuesday for the paper dated the following Saturday.

Of this issue of the Street Railway Journal, 8200 copies are printed. Total circulation for 1907 to date, 171,750 copies, an average of 8178 copies per week.

Reinforced Concrete in the Sub-Station

Although the modern power plant has for some time past felt the influence of reinforced concrete construction to a degree that has resulted in the use of this material in many new installations, the sub-station has not so widely come to be regarded as a legitimate field for such methods of building. Brick and steel continue to be specified in a large amount of railway sub-station work; but, as a matter of fact, there is no good reason for the failure of designers to appreciate the value of reinforced concrete even in small structures for power service. The increased demand for cement in the past five years has, together with improved processes of production, brought the cost of this material to a point where even small buildings constructed of it can be erected to compare favorably in cost with other materials.

The scarcity and increased cost of skilled labor makes it expensive to erect sub-stations to-day out of brick and timber, or even brick and steel. Concrete, properly supervised, fills the requirements admirably in a well-designed installation, and as the cost of preparing forms is a large percentage—perhaps 25 or 30—of the cost of using concrete, there is great advantage in using the same forms repeatedly. There is a place for economy of first cost in railway sub-station building construction designed according to repetitive standards of wall and floor arrangement. Variety of architecture is not greatly needed in the average sub-station building located outside city limits. The absence of fire risk, great speed of erection, and freedom from the ill effects of machinery vibrations common to concrete block or concrete steel sub-stations warrant their more extended consideration in the field of electric railway practice.

The Development of the Organization

One clause in a recent report of the New York Railroad Commissioners directs attention to a subject which is often overlooked in the creation of modern industrial enterprises. The large corporation, both manufacturing and transportation, is a development of the last few years, and has been made possible and even necessary by the present status of financial, engineering and social conditions. But it is a question whether the science of organization in the operation and direction of the affairs of the vast energies thus created has kept pace with the rapid work of the constructor. This, then, is the problem of the manager; to avoid on the one hand the Scylla of the wasted energies and confusion due to having too many in authority, and to escape, on the other hand, the Charybdis not only of stagnation but, at critical times, of that breakdown which often comes from too greatly centralized authority. In other words, it is possible to have either an insufficient amount of system, or else to create one which is too cumbersome and has too much backlash to meet the physical requirements of the modern large enterprise. From the standpoint of the chief clerk of the red tape division the latter plan may be beautifully ordered and quite perfect, but as a practical matter of administration it is often most ineffective.

The question is of particular interest to readers of this paper as it vitally affects the efficiency of transportation companies in their work. Railroad enterprises are not only

the most important examples of the large business corporations of the modern age but are those in which breakdowns, when they occur, most closely touch the general public and so become most conspicuous. Experience has shown that in them the more common error is that last mentioned. An organization may perform satisfactory work under an original set of conditions, but when the traffic increases and fast trains are being hurried over the tracks as rapidly as is in any way practicable, a long chain of intermediaries in the execution of orders often becomes a fateful burden. No one can guarantee effective work at all times in every department of a large company, but the best method of securing it, after careful selection of the operative, is a system which will bring the responsibility for action quickly to some one who has the ability to act promptly and who cannot shirk the responsibility for inaction. Moreover, the position of each link in the chain must be so definitely known as to prevent its being shoved out of sight in case of disaster.

The fact is that modern transportation, especially in suburban service, has reached such a density that many of the methods in the past considered efficient in railway administration have become altogether unsuited to the case. Incipient weakness may go from bad to worse in a few hours to an extent which, under less arduous conditions of traffic, would require days or weeks. Hence there must be extraordinary alertness in following up the first symptom of trouble, and any lost motion in getting at it may be calamitous. It is consequently a grave question in railway administration whether centralization of action has not been carried, as it may be in governments, to an extent that defeats its purposes. If for example, it were necessary as a matter of business routine to notify a Minister of Public Ways in Washington, through half a dozen intermediaries, that there was a hole in the pavement of Wall Street, and to receive from him formal authorization for the foreman of District 916A to proceed with repairs at his convenience, how many honorable gentlemen might tumble into it during the interim? It may prove necessary even to change radically the working scheme of railways in suburban service so that every section shall have absolute responsibility as regards its own condition subject only to a very general supervision and control. The effect upon the conditions discussed of the introduction of electric traction on steam railroads has and will be of considerable import, but it will be so mainly on account of its being the accompaniment of a heavy increase in traffic which must inevitably grow greater year by year. One of the problems of the future, then, is to find for the large transportation systems now coming into being managers who are capable of administering the vast enterprises created by the genius of the modern engineer. Such persons would never have to worry about the question of remuneration because a large company could afford to pay almost any salary to secure real ability in this direction.

Business-Getting Methods on Interurban Lines

Up to about three years ago the electric light companies throughout the country were inclined to take only that business which came to them of its own accord and seemingly they made no effort to develop new business. But for some reason or other there has been a change in the methods of these companies and they are now found most active in their efforts to get additional business. Although the new practice has been followed for only a few years, the results, as shown by increased load on the stations, have in many instances exceeded the expectations of the most sanguine. Many electric railway managements pursue similar business getting policies and enjoy the resulting traffic. On the other hand, there are some who evidently seem to consider their duty to the stockholders and bondholders fulfilled when they take care of the passengers who get on the cars of their own accord and handle the freight that is brought to the stations.

A wide-awake management can usually develop many schemes for increasing both freight and passenger traffic. Of course, advertising is at the bottom of all of them. Some managements evidently underestimate the value of advertising, otherwise they would not carry card racks full of other people's advertisements in their cars to the utter exclusion of notice regarding the railway system. Probably the most important feature to which an interurban road should give publicity is its time table. Even if the cars leave terminals on the hour and every one in the city knows it, time cards should be issued, for there are many strangers, traveling men and people from the neighboring farming country who are not so familiar with the schedule and who may learn of the existence of the interurban line or may be induced to patronize it by seeing a stray time card in a newspaper or posted in a hotel lobby or other public place. The fare from a few extra passengers is practically all profit, consequently it takes but a few such fares to pay for considerable advertising. The desirability for this action is so self evident that it seems hardly necessary to refer to it except that personal observation shows it to be frequently neglected. Where one has a choice of starting for a steam train which he knows will leave at a designated time or of waiting perhaps 30 minutes or three-quarters of an hour for an electric car, he will usually adopt the former plan.

Many interurban companies have also created traffic by getting out booklets containing picturesque views along the right-of-way and within walking distance from stations. Often these circulars weave an atmosphere of romance about many of the most picturesque points along the line by connecting them with accounts of historic or prehistoric days. Such opportunity can nearly always be found, even in the most modern and prosaic neighborhood, by a little study, coupled if necessary with faith in legendary lore, and undoubtedly can be made a legitimate cause for the collection of many additional fares.

There are various ways in which the freight traffic may be increased. When an interurban system finds freight can be hauled at a profit, every effort ought to be made to capture every shipment which can be handled. Energies should then be directed to the development of additional business. While steam roads are congested with freight and are slow in delivering freight, managements of electric railways can frequently prove to shippers and dealers that the electric line is in condition to make quicker deliveries. Where the electric road crosses many steam roads, dealers in the small towns along the electric line may be induced to direct shippers to route all shipments via the electric line.

One interurban road we recall, induced shippers to send goods in car load lots to one of the electric line terminals instead of in smaller lots to the merchants along the electric line. The latter then distributed the goods to the consignees. This arrangement resulted in a reduced freight rate to the shipper and considerable income to the electric railway company.

In the past steam roads have often expended considerable energy in encouraging manufacturing and mining industries and the development of farms and stock raising in the territories served by them. In some instances an electric road could in a similar manner encourage industries along its route. One ten-mile steam dummy road which has since been changed to an electric line derived considerable revenue through encouraging the raising of potatoes by farmers along its right of way. The management impressed the farmers with the profits to be derived from this crop and then encouraged buyers to go into the district. The whole crop was shipped out over the railway line. Incidentally, the potatoes lifted the mortgages on the larger number of the farms and helped to put the whole region in a prosperous condition. This, of course, helped the future receipts of the road.

In determining methods to be followed in increasing business no set rule can be followed. Local conditions must be analyzed before anything can be done, but a close consideration of these conditions will usually make evident to a wide-awake manager numerous ways of increasing business.

Rotary Converter Starting

In the operation of rotary converter sub-stations the best method of starting the machines is a question of large importance in relation to the prevailing conditions of service. Considerable difference of opinion still exists as to the value of each of the principal ways of throwing a rotary into service now commonly practiced. The requirements of continuous service demand that when it becomes necessary to put a rotary under load after an interruption of the main sub-station output, no time shall be lost on account of the unreliability of the starting arrangements. The first cost of the proper starting equipment should never be weighed against the certainty of its action without disturbance of the other machinery in the sub-station or possibly the rest of the distribution system.

Rotaries are usually started from either the alternating current side or by means of an auxiliary direct-connected induction motor mounted on the same shaft. Power from the direct current bus bar is often employed in large installations, but in small sub-stations alternating current must, as a rule, be the main reliance. It is difficult to decide which is the most advantageous method in many installations. The type of rotary purchased may practically settle the question, as some manufacturers prefer to supply a starting motor with the converter, while others favor the use of low voltage transformer taps and reactance coils. Each of these three methods has its own advantages and drawbacks.

A converter started by a separate small motor has the advantage of being positively brought up to speed by an outside source of power which creates very little interference with the regulation of the rest of the system. Induction motors are practically always used for this service, and as there is no more reliable motor known in modern practice, the certainty of the method is almost unquestioned, provided that the proper voltage can be applied to the motor terminals. A drop of 20 or 30 per cent in the voltage available at the induction motor, however, may fail to start the machine, so that long delays may occur in getting a system into operation if the regulation of the generators at the power plant is demoralized by low steam pressure at the engines or turbines, or other causes. The speed of connecting a rotary to the system by the small motor drive is usually slower than in the case of starting from the direct current bus, or from a storage battery in case the sub-station is so equipped; but in the majority of instances the acceleration of the converter armature from standstill to synchronism is fast enough for commercial requirements.

In starting from the alternating current side the practice is to apply from one-third to two-thirds normal voltage to the collecting rings by switching a set of sub-voltage transformer taps to the converter through a set of reactance coils. The converter thus starts as an induction motor, since the shunt field windings are generally disconnected to prevent the induction of excessive potentials in them. Normal voltage is thrown upon the slip rings as the converter approaches synchronism. The speed of acceleration in this method is high, and with prompt work in synchronizing, the converter should be placed in service in considerably less than a minute if a small machine, and in possibly a minute and a half or two minutes if a large unit of 1,000 kw. or over. The method is exceedingly simple, but it has the objection of inducing the flow of heavy starting currents if the voltage taps are connected so as to permit more than 30 or 40 per cent of normal potential when first applied to the slip rings. The reactance coils hold back a considerable rush of current, take up little space and are thoroughly reliable pieces of apparatus. The heavy starting current is the price paid for the quick acceleration of the converter armature to synchronous speed, but on a large system the starting current of a single converter is a small percentage of the load or at least of the generating capacity.

Maintenance expenses of starting apparatus are too small in relation to the total operating cost of sub-stations to carry much influence in the choice of methods of bringing rotary converters into service. The direct current bus bar method offers the advantages of maximum simplicity, together with small starting current, low cost of upkeep and reasonable speed of operation, approximating the rapid acceleration found in the alternating current tap and reactance arrangement. On the adverse side, it is not as reliable as the other methods, and is liable to cause surging if provision is not made to open the direct current auxiliary supply circuit just before the alternating current bus bars are connected with the rotary slip rings. This may be done automatically, but the apparatus requires very close adjustment. Probably the wisest plan in laying out arrangements for starting rotaries in important stations is to equip the plant with two methods. It should never be possible for a combination of circumstances to occur which will prevent the starting of a rotary in normal condition when low-tension alternating current power is available at normal voltage.

AN INDIAN TERRITORY INTERURBAN SYSTEM

With many people the idea prevails that Indian Territory is a wild, unpopulated country and little more than a rendezvous of outlaws and criminals. Such an idea, however, is far from true, for within the last fifteen years the outlaws have been driven out, a large portion of the farm lands has been put under cultivation, and mineral lands have been developed to such an extent that towns and cities have sprung up at relatively close distances all over the Territory.

ALONG A TANGENT ON THE CHOCTAW RAILWAY

The fact that an electric interurban railway, doing both a freight and passenger business, connects several of these towns is very good evidence that the Territory has within comparatively few years undergone a wonderful development. This road is that belonging to the Choctaw Railway & Light Company, and extends southeast from South McAlester to Hartshorne, 17 miles distant.

South McAlester is one of the two larger cities in the Territory and has a population of about 15,000 people. That the city is not a cluster of temporary wood buildings, such as is frequently found in a new country, is evidenced by the fact that it has a hotel costing $200,000, a Masonic Temple built at a cost of $200,000, and that $175,000 is being spent in the erection of public school buildings. In addition, business blocks to cost $500,000 are at present under contract. The main business street of the city is paved with brick manufactured in McAlester, and the buildings fronting on it are constructed either of stone or vitrified brick made within a radius of 2 miles from the business center. It has sewerage, natural and artificial gas, water-works and electric light systems, and all the conveniences of cities of the same size in other regions. Its rapid growth from a town of 3500 inhabitants in 1900 is due in a great measure to the development of coal mines in the surrounding region. It is, in fact, located near the center of what is termed the "segregated lands," which comprise a coal and mineral belt about 70 miles long.

A ROCK CUT ON THE CHOCTAW RAILWAY

TRESTLE AND WOOD TRUSS BRIDGE AT DOW LAKE TO BE REPLACED BY A FILL

These lands, because of the value of the minerals, were not apportioned among the individual Indians of the Choctaw tribe, but have been retained for the common benefit of the members. The development of the mining industry and agriculture in this region has been, and is now, greatly hampered because the land cannot be purchased outright. Mining leases must be obtained from the government, which, however, is now considering the question of selling the lands outright. As the interurban railway is built entirely within the segregated lands, whenever the lands are sold and opened up to mining under better conditions and to agriculture traffic over it will be greatly increased.

The towns along the line at the present time are sustained almost entirely by the coal mines. There are, in fact, within 3 miles of the railway line twenty-one mines, some of them having a capacity of 10,000 to 15,000 tons per day. The interurban line is operated in connection with a city system connecting the two contiguous towns, McAlester and South McAlester, and also in connection with the electric lighting system of South McAlester.

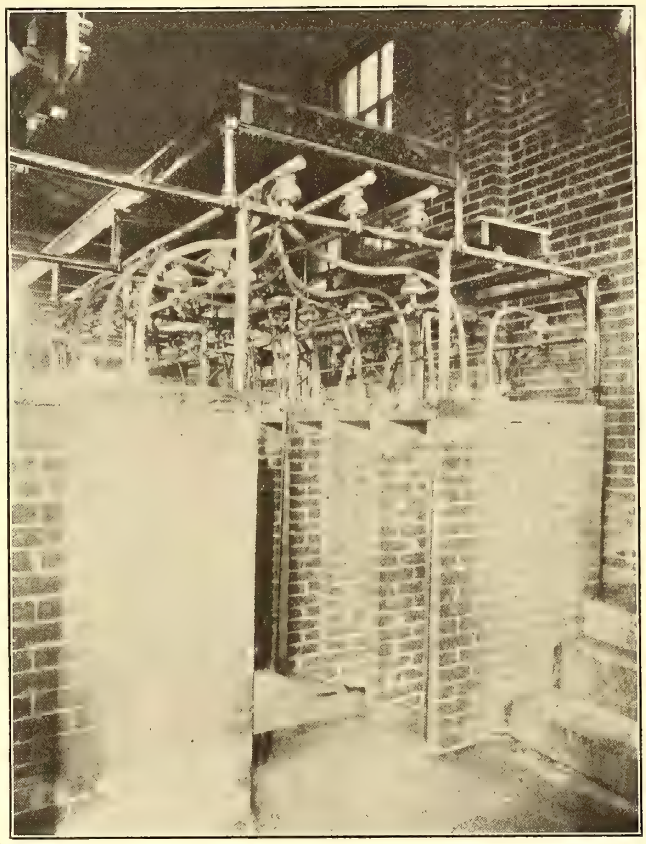
The line parallels the Choctaw, Oklahoma & Gulf Railway, the two roads being at no point farther than 1½ miles from each other. It is crossed by several mine switches from this road and by others from the Missouri, Kansas & Texas Railway system, but there is only one main line crossing with steam roads. At Bache and at Krebs switching connections are made with the steam roads.

TRACK AND ROADWAY

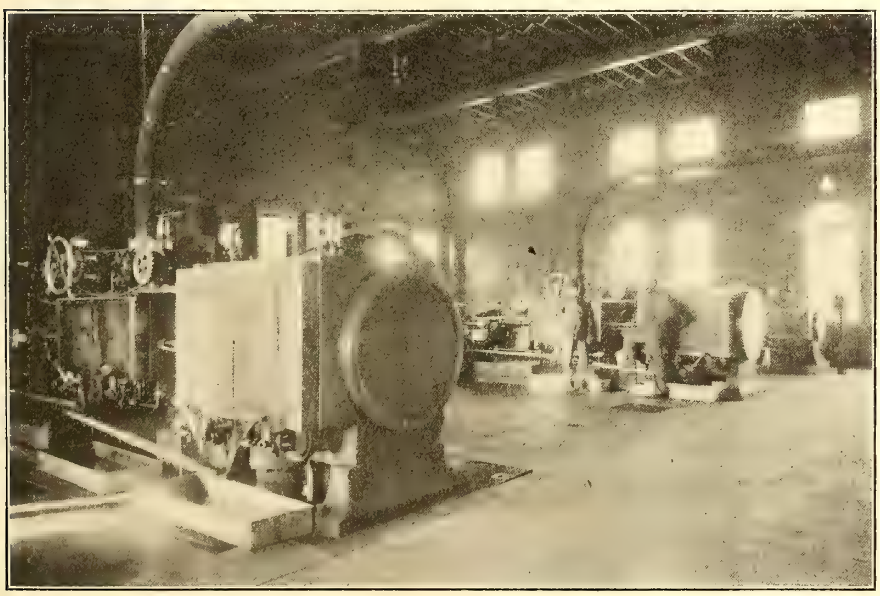
The private right of way on which the line is built was granted to the company by the government. Except in towns where it is limited to 60 ft. the width is 100 ft., and, as the land on either side is not cultivated or pastured, it is not fenced in. The line passes through comparatively hilly country, and to obtain a minimum grade of 2½ per cent. some heavy cuts and long trestles were required. The heaviest cut is in South McAlester. It is in solid rock, is 23 ft. deep, and about 800 ft. long. Near Dow, 13 miles from South McAlester, the track is carried over Brushy Creek, which lies in a ravine at this point, by a wood trestle 900 ft. long and 25 ft. high. At the middle point of the structure is a timber truss span supported on rock piers. The track is laid with 60-lb. rails, and practically all of it is ballasted with cinders.

POWER PLANT

The power plant for the system and for lighting North and South McAlester as well is located on the line about 1½ miles north and east of South McAlester. The station building measures 95 ft. x 69 ft., is of brick, and has concrete floors and timber roof trusses.



HIGH-TENSION WIRING IN THE CHOCTAW RAILWAY'S POWER HOUSE



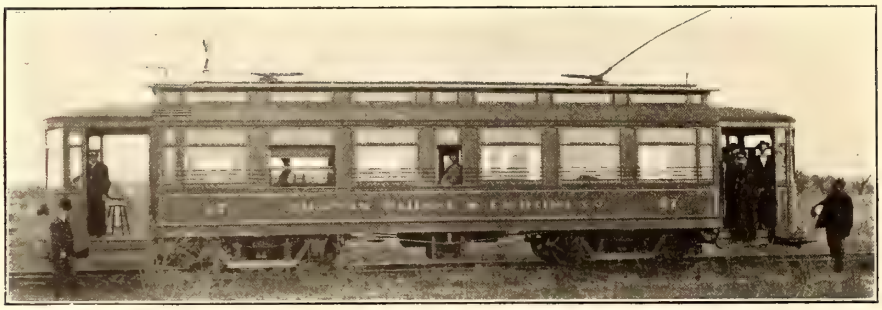
ENGINE ROOM OF THE CHOCTAW RAILWAY & LIGHTING COMPANY

The boiler room contains three 400-hp Stirling hand-fired boilers, high-pressure, and a low-duty Laidlaw-Dunn-Gordon duplex boiler, feed-pumps and a Cochrane feed-water heater. Coal cars are run from the main track onto a switch laid along the east wall of the boiler room, and the coal is unloaded through openings in the wall direct on to the boiler room floor. A lake south of the station, which has a capacity for about 6,000,000 gals., furnishes an ample supply of good water. The water from the lake flows by gravity into a settling well underneath the boiler room floor, from which it is pumped by the low-duty pump through a Cochrane feed-water heater. A stack, 6 ft. in diameter and 125 ft. high, serves all of the boilers.

The generating apparatus in the engine room consists of two 500-hp tandem compound Russell non-condensing engines direct connected to General Electric 13,000-volt, 25-cycle generators and a 150-kw Russell engine direct con-

nected to 2300-volt, 60-cycle generator, which, however, furnishes current for lighting only. It is the intention to install an additional 500-kw unit in the near future. A motor-generator set installed in the engine room consists of a 370-volt, 25-cycle, 350-hp motor direct connected to a 240-kw, 600-volt generator.

All of the high-tension apparatus is located in a small compartment between the engine room and the car house on the west. The railway apparatus in this compartment consists of two 13,200-volt, 120-kw, G. E. oil-cooled transformers, and instrument transformers located in brick cells and hand-operated, high-tension oil switches. The high-tension buses are carried on an iron pipe framework immediately over the aisle between the two rows of brick cells, while the lightning arresters are mounted on the east wall of the compartment. The one high-tension line leaving the station consists of three No. 4 copper wires arranged flat on one cross-arm. It continues to Dow, about 12 miles east, where a portable sub-station installed in a box car is located. The car is equipped with two transformers in one end, a 300-kw rotary converter in the other, and a switchboard in the open space in the center.



ONE OF THE CHOCTAW RAILWAY & LIGHTING COMPANY'S STANDARD INTERURBAN CARS

OVERHEAD CONSTRUCTION

Outside the city limits the single No. 000 trolley wire is supported on brackets. The poles carrying high-tension wires are 35 ft. long, while beyond Dow 30-ft. poles are used. Every pole is numbered. Two telephone wires are carried on brackets the full length of the line. Lightning arresters are placed five to the mile.

CAR EQUIPMENT

The car equipment consists of ten motor, two double-truck passenger trail cars, two standard steam road gondolas and one box car. Two additional interurban passenger cars are to be purchased. Four of the motor cars are small ones with single truck for city service, and the remainder, with the exception of a freight car, have double trucks and are for interurban service. Two of these are 43 ft. long and the remainder 47½ ft. long over all.

The freight motor is 49 ft. long over all, has an oval roof and is provided with longitudinal seats, which may be let down when it is desired to use it in passenger service.

REPAIR SHOPS

The repair shops are located in a brick building adjoining the power house. The greater portion of the building is taken up by three repair tracks without pits. One of these, however, is elevated on a trestle 5 ft. above the ground, to give the advantage of a pit. A brick addition west of the tracks contains machine tools, while the blacksmith shop is in a detached building in the rear. The equipment of machine tools consists of a 100-ton wheel press, 48-in. boring mill, an engine lathe with an 8-ft. bed, and a 14-in. swing, a drill press and an emery grinder.

FRONT VIEW OF THE CHOCTAW RAILWAY & LIGHTING COMPANY'S CAR HOUSE

WAY STATIONS

Stations of a substantial character are located at all of the towns. These buildings are usually constructed with the freight room floor elevated above that of the passenger waiting room and a freight loading platform built adjacent to the freight room. The terminal station at Hartshorne is

a brick structure, and has in the rear a yard for the storage of timber and other heavy materials.

The freight station at South McAlester is a pavilion provided with Kinnear rolling steel doors on all sides, which may be let down to enclose it entirely.

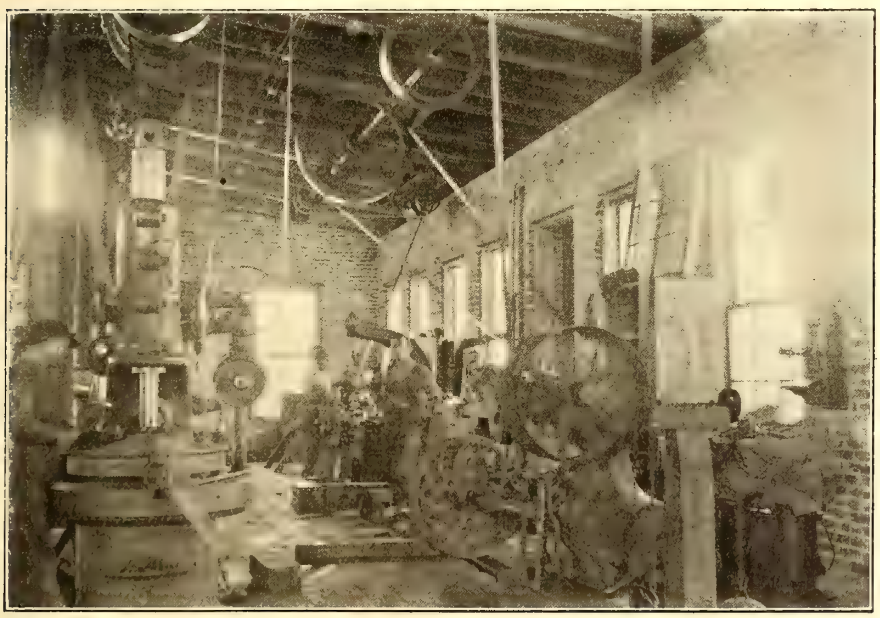
Station agents are kept at practically all of the stations from 6:30 a. m. to 8:15 p. m. On special occasions, however, they are kept later.

FARES

Regular fare on the interurban line is about 2½ cents per mile. A sixty-coupon ticket sold for $2.25, good for bearer, is the only form of special ticket. On the city lines the fare to school children and children under twelve years is 2 cents. The issuance of passes has been recently discontinued. This was effected by writing personal letters to the holders and no difficulties were experienced.

COMBINED FREIGHT AND PASSENGER STATION

Interurban cars are operated at hourly intervals, one hour being required to make the trip between terminals. On special days a forty-five-minute service is given and all cars are double-headed. The cars are dispatched by means of a telephone dispatching system, the dispatchers being located at South McAlester.



MACHINE EQUIPMENT OF THE CHOCTAW REPAIR SHOPS

A contract has been made with the government for handling mail, which is carried to and from all towns along the line in passenger cars. Express packages up to 200 lbs. weight are carried on all passsenger cars. To induce traffic, advertising matter of merchants in South McAlester is carried to the adjacent towns free when accompanied by one passenger.

FREIGHT MOTOR CAR ON THE CHOCTAW RAILWAY

FREIGHT AND PASSENGER STATION AT HARTSHORNE TERMINUS

The freight car makes two round trips per day, usually hauling two or more trailers. All the coal for the power house and also that for the Rock Island pumping station at Dow Lake is hauled by this car. The two gondolas and the box owned by the company are in continual use carrying lumber from Hartshorne to South McAlester.

A large percentage of the freight receipts is obtained from hauling from the terminal cities of goods retailed by the merchants in the mining towns along the route. These goods were formerly shipped direct to the smaller towns in small quantities, and the business has been obtained by representatives of the railway company getting after the salesmen for the wholesale houses and showing them that cheaper rates could be obtained and less delays encountered by shipping in carload lots to South McAlester and distributing over the electric line from this point.

J. H. Merrill, formerly secretary of the Central Electric Railway Association, is general superintendent of the system, with office at South McAlester. Arthur W. Underwood, of Chicago, is president, and George W. Knox, also of Chicago, is managing engineer. The earnings for the six months the line has been under new management are 60 per cent greater than for the previous six months.

EMPLOYING AND CARING FOR TRAINMEN AT LITTLE ROCK

The street railway system at Little Rock, while not large enough to demand all the "red tape methods" necessary on the larger systems to insure the employment of trainmen of the proper character, does nevertheless exercise a great deal of care in the employment of its motormen and conductors. Applicants are provided with a blank which they are required to fill out in their own handwriting. In making the application they promise to abstain from the use of intoxicating liquors if accepted. In addition to the customary questions, the blank requires the applicant to say whether or not he owns property and what its estimated value is, to what societies he belongs, whether or not he owns a watch or has ever been arrested.

After the references which he gives on his application blank have been investigated satisfactorily, he is ordered to report to the office, and upon the payment of a deposit of

APPLICATION

Badge No............. File No...............

LITTLE ROCK RAILWAY AND ELECTRIC COMPANY

Name ....
Position ....
Reference sent for { Personal ....
{ Mail ....
Applicant sent for...
Date Appointed ....
Position ....
Resigned ....
Discharged ....
Cause ....
....

CAUSE OF REJECTION

....

RECORD OF FORMER EMPLOYEES

$20 is given an appointment card which orders the dispatcher to place the applicant for a longer or shorter period of time on each of the lines of the system. After an instructor on each line has signed the card to the effect that the applicant is competent and understands the duties as required by the position, he is sent to the master mechanic, who gives him a general idea of the car equipment and instructs him how to cut out motors, put in fuses, and what to do in case of other emergencies. He is then given special instructions as to what to do in case of accident and lectured in regard to his attitude toward the public. After having submitted to examinations on all the instructions given he is put on the extra list. The instruction period varies in length of time from ten days to three weeks.

Men are preferred who have not had previous experience on other systems, as it is considered easier to train men to the methods of the company who do not have to unlearn the practices of another company. Most of the men are obtained from the adjoining country and within a radius of 30 or 40 miles. Married men are preferred to single ones. The height requirement for motormen is 5 ft. 7 ins. and the weight 150 lbs. Conductors must weigh 130 lbs. or over.

Form 101.

LITTLE ROCK RAILWAY AND ELECTRIC CO.

Date ________ 190__

Mr. ________

Place bearer ________, badge ____ on cars of all lines to learn the duties of ________

____

INSTRUCTED BY

LINE	TRIPS	INSTRUCTOR	BADGE
Fifteenth Street,			
South Main,			
West Ninth,			
Highland Park,			
East Ninth,			
East Fourteenth,			
Pulaski Heights,			

NOTE.—Instructors must not sign this card until they are thoroughly satisfied that the applicant is competent and understands the duties of the position applied for.

This is to certify that I have received the necessary instructions and thoroughly understand the duties of ________, as required by the rules of the Company, and have also received the following supplies, all of which I agree to return to an authorized officer of this Company or forfeit amount shown opposite each article.

MARK

Badge, - - - - - - valued at ________
Punch, - - - - - - valued at ________
________ valued at ________
________ valued at ________

Name ________

Date ________ 190__

I have examined the above named applicant and find him thoroughly familiar with the duties of a ________

____

________ Superintendent.

Date ________ 190__

FORM TURNED IN BY GRADUATE STUDENT

DISCIPLINE

When trainmen by the exercise of good judgment avoid an accident, or when they show in any way that they have the interest of the company at heart, a letter of commendation is sent to them. Whenever a motorman or a conductor has committed an infraction of the rules not serious enough to warrant discharging him, he is made to report and work at his own expense as a student with one of the other motormen or conductors a length of time as designated by the superintendent. This system, which has been termed the "kindergarten" by the men, is much more effective in making them remember the rules than is the practice of laying them off for small offenses.

The company maintains a club room at the car depot which is equipped with shower baths, wash basins, large easy chairs, writing tables and reading matter. The employees have a baseball team which was equipped with uniforms and apparatus by the company, and which has won the city league championship. There is a benefit association composed of the employees and having employees as officers. Each member pays weekly dues to the association

LITTLE ROCK RAILWAY AND ELECTRIC COMPANY.

Little Rock, Ark.., 190....

Mr. ....
....

Dear Sir:

Mr. .... of ....

has applied to this company for a position as..................................and refers to you for testimony as to his character. If appointed to this position, human life may depend upon his judgment, or be imperiled by his carelessness. He will, if appointed a conductor, have custody of the money of his employer, and will, besides, come in daily contact with the aged and feeble, and with women and children, who are entitled to the utmost courtesy and the highest degree of care. Is the applicant, in your judgment, fit to occupy the above position? This company feels seriously the responsibility of making such selections, there is too much at stake to accept applicants without the most careful inquiry, and therefore it adopts this means to assist it in securing the best men available.

Will you kindly give me, as early as possible, the information asked for in the following questions. Your answers will, I assure you, be considered entirely confidential and without prejudice to you.

Yours truly,...

Superintendent of Transportation.

1. Was applicant ever in your service? If so, for how long? From.................................. to ....
2. How long have you known him?...
3. Are you connected with him by relationship or otherwise? If so, in what way?...................................
4. Are his habits sober and correct, and is his conduct such as to entitle him to our confidence?........................
5. Have you ever heard of his having been irregular or unsteady in his habits, or addicted to any bad habits?

....

6. Is he quick tempered?................................ 7. Is he polite?..............................
8. Is he talkative or quiet?.............................. 9. Is he a careful man?..........................
10. Do you believe him thoroughly honest?...
11. Has he ever been dismissed from any situation to your knowledge? If so, under what circumstances?...............

....

12. Has he ever, to your knowledge, been employed on any steam or street railroad in any position?.....................

....

13. Have you any reason to consider him incompetent to fill the position he seeks?....................................
14. Has he any distinct traits of character not set out above?...

Signature .... Vocation ....
Address .... Dated ....

BLANK SENT TO REFERENCES GIVEN BY APPLICANT. NOTE THE ATTENTION CALLED TO THE RESPONSIBILITY OF THE POSITION

and receives sick and death benefits from it. The association dissolves at end of every twelve months and the money in the treasury is distributed pro rata among the members not participating in benefits during the year. It is then organized again for the succeeding year. The company contributes to the first payment and thus keeps the men from joining organizations which would be detrimental to their welfare.

Form 300 Little Rock, Ark., ..., 190....

LITTLE ROCK RAILWAY & ELECTRIC COMPANY

To Be Answered in Applicant's Own Handwriting

I hereby make application for a position as.............................. in the service of the Little Rock Railway & Electric Company, and if accepted I agree to comply faithfully with all rules, regulations and instructions governing the employees as the management may from time to time establish; to abstain wholly from the use of intoxicating liquors while on duty, conduct myself in a gentlemanly manner and work to the best interests of my employer.

It is further understood that in case my services are not satisfactory and I do not conform to your rules the company may terminate my employment at any time.

1. Name in full (no initials)..............................
2. Present address.............................. Street.............................. City or Town
3. How long have you resided at above address?..............................
4. How long have you resided in Little Rock?..............................
5. Birth place? .... 6. Date of birth ....
7. Married or single?.............................. 8. Housekeeping or boarding?..............................
9. State what family you have?..............................
10. How many persons are dependent on you for support?..............................
11. Where do they live?..............................
12. Are you a citizen?..............................
13. Are you subject to any sickness or infirmity?.............................. 14. Are you crippled or deformed?..............................
15. Are you ruptured?.............................. 16. Have you ever had a fit?.............................. 17. Have you ever fainted?..............................
18. Is your hearing perfect in both ears?.............................. 19. Are your eyes in perfect condition?..............................
20. What property do you own?.............................. 21. Estimated value?..............................
22. Where located?..............................
23. To what societies or organizations do you belong?..............................
....
24. Where did you last attend school?..............................
25. Do you own a watch?..............................
26. What trade have you learned?..............................
27. Have you ever been arrested?.............................. 28. Have you ever been convicted of any crime?..............................
29. Do you drink intoxicating liquors?..............................
30. Have you ever been discharged or suspended from any position?..............................
31. Where? .... 32. What reason?..............................
33. Have you ever been employed by this company?..............................
34. In what position?.............................. 35. Why did you leave?..............................
36. Have you any relations employed by this company?.............................. If so, give their names..............................
....
37. By whom are you now employed?..............................
38. How long have you been out of employment?..............................
39. Reason for leaving last situation?..............................
....
40. Were you ever employed on a street railway?.............................. 41. In what capacity?..............................
42. Name of company..............................
Employed from.............................. to .... 43. Why did you leave?..............................
....
44. Give names of all steam or street railways on which you have been employed. ....
Name of company..............................
Name of company..............................
Name of company..............................
....
45. Fill in the following blanks showing how you have been employed during the past six years:

Name of Employer	Address	Your Position	Date You Entered Servitude	Date You Left Service	Reason For Leaving

Give the names, addresses and occupations of four persons for reference, who are not related to you, and who have known you at least two years:

46. Name ....
Business ....
Street number ....
City or town .... State ....
47. Name ....
Business ....
Street number ....
City or town .... State ....
48. Name ....
Business ....
Street number ....
City or town .... State ....
49. Name ....
Business ....
Street number ....
City or town .... State ....
50. I hereby certify that I understand the above and that the answers given are true and correct.

Signed..............................

Witness ....

DO NOT FILL THIS OUT

Age ....
Height ....
Weight ....
Color Eyes ....
Color Hair ....
Mustache ....
Beard ....
Complexion ....
Characteristic Marks ....
....

Remarks ....

STANDARD FORM OF EMPLOYMENT APPLICATION WITH PORTION TO BE FILLED OUT BY EXAMINER

THE SOUTHWESTERN ELECTRIC & GAS ASSOCIATION CONVENTION

The Southwestern Electric & Gas Association held its third annual convention at San Antonio, Tex., May 14, 15, and 16. The several sessions were well attended, and interesting and beneficial discussions were indulged in both upon the papers presented and upon questions originally submitted to the association question box. The papers read were all printed and copies distributed at the time of their presentation. The questions submitted to the question box during the year and the answers given to them by the several members of the association had also been printed, and each member was provided with a bound copy. The work of editing the question box and putting it in book form was well done by Samuel Kahn, of San Antonio.

TUESDAY MORNING SESSION

The first session of the convention was called to order Tuesday morning by President H. S. Cooper, of Galveston, who introduced Regan Houston, of San Antonio. In welcoming the convention to his city, Mr. Houston took occasion to refer to the recent legislation adverse to public corporations enacted by the last Texas Legislature.

President Cooper, in his address, said what was most vital to the association was the molding of public opinion to prevent the enactment of more stringent tax laws against Texas corporations. The corporations, he said, as a whole had gotten a bad name, and the public must be informed of the truth concerning them. He urged the establishment of a permanent secretary's office to carry out the association work better.

H. T. Edgar, of Fort Worth, at the request of President Cooper, told of the work of the legislative committee during the past session of the Legislature. Soon after the assembling of the Legislature the executive committee of the association held a meeting in Dallas and appointed three chairmen of a legislative committee, one for the electric railway, one for the electric light and one for the gas interests. These chairmen afterward selected associates from the managers of plants and systems. The chairmen, when not in Austin, were kept informed of conditions there by a representative kept in Austin for that purpose. The legislative committee, he said, had, by ardent work, prevented the passage of a law taxing the intangible assets of corporations, and had fought hard to prevent the passage of the law taxing the gross receipts. The best that could be done, however, was to get the tax reduced to a maximum of one-half of 1 per cent of the gross receipts of electric light corporations and three-fourths of 1 per cent of street and interurban railway properties. Had it not been for the efforts of the committee the taxes would, in most probabilities, have been 2 per cent and 3 per cent.

President Cooper called attention to the finances of the legislative committee, saying that there was a deficiency in cash that should be made up.

Legislative matters were further dealt with in a paper entitled "Education of Legislators with Reference to Public Service Corporations," presented by H. M. Moore.

TUESDAY AFTERNOON SESSION

At the opening of the session Tuesday afternoon, V. W. Berry, master mechanic of the Stone & Webster properties in Texas, read a paper on the use of labor-saving tools and devices in central stations and car houses. He urged the installation of pneumatic hoists and lifts in car houses, saying that the use of chain blocks and mechanically operated hoists were often overloaded, with disastrous results, and at times the men operating them were subject to injury.

President Cooper, in opening the discussion on Mr. Berry's paper, said he had installed pneumatic hoists and lifts in the shops at Galveston with good results. Two locomotive compressors were originally installed to furnish compressed air to pump fuel oil. Pipes had been extended from these pumps over the shops, and both car jacks and chain hoists had been substituted by air lifts. With present apparatus, with four men, wheels were set out in forty minutes and armatures were changed in a comparatively short time. The cost of the air apparatus had been only about $300, as most of it had been made in the shop. The hoists had enabled him to cut the shop force, so that about $2,500 was saved annually. Moreover, the work was done with more safety.

Mr. Cass, of the Westinghouse Air Brake Company, said that he found in many instances compressors of too small a size were installed in shops because of the rapidity of the extension of the use of air when the compressors were once installed.

A question box query concerning the keeping of pole line data resulted in a lively discussion. F. C. Randall, of Galveston, explained their method of keeping such data. Perspective views of sections of the pole lines were drawn on cards. The drawings were all made so that the observer faced the line in the outgoing direction. Pole locations were numbered consecutively, and where lines branched a separate set of cards was made for each branch.

E. T. Moore, of Dallas, had a small map of the city ruled off into twenty-five sections. For each section there was a map to a larger scale on which the locations of poles were shown. Each pole was given a number which referred to a card upon which all data concerning that pole were kept.

In reply to the statement of one member that he saw no necessity of keeping separate data for each pole where all carried the same wires, President Cooper took exception, saying that where definite data were kept, in the event of damage suits, statements could be sworn to, and this might enable the operating company to save thousands of dollars in damages.

In opening the discussion on the treatment of poles with preservatives, President Cooper said the question was a very important one, in view of the fact that in the last few years the price of lumber had gone up in Texas about 100 per cent. The question box query upon which the discussion was based was whether or not it would not be advisable to treat only the butts of poles, or possibly only a small section of the pole near the ground line, instead of treating the entire pole. President Cooper was of the opinion that poles could not be treated by the vacuum process for only a portion of their length, but that it was necessary to treat the entire pole. Mr. Edgar said a pole man had explained to him that it was possible to treat only the butts. The poles were set upright with only their butts in the creosoting cylinder, and an air-tight joint was made around the poles where they came out of the cylinder. A price of $4.50 had been quoted to him for a 35-ft. pole with a 7-in. top having only the butt creosoted. Mr. Edgar saw no necessity for treating the pole above the ground line, as the exposed portion would last as long untreated as the treated portion at the ground line.

George H. Cushman, of San Antonio, brought up the question of the conductivity of treated poles, and there fol-

lowed a discussion as to whether or not this conductivity varied with age.

President Cooper vouched for the fact that creosoted poles were good conductors. Because of this conductivity the linemen in Galveston were compelled to mount poles and dismount them with a jump, so as not to have a spur in the pole and a foot on the ground at the same time. He was compelled to use creosoted poles because in the wet, salty sand of Galveston an uncreosoted pole lasted only about three years. He did not believe the conductivity changed with age, as he had noticed no change in the conductivity of the creosoted poles put up soon after the Galveston storm in 1900. One member, in asking for information concerning creosoted cypress poles, stated that a price of $3.25 had been quoted him for a 25-ft. pole of this wood.

In the discussion regarding the effect of treatment on the wood fiber it was stated that the deteriorating effect was caused by high-temperature steaming. It was necessary to treat only green timber to the vacuum and steaming processes, as thorough penetration of seasoned timber could be obtained by treating it in vats with oil at a temperature of 200 degs. F.

E. E. Nelson, of Fort Worth, said his company was replacing the poles between Dallas and Fort Worth with creosoted pine poles.

The remainder of the afternoon session was devoted to discussions regarding the getting of new business by electric light and gas companies.

WEDNESDAY MORNING SESSION

At the opening of the Wednesday morning session President Cooper read a telegram from M. M. Phinney, expressing regrets at his inability to be present. Afterwards he appointed on the nominating committee H. S. Potter, of El Paso; J. P. Crerar, of Denison; Samuel Kahn, of San Antonio, and E. D. Kelley, of Hillsborough. A special committee to draw up resolutions regarding the establishment of a permanent secretary's office was also appointed. This committee consists of H. T. Edgar, of Fort Worth; W. B. Head, of Grand View; W. B. Tuttle, of San Antonio; A. E. Judge, of Tyler, and C. H. Dunbar, of Houston.

After the appointment of this committee Professor Arthur C. Scott, of the electrical engineering department of the University of Texas, read a paper on the value of scientific tests to public service corporations. He said the engineer of today occupied a position midway between the pure scientist and the strict utilitarian. He called attention to the work of the railway department of the University of Illinois and to the tests made on railway properties by the department with the aid of the electric test car and the dynamometer car with which the department was provided. He said that it was evident that the corporations saw the value of the tests or otherwise they would not have co-operated with the university in making them.

He suggested that it might be worth while for the corporation directors of Texas to inquire into the work of the technical schools of the State, with a view to increasing their own scope and productiveness and also to procure good men to fill vacancies. It would be to their interests also to co-operate with the schools with a view to making tests on power plants and other portions of the systems. Professor Scott, after the presentation of his paper, was, under a suspension of rules, elected an honorary member of the association.

Mr. Edgar wanted to know more in detail what facilities Professor Scott's department possessed for making scientific tests and what tests could be undertaken. In response, Professor Scott gave a general outline of the steam and electrical equipment of the laboratories in the university. The members were unanimous in the belief that the engineering department of the university should receive more encouragement from the State Legislature, and, with a view of calling the attention of the members of the Legislature to the school, a motion was passed to have 500 copies of Professor Scott's paper printed and a copy mailed to each member of the Legislature.

F. C. Randall, of Galveston, presented an interesting paper entitled "The Getting Up and Trying Out of Forms." Forms upon which data was kept, he said, should be gotten up in such a manner as to show at a glance the data required, and the data should be put down in proper sequence and along the trend of thought of the person who used the data. Employees should be thoroughly instructed regarding the forms they are required to use. A sample, properly filled in, often aided an employee to understand the character of answers or information desired. The size, shape and color of forms should be given careful consideration. The size should be such that in cutting it from stock paper no waste was entailed.

President Cooper, in opening the discussion on the subject of forms, termed a form a channel of communication of the office with the outside business. He emphasized the importance of trying out forms, adding that very frequently forms were unfitted for the purpose for which they had been gotten up. He cited a case where some forms which were intended to be filled in by outside men, who usually employed stub pencils, had blank spaces measuring 5/32 in. As to the proper size of forms, he had adopted an 8 in. x 11½ in. card as a basis. Other sizes used were either multiples or fractions of this size. These sizes could be cut from stock paper without waste. He had simplified the filling out of forms by so wording them that the answer "yes" or "no" was sufficient, and he had found that men not able to write well appreciated the privilege of using a circle for "yes" and a cross for "no."

Mr. Tuttle said that by cutting out unnecessary details and by avoiding the repetition of information on different forms he had simplified his system of forms considerably.

Mr. Edgar believed it possible for electric railways to use the same system of forms to a very great extent. He said the Stone & Webster Corporation had a department for the getting up of forms. All new forms designed by the different roads were submitted to the department, which compared them with other forms on file and was often able to make valuable suggestions.

WEDNESDAY AFTERNOON SESSION

The Wednesday afternoon session was opened with a discussion on the full convertible car and the best car for use in cities. Mr. Burdett, of Austin, said his company had had full convertible cars in use for several years. Some of them were going to pieces, and he did not regard them as a success.

E. T. Moore said that in Dallas they used the semi-convertible car successfully. He considered it a good car for summer use, as well as in winter, because of the protection afforded in sudden showers.

T. C. Brown, of San Antonio, had never had any experience with the full convertible car, but it was his opinion that an open car would not wear out until its cost had been paid in accident claims. He considered the semi-converti-

ble car the only one for all-round use. He had been operating twelve cars of this type for eighteen months and had had no trouble.

H. S. Potter, of El Paso, spoke of the California type of car. His cars had the closed compartment in the center. He did not consider them as good as the semi-convertible as regards accidents, and added that his company would not purchase any more.

President Cooper thought the open car had the advantage that it was preferred by the public, but added that the consensus of opinion was that increased liability to accidents precluded its use. He did not think he could get along without the open car. He had had very few accidents directly traceable to it.

Mr. Brown said he at first thought the public would object to the semi-convertible car, but had found they preferred it. He attributed this to the fact that an open car seat with five persons in it was uncomfortably crowded, and that the end-seat hog made it inconvenient for people to get in and out. Added to this, people usually went in pairs, and they could be seated together in the semi-convertible car. Further, in the open car with people standing between the seats the ventilation was not as good as in a semi-convertible car. One drawback to the semi-convertible car was the time required to load and unload it. There was hardly a day that there was not an accident report turned in regarding some one falling off the car.

Mr. Edgar said that people at Fort Worth preferred the semi-convertible car. Last year he got a petition from the people along one line not to run open bench cars on that line. He had sixteen open cars, but wished he had none. He questioned the statement that the open car could be loaded and unloaded the quicker. This, he thought, could be done only when the car was unloaded all at once.

President Cooper stated that he did a large excursion business and cars were loaded and unloaded all at once. Frequently he had to handle 5000 or 6000 people in twenty minutes, and that to do so the cars must be loaded and unloaded quickly. He also brought up the point that an open car was very much lighter per passenger carrying capacity. He always noticed an increase in the station load when the open cars were taken off. He thought also that the people naturally loaded the car evenly and this reduced the maintenance.

E. T. Moore said he could not make the same schedule with semi-convertible cars as with open cars, but Mr. Potter had found the semi-convertible car the quickest. He said the Mexicans of El Paso always hesitated as to where to get on an open car, and this took time.

At the conclusion of the discussion concerning types of cars the question of whether or not transfers should be registered on the same register as cash fares was open for discussion.

Mr. Brown thought everything should be rung up on one register. Too many traction men considered the register as a policeman. He regarded it only as a counter. The money the company lost was that which was never rung up. A complicated register system gave the conductor the idea that the register was a spotter and that the officials were depending on it to catch him and were not watching him. Mr. Brown was not afraid of those conductors who go into collusion with others. These, he said, were found out soon.

President Cooper also considered the register in the light of a tally—that too much importance was attached to it. He believed in using every possible check outside the register. The best way was to watch the receipt curve of the car, and when this curve became abnormal to look for the cause. He said we could not get a machine that would take account of human nature. The personal element must be pitted against the personal element.

Mr. Edgar said spotters wanted two registers, and that a checker was confused when everything was rung up on one register.

H. M. Moore believed in watching the men as is done in the United States mail service.

The question, "To what extent should transfers be checked by the accounting department," was next opened for discussion.

A. W. Q. Bertwell, of Houston, did not think it necessary to audit transfers every day. He thought it sufficient to see that all transfers were turned in on the line for which they were punched and that the time limit was O. K. About once a week a thorough checking should be made.

President Cooper said that his transfers were not dated. They were punched on the edge in an arbitrary place each day, and, as no one knew where the punch was going to be, there was no chance of fraud. It was easy for the conductor to tell whether or not a transfer was of the correct date, as the punched out portions of all transfers collected on one day must coincide.

Mr. Brown said that in San Antonio, although a conductor could not refuse to take a transfer dated incorrectly, a card had been gotten up for use in connection with transfers not dated right when the passenger insisted they be taken. The card simply showed that the conductor did not take the transfer unknowingly.

C. J. Thomas, of San Antonio, added that he did not believe constant checking of transfers with a big force did not pay. He counted the transfers and would check up one line at a time at intervals.

THURSDAY MORNING SESSION

The Thursday morning session was given over to the supply men or associate members. The object of the meeting was to bring about a closer understanding between the operating and the supply men.

Guy C. Gum, district sales manager of the Nernst Lamp Company, who had charge of the meeting, said the alert supply man usually noted the practice at different places and was often able to give to those he visited valuable information. A feeling of delicacy, however, often prevented him doing so until asked.

O. E. Turner, of the General Electric Company, urged the supply men to bring pressure upon non-members of the association they met in their travels to join the association. Among other speakers were Ernest Boehme, Electric Service Supplies Company; Sam Hobson, Wesco Supply Company, and T. B. Whitted, of the Westinghouse Machine Company.

The meeting resulted in the passage afterwards of a resolution providing that the associate members be provided with application blanks and by-laws with a view to getting new members. The resolution also provided that the associate members be supplied with a badge, somewhat different from that of the active members, and for the appointment of a committee to make arrangements for exhibits at future conventions.

THURSDAY AFTERNOON SESSION

The Thursday afternoon session was opened by a paper of interest to gas men only. The report of the secretary, given later, showed that the association had three honorary

members, sixty-seven active and sixty-six associate members.

A resolution was passed providing for the establishment of a permanent secretary's office in Dallas, and that this office collect data of interest to the members for the exclusive use of the members.

On a motion by Mr. Edgar, the thanks of the association was tendered to the officers of the San Antonio Gas & Electric Company and of the San Antonio Traction Company for the many courtesies received.

The nominating committee reported the following ticket, which was afterwards elected unanimously: President, H. T. Edgar, of Fort Worth; first vice-president, W. B. Tuttle, San Antonio; second vice-president, J. P. Crerar, Denison; third vice-president, J. D. Oliger, Cleburne; secretary, R. B. Stichter, Dallas; treasurer, A. E. Judge, Tyler. Executive committee—H. T. Edgar, H. S. Cooper, W. B. Tuttle, J. D. Oliger, H. M. Moore, J. P. Crerar, R. B. Stichter, M. M. Phinney and J. F. Strickland. Finance committee—W. B. Head, C. H. Dunbar and E. T. Moore. Advisory committee—J. E. Farnsworth, W. J. Jones, A. A. Hauser, W. H. Chapman, Arthur B. Foster, T. C. Brown, J. A. Myer, A. W. Guthrie, W. Broyles and Fred M. Lege.

At the invitation of H. S. Potter, it was decided to hold the next annual meeting at El Paso, Tex.

ENTERTAINMENT FEATURES AT THE TEXAS CONVENTION

The San Antonio Gas & Electric Company and the San Antonio Traction Company, as hosts, provided several features for the entertainment of the delegates and visitors to the Southwestern Gas & Electric Association Convention at San Antonio. Tuesday afternoon the convention party made a tour of the city in special cars. The trip terminated at Electric Park, where a Mexican supper was served. Thursday morning the ladies of the party were taken in automobiles to visit the famous Spanish missions, a few miles distant from San Antonio. At another time they visited interesting portions of the city in carriages. All members were supplied with free transportation while in the city.

EXHIBITS AT THE TEXAS CONVENTION

A very extensive exhibit of electrical apparatus was made at the convention by several electrical concerns. Among the concerns which made exhibits and which were represented were Westinghouse Electric & Manufacturing Company, Westinghouse Machine Company, Westinghouse Air Brake Company, Nernst Lamp Company, General Electric Company, Western Electric Company, Columbia Incandescent Lamp Company, Standard Underground Cable Company, Commercial Electric Supply Company, Wesco Supply Company and the Electric Service Supplies Company.

The Brooklyn Rapid Transit Company has just placed in service on the Fulton Street line a new all-steel surface car. The car in its outer lines and interior arrangement closely resembles the well-known "Brooklyn type" of cross-seat convertible car which the B. R. T. has adopted as its standard.

IMPROVEMENTS ON STATEN ISLAND

During the summer of 1906 the Richmond Light & Railroad Company, of Staten Island, N. Y., suffered some severe traffic interruptions due to unlooked-for demands on the Livingston power station. This was caused by the extraordinary increase in pleasure traffic on the municipal ferry boats crossing New York Bay, as most of the passengers continued their journey either to the wooded parts of the island or to "Happyland," an amusement park reached by the company's lines. To make matters worse, part of the power station could not be used at all, owing to difficulties arising from the installation of new apparatus. The coming season, however, will find the company fully prepared to do justice to both its railway and lighting business.

No important change has been made in the power station building except to construct a Custodis perforated radial molded brick stack 200 ft. high and 15 ft. inside diameter. The two 500-kw Curtis turbines installed in June, 1904, are no longer operated with jet condensers, but with the C. H. Wheeler Manufacturing Company's "wet system" condensers. Each unit contains 2000 sq. ft. of surface. The air pump is of the Mullan horizontal, high-vacuum type, and the circulating pumps of the centrifugal type take their suction from a main which, in turn, draws its water from the river, and also furnishes condensing water to the other condensing plants in the station. The two turbines are spaced at about 25 ft. centers, and the exhaust connections between the turbines and condensers have side openings, permitting a cross-over connection of the exhaust main from one turbine to the other, and thus making it possible to use either turbine with either condenser

The new power generating equipment consists of two 500-hp Babcock & Wilcox boilers and one 1500-kw, 60-cycle, 2500-volt, six-phase Curtis turbine. Voltage taps are also provided so the machine can deliver current at 2300 volts. The turbine operates with a Blake jet condenser at a gage pressure of 150 lbs. The generator on the turbine has eight poles, runs at 900 r. p. m., and is provided with a rheostat suitable for mounting back of the switchboard. The auxiliary apparatus includes two steam-driven pumps furnishing 12 gals. of oil per minute at a pressure of 300 lbs. per sq. in., together with an oil tank and filter. A turbo-exciter is provided, consisting of a 35-kw, two-pole horizontal Curtis steam turbo-generator set running at 3600 r. p. m. and delivering current at a potential of 125 volts.

There is also one 500-kw General Electric quarter-phase, rotary converter running at 600 r. p. m. and compound wound to deliver current at 600 volts, together with two 275-kw, 60-cycle, oil-cooled transformers. The primaries of the latter are arranged for 2500 volts, two-phase, and the secondaries for 365 volts, six-phase; the primaries are provided with four 2½ per cent taps and the secondaries with one-third and two-third taps for starting. In addition to this apparatus the General Electric Company provided a complete switchboard.

Beside the turbo units mentioned, the Livingston station contains two 500-kw, 2500-volt Westinghouse alternators, one Walker d. c. generator and two 400-kw G. E. machines, all connected to Allis cross-compound engines.

The 1500-kw turbine will take care of the lighting load, the rest being more than sufficient to handle the railway business. The transmission voltage is 2300 to 2500 volts and the longest transmission is to Tottenville, 15 miles distant. Since the Richmond Company's station is on the

north side of Staten Island and that of the Staten Island Midland Railroad on the south shore at Grassmere, an agreement has been made between the companies to rearrange the circuits so the southern lines of one company will be fed from the southern station of the other, and vice-versa.

Vice-President and General Manager S. F. Hazelrigg, who has been directing the power house changes of the Richmond Light & Railroad Company, has also ordered twenty fifteen-bench open cars from the Stephenson Works of the J. G. Brill Company. These will be 42 ft. long over all and 7 ft. 3 ins. wide. They will be mounted on No. 22-E maximum traction trucks. There will be two G. E. 80 motors per car. The cars will be equipped with Sterling double-chain brakes and registers. This extra rolling stock will enable the company to give a three-minute service to "Happyland" from the New York ferry terminal at St. George.

THE AIR OF THE NEW YORK SUBWAY.

A paper discussing the quality of the air of the New York subway prior to 1906, hence prior to the introduction of louvres and other means of ventilation installed last year, was read by Dr. George A. Soper, of New York, before the Society of Arts in Boston, and has just become available through re-publication in the "Technology Quarterly." The paper itself is an elaborate one, but some of the main facts determined by Dr. Soper will be given.

His first test was to determine the extent to which the air was drawn through the stairways and was moved in the subway by the passage of trains. An average of 573,000 cu. ft. of air per hour moved in and out through one stairway was obtained. The circulation of air between stations was determined by the time required for an odor from a highly concentrated grade of cologne to pass from one station to another. It was found that the average rate was 3.08 miles per hour.

The subjects of temperature and humidity were then considered. Before the trains commenced running the air in the subway was cooler in summer and warmer in winter than that outside. After the opening of the subway conditions began to change, and by the summer of 1905 the subway was generally warmer than the streets. In the early part of July, 1905, the average difference was less than 5 degs. By the end of August it became 7.5 degs.; in October it was 11 degs., and by November 10-16 it was 18 degs. The highest average temperature for any week in 1905 was 88.2 in the subway and also in the streets.

The relative humidity in the subway was generally less than out of doors, and varied from less than 1 per cent in August to 16 per cent in November. There were no fogs or mists in the subway, but a faint haze was not uncommon.

Another test was to determine the amount of carbon dioxide. The average of all results was, for the subway, 4.81 volumes per 10,000 volumes of air, and for the street, 3.67. This difference was regarded as very slight, since at no time or place was the carbon dioxide large. The greatest amount discovered was 8.89 volumes per 10,000. This occurred in the tunnel between the Grand Central station and the Thirty-Third Street station on Dec. 27, 1905, at 6:02 p. m., where there was a blockade. The carbon dioxide in the subway varied according to season, place where the sample was collected and other circumstances. More carbon dioxide was found in the autumn than in the summer or winter. It seemed likely that this was explainable largely on the ground that many more passengers were carried in autumn than in summer, and that in winter there was more wind in the streets, increasing the amount of ventilation.

Bacterial tests showed that there were on the average more than twice as many bacteria in the air of the streets as in the air of the subway, except after rains, when fewer were found outside than inside. The same applied to the molds. The number of bacteria in the air of the subway varied with the amount of travel. It was not found that any harmful germs were capable of multiplying in the oil which dripped from the machinery of the cars upon the broken stone ballast and wooden ties of the roadbed.

The examination of the dust in the subway showed that over 60 per cent of it was iron. The rest was silica, oil and organic matter. The speaker explained the large proportion of iron by the wear of the brake-shoes, which he calculates at one ton every month for each mile of subway, to which should be added the wear from the rails, wheels and contact shoes.

In his conclusions Dr. Soper said: "According to usual sanitary standards, based on chemical and bacteriological analyses, the general air of the subway was always and everywhere satisfactory. The air in the cars in winter is not included in this statement. The general air, although disagreeable, is not actually harmful, except possibly for the presence of iron dust." This matter is now being investigated by the author. The high temperature of the subway, according to Dr. Soper, was its most noticeable objectionable feature, and is worse in the mornings and evenings of summer, during the hours of greatest travel and when the air outside was cooler than during the rest of the day. This heat did not indicate that the air was vitiated or stagnant, as is popularly supposed, but because a great deal of heat was produced in it and stored by the material of which the subway was built. The small excess of carbon dioxide in the subway over that in the streets showed that the air was renewed with remarkable frequency. The air was best where the subway was most open to the streets, and conversely it was least satisfactory where the subway was most enclosed. The comparatively small number of bacteria found in the air of the subway indicates that the bacteriological condition of the air was satisfactory, but no attempt was made to identify the different kinds of bacteria. The odors of the subway were objectionable chiefly because they were disagreeable, and they can probably be reduced.

A new through service to Granite City was started by the East St. Louis & Suburban Company May 15. Cars leave Third Street and Washington Avenue, St. Louis, on the hour, twenty and forty minutes after the hour for Granite City, without change. In Granite City the cars leave Nineteenth and B Streets at ten, thirty and fifty minutes past the hour. The running time is forty-five minutes. Six handsome new high-speed and up-to-date cars are used in this service, and the fare for a single trip is 20 cents. Commutation tickets are sold, making the fare 12½ cents to St. Louis and 10 cents to East St. Louis. On the same date the service to Edwardsville was improved by starting the Alton cars on the half hour. The Illinois Traction System's cars run on the hour, and the change gives an additional car each hour to Edwardsville. The regular Edwardsville car leaves on the half hour, but the trip by way of the Alton line, with a change at Mitchell, can be made in much less time than by way of Collinsville.

SOME FACTS AND PROBLEMS BEARING ON ELECTRIC TRUNK-LINE OPERATION*

BY FRANK J. SPRAGUE

It is not my intention in the present paper to investigate railroad economies, or to formulate any final conclusions in the matter of steam railway electrification, but rather briefly to analyze and make running comment upon various phases of the problem often discussed by engineers; to give some comparative facts as they have thus far developed; to describe sundry developments in electric locomotive construction; and to illustrate in some detail features specifically characteristic of the three typical initial equipments now commanding attention.

MOTOR EQUIPMENTS

In discussing the selection of any system, the first thing to investigate is the motor. In railway operation that which is to be replaced in a steam locomotive; in other words, a motor supplied by a local boiler, furnace, and coal bin: that which is proposed in its place is another motor, or group of motors, supplied through a wire by bigger boilers, furnaces and coal bins, or by energy from a water-power. The working conductor, with everything connected to it in transmission or generation, although essential, is tributary to the motor and its requirements.

It is not sufficient that the source of power can be made of any desired size, although it is an essential feature; in any case, such concentrated generating equipment must supply a number of motors. What is essential, and in the last analysis vital, is that the new motor shall have not only certain mechanical advantges, to the extent of eliminating the evils of reciprocating parts and reducing the cost of up-keep, but above all it must have capacity, measured not alone by drawbar pull or speed, but by both, and it must be of sustained character; and this capacity, to accomplish more than the steam locomotive, must be greater than that of the latter. Such capacity should naturally be attained first, by increase of the capacity of the individual motor or locomotive, and then, when this increase has reached its limit, by combining motors or locomotives under a common control by the multiple-unit system.

LIMITATION OF DESIGN

The designing of electric railway apparatus is handicapped by certain physical limitations which it is not in the power of the designer to change; for example, gage of track, size and number of drivers, length of rigid wheelbase, dead and total weights per wheel and axle, clearance of motors above the track, permissible speeds of parts, provision for accessibility and repairs, and capacity for heat radiation. Every steam locomotive, when properly designed, has capacity to slip its drivers on sanded tracks; it can maintain nearly its maximum average drawbar pull for a considerable range of speed as long as its boilers can make sufficient steam. Although at the disadvantage of having reciprocating parts, its drivers, being coupled together, cannot slip individually. In short, it is designed of a weight necessary to get the tractive effort required to pull a definite load, and then for all the capacity in the matter of speed which its fire-box and boilers can provide for. Essential defects are that its drawbar pull varies widely, depending on the position of the connecting-rod; that it does not materially increase below a certain speed, and the steaming power is limited. Hence comes the limitation of the "ruling grade." On the other hand, the electric locomotive, when likewise properly designed, provides a drawbar pull of constant character throughout the revolution of the driver; it increases to an extraordinary degree when necessary; and the capacity of the boiler supplied at the central station is ample. On all service, however, high continuous capacity of the motor is essential.

Capacity being, therefore, the keynote of the equipment, I shall discuss at some length the characteristics of conductors and motors used with direct current and with alternating current. In so far as these comments relate to single-phase, alternating-current operation, they will in some measure be based upon the only existing commercial development of this character now in the United States; that is, upon the series-wound, commutating, single-phase motor with compensated fields, operated at 25 cycles. Lowering the number of cycles to increase the capacity of the single-phase motor, as has been suggested although not yet developed in commercial practice, of course merits serious consideration, and I shall add some comments upon this proposed change.

BEHAVIOR OF CONDUCTORS

Both motors and conductors when used for direct current or for single-phase alternating current, present certain differences of such inherent character that there seems no present likelihood of material change, and this conclusion is as sound in regard to the motor differences as it is in regard to conductors. When used for single-phase alternating currents, conductors offer, by reason of self-induction, an impedance or resistance to current materially greater than they present to direct currents. This impedance, and the consequent loss of energy at any particular potential delivery, depends upon the shape and material of the conductor, upon the frequency of alternation, the density of current and the power factor. Under ordinary conditions, a round copper conductor of, say, No. 0000 size, has at 25 cycles an impedance of about 1.6. But with iron or steel conductors this impedance is increased many times, because the magnetization of the iron and the self-induction drive the current toward the skin of the conductor, so that the body of it is useless, and it might as well be a shell of very much less weight.

This effect in steel rails increases with the quality and with the cross-section of the rail. For example, according to the report of the test commission of the recent International Electrical Congress, on 50-lb. traffic rails the ratio of impedance to direct-current resistance at 25 cycles and 300 amperes is about 5.4, while on 80-lb. rail this ratio with the same current is 9.0, with the curious result that increasing the cross-section of the rail does not apparently increase its actual capacity for carrying single-phase currents. Quite the contrary, of course, is the fact in regard to direct currents, the conductivity increasing with the cross-section and quality.

These statements are made, not because of special novelty, but in emphasizing certain inherent differences in conductors in their behavior toward the two kinds of current; additional weight is lent to the statement that the differences inherent in direct-current and single-phase alternating-current motors are likewise radical, and are probably permanent in character.

TYPES OF MOTOR

Among the many types of motors proposed for railway service four are now being exploited: Polyphase alternat-

*Abstract of a paper presented at the meeting of the American Institute of Electrical Engineers, New York, May 21, 1907.

ing-current motor without commutator; single-phase alternating-current motor without commutator; single-phase alternating-current motor with commutator; and direct-current motor with commutator.

Of these, two, the direct-current and the three-phase motors, each have a continuous rate of energy input, while the single-phase motor has an intermittent and variable rate. Moreover, there is combined in the single-phase motor two distinct functions, those of a motor and a transformer, and the latter cannot be entirely eliminated. The result is a reduction in both continuous and overload capacities.

It is in this particular that the single-phase motor, despite a great amount of experimental development, has remained defective; and while not prohibitive to the extent of making it an unworkable machine, its defects are so inherent as to place it at a serious disadvantage in individual comparison with other types of motors. To attain the pre-eminence hoped for, the external advantages in current supply must be very marked. In fact, rated in the same manner and under like physical conditions, it is only about half as good as the direct-current motor. Or to put it another way, the weight of the complete single-phase electrical equipment on a car or locomotive, including transformers, motors and controlling apparatus, for continuous hard service, and with like physical limitations and ventilation, is about twice that required for direct-current apparatus. In addition to this there is, of course, a material increase in the mechanical equipment necessary to carry the electrical apparatus. The reason is simple—it is because of the heat generated on account of lower electrical efficiency, and the working the fields of the motors at a reduced magnetic flux.

When considering locomotives, the net result is that the total weight of a single-phase alternating-current locomotive, with a service capacity equal to that of a direct-current locomotive of like armature speeds and permissible temperature-rise (this temperature-rise being the ultimate limitation of a motor for continuous service) will easily be from 30 to 50 tons more.

An increase in the total weight of a train amounting to from 3 per cent to 10 per cent is perhaps not of itself of so much importance, because such a difference in net power demand can easily appear for various reasons; but a ratio of 2 to 1 in capacity for the limit of equipment possible to install within given allowable dimensions and number of units is a matter of vital importance.

If an increased weight is permissible for any given capacity, there must be some ample compensation for it. Of course, this is claimed to be the fact in the single-phase system, but another possible advantage which might prove important is the abolition of gearing and bearings, and simplification in motor and locomotive construction.

COMPARATIVE WEIGHTS OF DIRECT-CURRENT AND 25-CYCLE SINGLE-PHASE ALTERNATING-CURRENT MOTORS

While testimony is practically universal that not only is any single-phase motor, whatever the number of alternations, more or less inefficient than a direct-current motor of like weight or capacity, the differences of efficiency, excluding the losses in the gearing, are variously estimated.

Valatin and others have indicated one measure of comparison between motors of different makes, types and capacity.

Fig 1 shows a comparison between a 125-hp d. c. motor and an a. c. motor of the same weight. The comparison also includes the "weight-coefficient," which for convenience may be expressed by the following equation:

$$\text{Weight-coefficient} = \frac{\text{Nominal rated horse-power}}{\text{Revolutions} \times \text{weight in tons}}$$

This is a factor of the greatest importance, and it should be considered not only for the one-hour 75 deg.-rise load, but throughout the whole thermal curve.

Generally speaking, it will be noted from these curves that: starting at 500 revolutions for a thirty-nine-minute run, the capacity of the direct-current motor averages approximately nearly double that of the alternating-current throughout the thermal range; the speed of the alternating-current motor rises at a much more rapid rate, until on a five-hour run it is double that of the direct-current motor, despite the fact that it is only developing one-half the

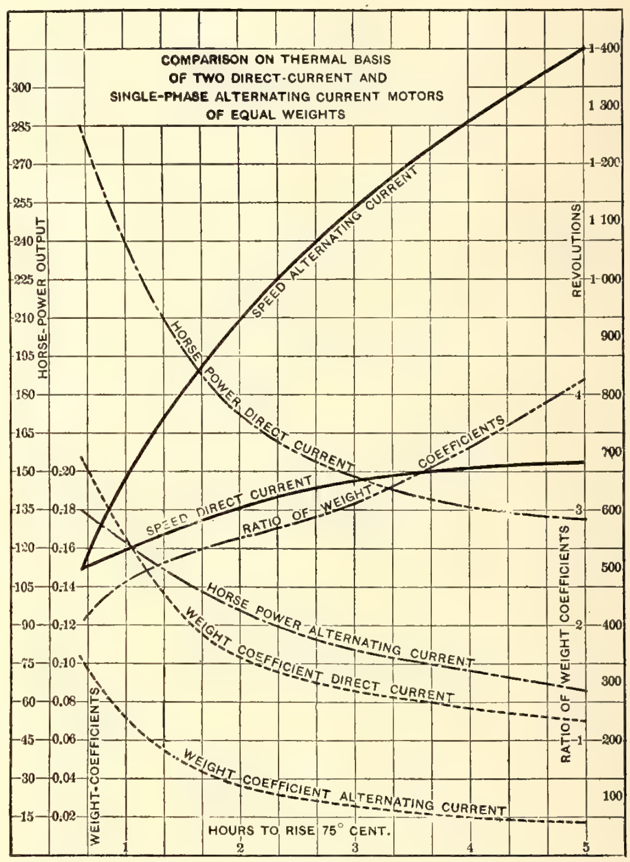


FIG. 1.—COMPARISON ON THERMAL BASIS OF TWO DIRECT-CURRENT AND SINGLE-PHASE ALTERNATING-CURRENT MOTORS OF EQUAL WEIGHTS

power; the direct-current motor has a five-hour capacity in excess of the one-hour capacity of the alternating-current motor; and the ratio of the weight-coefficients, beginning at a trifle of over 2 to 1, rises to more than 4 to 1 in favor of the direct-current motor on the longer runs. This comparison of weight-coefficients does not include the collectors, control switches, rheostats, transformers, or wiring, which in the aggregate are enough heavier for the alternating-current motor to maintain these disparities.

It is evident, therefore, that a pair of these alternating-current motors can handle only about one-half of the total load of the direct-current motors, with all the disadvantages of higher armature speed and smaller air-gaps; and considering the excess weight of the control apparatus, the net load over and above the electric equipment would be considerably less than one-half.

The general comparison is not, so far as the relative characteristics are concerned, individual to this particular

size of motor, but seems to be equally applicable through a wide range, and indifferently as to the make, or whether the alternating-current motor is of the series-compensated or the repulsion type. Furthermore, these differences are seemingly so inherent that there is little chance for improvement at 15 cycles.

DIFFERENCE BETWEEN DIRECT-CURRENT AND SINGLE-PHASE ALTERNATING-CURRENT MOTORS

The inherent differences between single-phase and direct-current motors may be briefly summed up as follows:

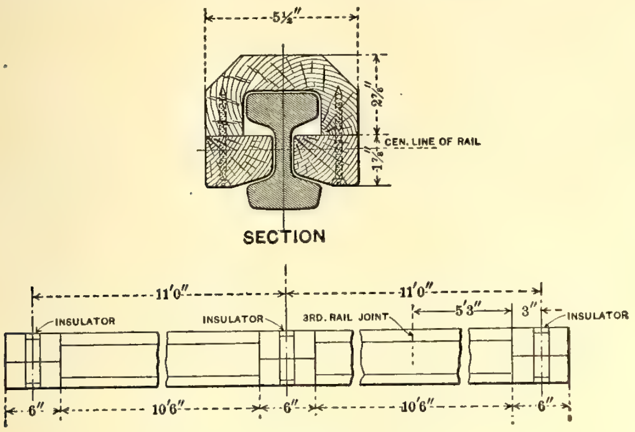


FIG. 2.—NEW YORK CENTRAL THIRD RAIL, WITH WOOD COVERING

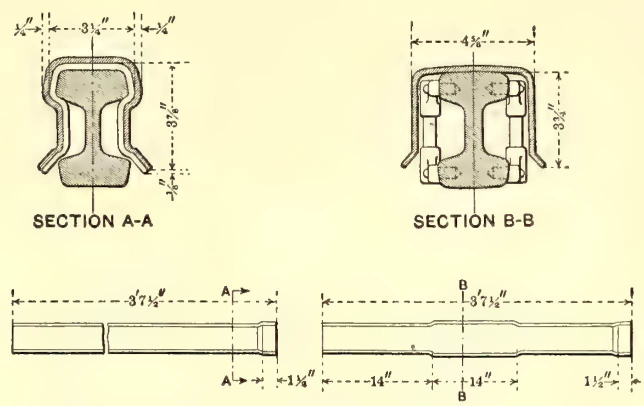
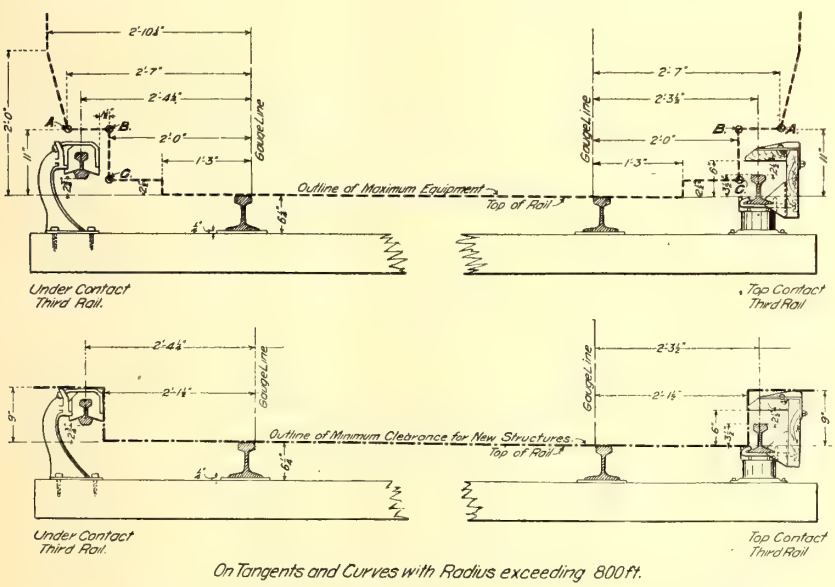


FIG. 3.—NEW YORK CENTRAL THIRD RAIL, WITH FIBER COVERING

1. The input of current in one is continuous; in the other intermittent.

2. One has a single frame, the electrical and mechanical parts being integral; the other has a laminated frame contained within an independent casing. Hence there is not equal rigidity or equal use of metal.



FIGS. 4 AND 5.—CLEARANCE LINES FOR UNDER AND OVERRUNNING THIRD RAIL

3. One has exposed and hence freely ventilated field-coils; the other has field-coils imbedded in the field magnets.

4. One has a large polar clearance, and consequently ample bearing wear; the other has an armature clearance of about only one-third as much, and hence limited bearing wear.

5. One is operated with a high magnetic flux, and consequently high torque for given armature-conductor current; the other has a weak field, and consequent lower armature torque.

6. One has a moderate sized armature and commutator, and runs at a moderate speed; the other, with equal capacity, has a much larger diameter of armature and commutator, and runs at a much higher speed.

7. One permits of a low gear-reduction, and consequently a large gear-pitch; the other requires a higher gear-reduction, and a weaker gear-pitch.

8. The windings of one are subject to electrical strains of one character; in those of the other the strains are of rapidly variable and alternating character.

9. The mean torque of one is the corresponding maximum; the mean torque of the other is only about two-thirds of the maximum.

10. The torque of one is of continuous character; that of the other is variable and pulsating, and changes from nothing to the maximum fifty times a second.

11. One has two or four main poles only, two paths only in the armature, and two fixed sets of brushes; the other has eight to fourteen poles, as many paths in the armature, leading to unbalancing, and as many movable sets of commutator brushes.

12. One can maintain a high torque for a considerable time while standing still; the other is apt to burn out the coils which are short-circuited under the brushes.

13. In one, all armature-coil connections are made directly to the commutator; in the other, on the larger sizes resistances are introduced btween the coils and every bar of the commutator, some of which are always present.

14. In one the sustained capacity for a given weight is within the reasonable requirements of construction; in the other it is only about half as much.

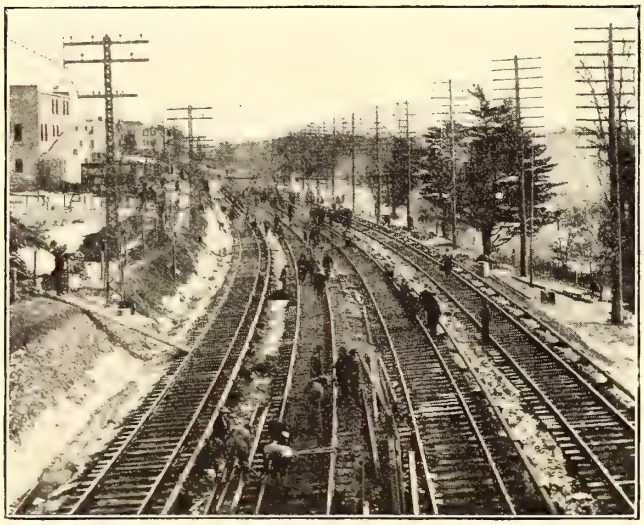
15. Finally, the gearless type, with armature and field varying relatively to each other, is available for one, but this construction is denied to the other.

Consideration, then, of the characteristics peculiar to each class of motor indicate, not that the single-phase motor cannot be used, but that if adopted the weight or number and the cost of locomotives or motors required to do the work must be much greater; that the depreciation of that which is in motion will be much higher; and that there will always be an excess weight of fixed amount per unit

which must be carried irrespective of the trailing or effective loads. We must, therefore, in many cases be led to the selection of the direct-current motor, that motor which has the higher weight-capacity, the greater endurance, and the lower cost per unit of power.

COMPARISON OF DIRECT CURRENT AND ALTERNATING-CURRENT BRAKING

On the general subject of braking it should be pointed out that with direct or continuous-current motors there is always a residual magnetism in the fields because of their construction, and the fact that the exciting current never changes direction. Such machines, therefore, can always promptly build up automatically when properly closed upon themselves and the reverser is set in the proper direction.



FIGS. 6 AND 7.—TRACK AT WOODLAWN AFTER ACCIDENT, SHOWING EFFECT ON THIRD RAIL

A similarly effective method of braking has been claimed for motors operated by single-phase alternating currents, but it would seem that in this case there is not the same degree of reliability. In such motors the field is laminated to the last degree to cut down heat-losses and to increase the capacity; it will hold but little residual magnetism under any circumstances, and furthermore the field is excited by a rapidly varying alternating current. It is, therefore, possible that at times the field will be nearly inert, and comparatively slow, with its low-turn winding, in building up, or possibly the field may be entirely inert, and may refuse to build up at all. There seems, therefore, no certainty whatever that a single-phase alternating-current motor, disconnected from the line, and without any other exciting source, will, when closed upon itself, always build up into a braking dynamo.

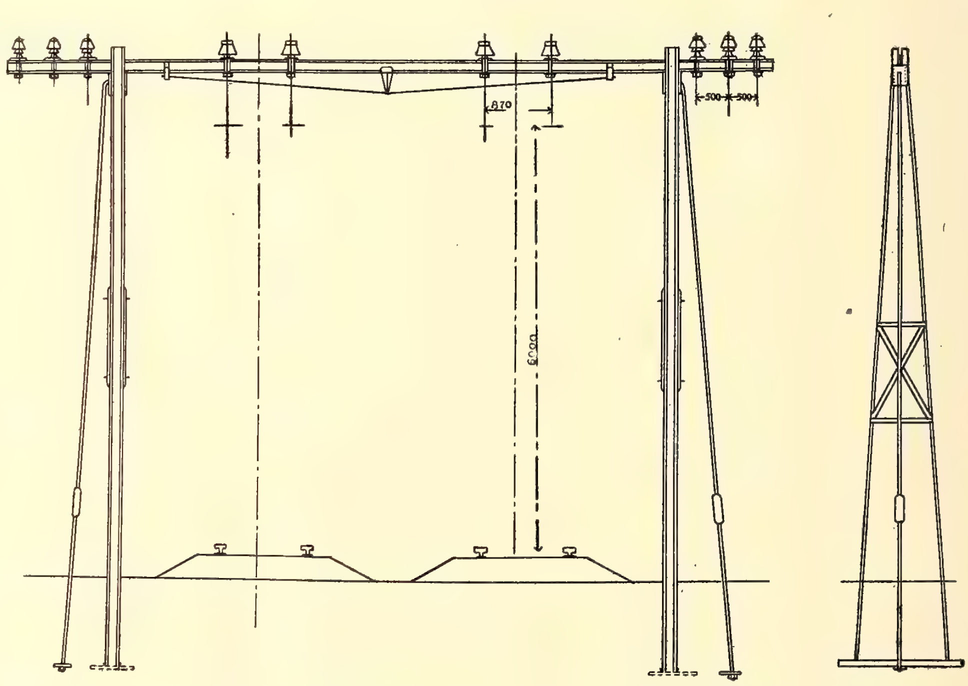


FIG. 8—THREE-PHASE LINE CONSTRUCTION ON THE PONTEDECIMO-BUSALLA LINE, ITALY

Aside from the ordinary objection of having such a possible failure, the consequence might be serious should it be necessary suddenly to call upon the machines to brake; as, for example, when getting under way, or when slowly ascending a grade there should be a failure of current and the train begin to back down before the air brakes were applied, or in case for any reason they should not be promptly available.

GENERAL COMPARISON OF WORKING CONDUCTORS

All working conductors are in many ways objectionable, but since they are a necessary connecting link between the source of supply and the motors, some comparisons may be made of the two types, the under-contact, protected type of third-rail and the overhead trolley, as affected by construction and operation.

The third rail is an inert structure, it can be aligned

accurately with the track, is not under strain, and its expansion can be readily taken care of. The overhead trolley is necessarily a system under strain, and where permanency is desired and high potentials are used it must be carried by one or more catenary cables, which on roads of high curvature makes the construction more difficult. Its alignment in the latter case does not correspond with the line of track, and as ordinarily constructed it is subject to extreme variations of tension on account of weather changes.

The third rail offers some hindrance to the ordinary maintenance of track; but overhead construction is inelastic, and the laying of additional tracks, or changes in grades or alignment require radical and expensive alterations or additions in permanent overhead structures.

Derailments will crush one form of conductor to the ground, forming a short-circuit which will cut off the section; but they may also knock down the supporting structures of the other, and, where there is a plurality of tracks, put them all out of service.

In wrecking, the third rail offers some obstruction to the throwing of the equipment to one side; but, on the other hand, overhead conductors may interfere with the operation of the crane booms of the wrecking car.

Where there are two or more tracks, snow cannot be piled up between them if the third rails are located there; but on the other hand overhead conductors are a source of danger to trainmen, to snow-shed and tunnel repairers, and in the open are subject to troubles of sleet formation.

The third rail will oftentimes be covered with snow, but is unaffected by sleet. Very thorough tests made in connection with the New York Central work show satisfactory operation, not only in sleet storms, but with the rail buried in snow. Additional depth should not add much difficulty. With regard to frogs and switches, there are no problems which cannot be solved with this type of third rail, with an occasional overhead section, and any required amount of power can be collected at operative speeds.

On Western roads, where a rotary snow-plow is used, overhead conductors and the supporting insulators, especially in yards, will be subject to a heavy bombardment of snow, ice and refuse, with possible resultant breakage, and the under sides of the umbrellas of the insulators will be often filled up with wet snow.

As to danger to passengers or employees, this is largely overcome where the under-contact third rail is properly protected, and is designed with due regard to equipment clearances. With an overhead high-tension trolley, there is, on trunk railways, where there are overhead street or highway bridges, tunnels and snow-sheds, great possibilities of danger because of rearing equipment in case of derailments or collision, and the physical necesssity of often bringing the trolley within a short distance of the cars.

Then there are corrosion and soot deposits when steam and electric operation are maintained over the same track. Where the steel supporting bridges also carry signals, as is proposed in some cases, there is increased danger to men engaged in cleaning, painting, or repairing overhead structures, and taking care of signals; and when spanning two or more tracks there is a possible interception of the train operators view of signals because of dips in the railroad grades bringing overhead bridges in front of the semaphores, which likewise may be made less distinctive if they have truss members for a background.

In the matter of inspection, that of the third rail can probably be carried on by the regular section hands, and ordinary repairs made without interfering with traffic. Repairs of an overhead system on a main trunk line presents some special difficulties. It will often require judgment and experience to determine just where trouble may exist, and in any case that particular section of the line must be absolutely cut out and made dead. If the repairs be other than at a rigid cross-suspension, it would seem that they would have to be made from the top of a structure, running on, and for the time being occupying the rails and propelled by its own power. The old practice common to street overhead trolleys is, of course, unavailable; there a construction wagon can drive on to the track and off again at will, and the line even while alive can be readily repaired, but a practice possible with 600 volts would probably be fatal when attempted with the very high potentials now obtaining in single-phase operation.

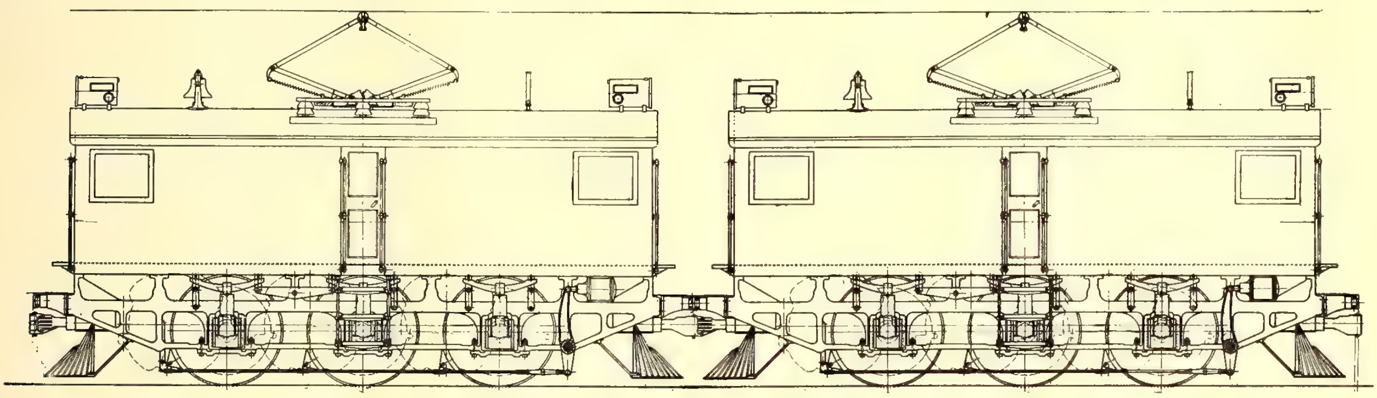


FIG. 9.—140-TON DOUBLE UNIT A. C. LOCOMOTIVE

In this latter system it seems vital in the interests of general safety that every crossing bridge, and every supporting structure should be mechanically and permanently connected with the return circuit of the rails, to avoid the possibility of such structures being in partial or complete contact with the overhead conductors and not absolutely grounded, and at all crossings and highways both the catenaries and the trolley wire should be thoroughly shielded from either accidental or wilful interference.

The time-honored tickler in universal use on steam railways to warn freight brakemen of the proximity of highway crossings, bridges and tunnels seems unavailable with an overhead system, because if it did not catch in the pantograph collector it would be an ever present menace not only in wet but also in dry weather, because of the possibility of it coming in contact with the overhead line.

Where single-phase alternating-currents are used, the magnetic and static inductive effects on telephone and tele-

graph circuits cannot be ignored, nor the danger of interference with signal systems disregarded.

The attitude of city authorities may in time raise effective obstacles to the use of overhead wires except where all crossings pass beneath the line of the road, and will, I think, ultimately require new third rail construction to be fully protected—even although on a private right of way.

The degree of success of the alternating-current development will depend primarily on the development of capacity and all-round operative features in single-phase locomotive and car equipments. The 25-cycle motor (hitherto the only frequency actually installed) whether judged by individual comparison or specific equipments, or the general testimony of electrical engineers of manufacturing companies, has proved inadequate when compared with its rival. To correct this defect it has been proposed to adopt 15 cycles as a standard of operation. It is difficult to establish exact comparison of equipment weights unless one personally conducts tests, or has complete technical reports which have been made on identical bases; but the following table is one comparison of the approximate weights of complete equipments of two recent typical types of like nominal capacity.

Weight of Four-Motor Alternating-Current Equipments.

Motor	A	B
Cycles	15	25
Nominal capacity per motor	75 hp	75 hp
Individual weights:	Lbs.	Lbs.
Armature	1333	1146
Field	2414	2646
Gear, case, and pinion	398	407
Total motor	4145	4199
Car equipment:	Lbs.	Lbs.
Four motors	16,580	16,796
Transformer and rheostat	6750	4325
Controller and adjuncts	1000	1000
Trolley	500	500
Wiring, switches, etc. (?)	1950	1239
	26,780	24,060
Excess A over B	2720	

These totals are not final in either case, for the individual motor weights of each type will very likely be increased from 300 to 450 lbs. in regular manufacture. But allowing for such changes and corrections as seem reasonable, not only is no actual saving in A over B probable, but the excess of nearly a ton and a half against the 15-cycle equipment will remain in some makes. On the other hand, the manufacturers of B hope to show about 10 per cent total saving in the weight of a 15-cycle equipment, but this hope is based upon theoretical estimates, not actual performance.

On other sizes it is probable that these relative differences will vary somewhat, but a comparison of the weight coefficients of large 15-cycle motors and direct-current motors of like weight show a ratio of two to one in favor of the direct-current machine.

MOTOR AND LOCOMOTIVE CONSTRUCTIONS

Motors are of the geared and gearless types, may be entirely separate units or partly integral with the truck frame, and may be wholly or partly spring-supported. Locomotive designs, influenced in part by the type of motor adopted, show a great variety of constructions, and may be very generally classed as rigid frame with all weight on the driving axles and without leading trucks; rigid frame with either single axle or bogie leading trucks at each end; and bogie-truck locomotives, the bogies being pivoted under the cab and sometimes linked together.

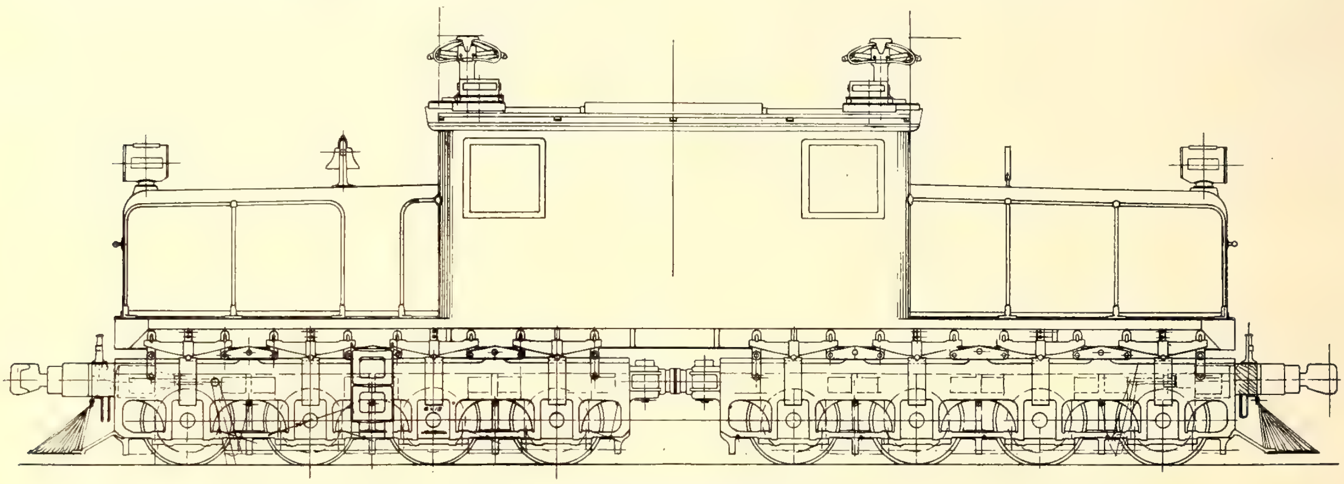


FIG. 10.—A 125-TON ELECTRIC LOCOMOTIVE EQUIPPED WITH EIGHT GEZ 28 MOTORS

Each half of the double-unit locomotive shown in Fig. 9, which is a study by one of the large companies, has three axles, to each of which is geared an alternating-current motor, after the usual fashion. Each section has a rigid wheel-base of about 12.5 ft., and weighs from 65 to 70 tons, making a total weight of from 130 to 140 tons for a unit having a rated capacity of about 1500 hp with natural ventilation.

An analysis of the action of a locomotive demonstrates beyond question that this general type of machine, that is, one having a rigid frame and no guiding trucks, is limited to moderate speeds, and would be unsafe if operated at high speed on a road with much curvature and special work. Notwithstanding the fact that it has been strenuously advocated, even recently, I think this particular type will not find favor among the railroad men, and it is already practically abandoned in the proposals of the manufacturers in favor of a bogie-truck type, or an articulated type composed of two rigid frames with single axle leading trucks at each end of the complete unit. It is also proposed to carry the geared motors, centered on a spring-connected quill, directly over the main driving axles, and to support the entire motor by springs from the locomotive frame.

Particular interest naturally centers upon the distinctive types of locomotives installed on four important railway sys-

tems, the Valtellina and the Simplon Tunnel in Switzerland, the New York Central, and the New York & New Haven, which well illustrate three of the principal methods of construction developed to meet the demands of different electrical systems.

As illustrating a high order of electrical and mechanical engineering, the work of the Ganz Company merits special mention, for it is undoubtedly true that the present status of the polyphase system, which stands on a favored plane with many Italian engineers, is owing almost entirely to the efforts of this company.

The general characteristics of the New York Central type of locomotive, the Batchelor machine as developed by the General Electric Company, are pretty generally understood.

It is gratifying to note that although the electric service was inaugurated only as recently as the 22d of last December, has been developed under extraordinarily difficult circumstances, and has had to face much adverse criticism because of a serious accident due to extraneous causes, already 305 train movements, representing 86 per cent of the present total of the New York Central and Harlem trains, both locomotive-drawn and multiple-unit, are operated electrically. The aggregate delay has been less than with the old steam service, a fact particularly noticeable in times of snow storms. The main station output for twenty-four hours is but about 65,000 kw-hours, and when the batteries are in service but one steam unit is required at time of maximum load.

The New Haven alternating current-direct current locomotive, built by the Westinghouse Electric & Manufacturing Company, is of the two-axle free bogie type. The rigid wheel-base is 8 ft., the total wheel-base 22 ft., the length over all 37 ft. The weight of the locomotive is 93 tons, having been raised considerably over early expectations. It has an hour rating, on the usual standard, of 1000 hp when operated at 25 cycles, but is fitted with blowers to raise the average capacity. It is intended to handle a 200-ton trailing load at schedule, with some margin of performance.

Although built primarily for operating directly from 11,000-volt, single-phase alternating current, these locomotives must operate also from the 650-volt direct current while on the Harlem tracks. They, therefore, have additional control provision, and besides the double-pantograph collectors, have contact shoes, those on the side being arranged for lifting by air pressure on account of limited clearances on a part of the run.

The motor armatures are wound for operation at a normal maximum of about 250 volts, and hence are connected in permanent series of two, while the field circuits are arranged for each pair of motors in a separate group, and for series-parallel grouping independently of the armature circuits, to provide for the varying flux in alternating-current and direct-current operation. Of course, the motor groups on the two trucks can be connected for series-parallel operation with direct-current supply, but with the disadvantage of using about double the amount of current at slow speeds that is required when four motors, each wound for the full potential, are in series.

The first of these machines, pulling a short train, made

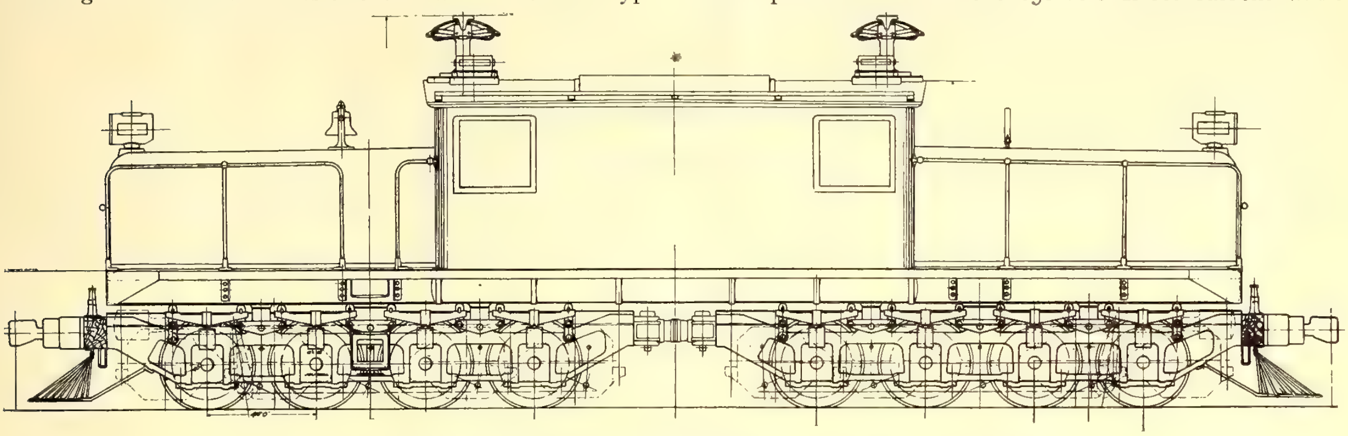


FIG. 11.—A 96-TON LOCOMOTIVE EQUIPPED WITH EIGHT GEZ 30 MOTORS

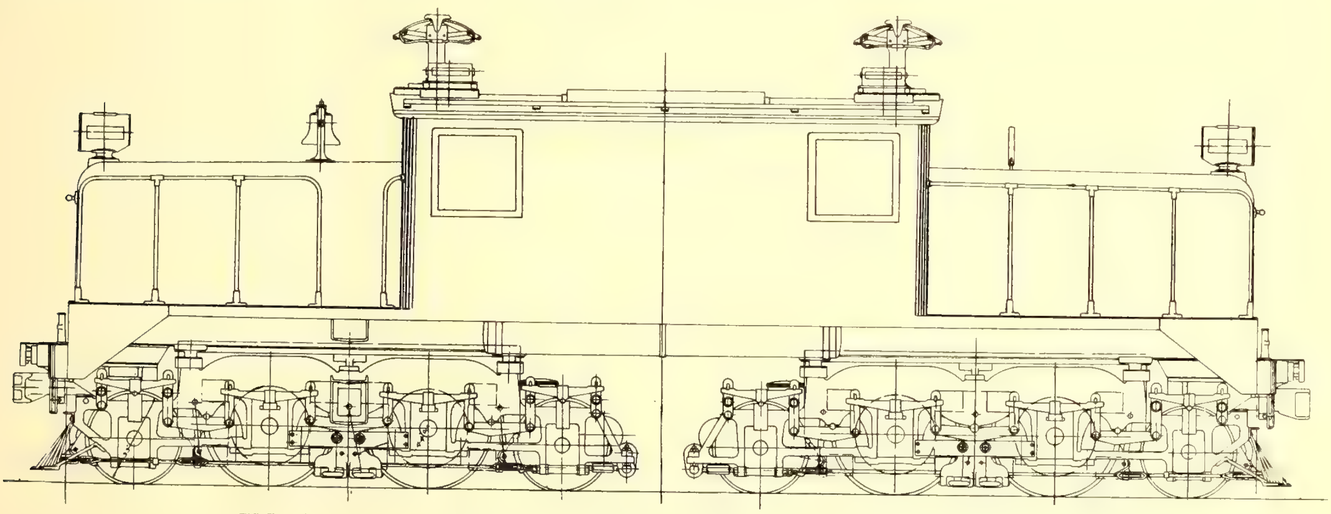


FIG. 12.—110-TON ELECTRIC LOCOMOTIVE EQUIPPED WITH FOUR GE 84 MOTORS

entry into the Grand Central Station on May 11, 1907, and in a short time the operation of equipment should be under service test.

Some question has been raised as to whether trucks with drivers of so large a diameter, 62 ins., on which are concentrated 15 tons of motors in a limited wheel-base, will track properly under all conditions of rail. Experience, however, is the final criterion.

Sometime since I made a very careful investigation of the

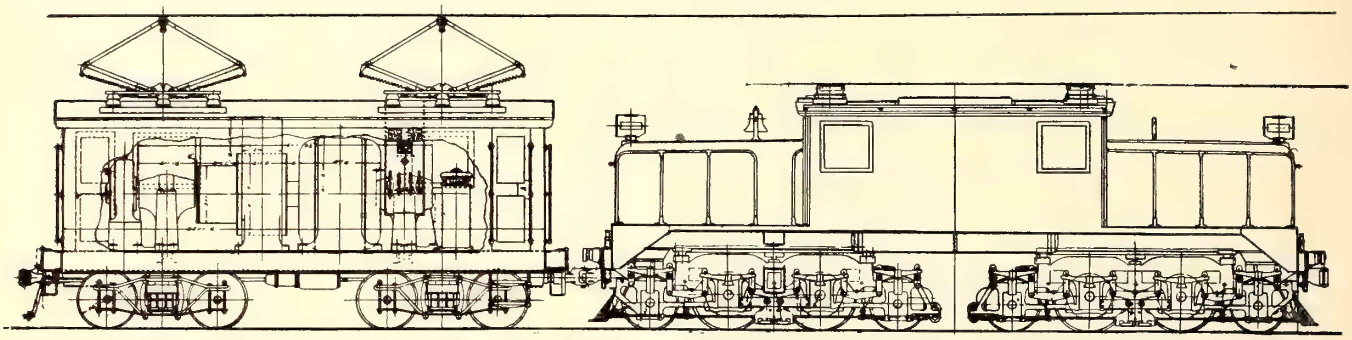


FIG. 13.—ALTERNATING-CURRENT LOCOMOTIVE MOTOR-GENERATOR COMBINATION, WITH INDEPENDENT TENDER

possibilities of direct-current gearless and geared motors, the former of the bi-polar type, for the same service, a very severe one.

Both machines are of the four-axle, bogie-truck type, the trucks being linked together. The geared locomotive, Fig. 10, weighs 93 tons and the gearless, Fig. 11, 126 tons, but the weight per axle is well within the usual allowance. On

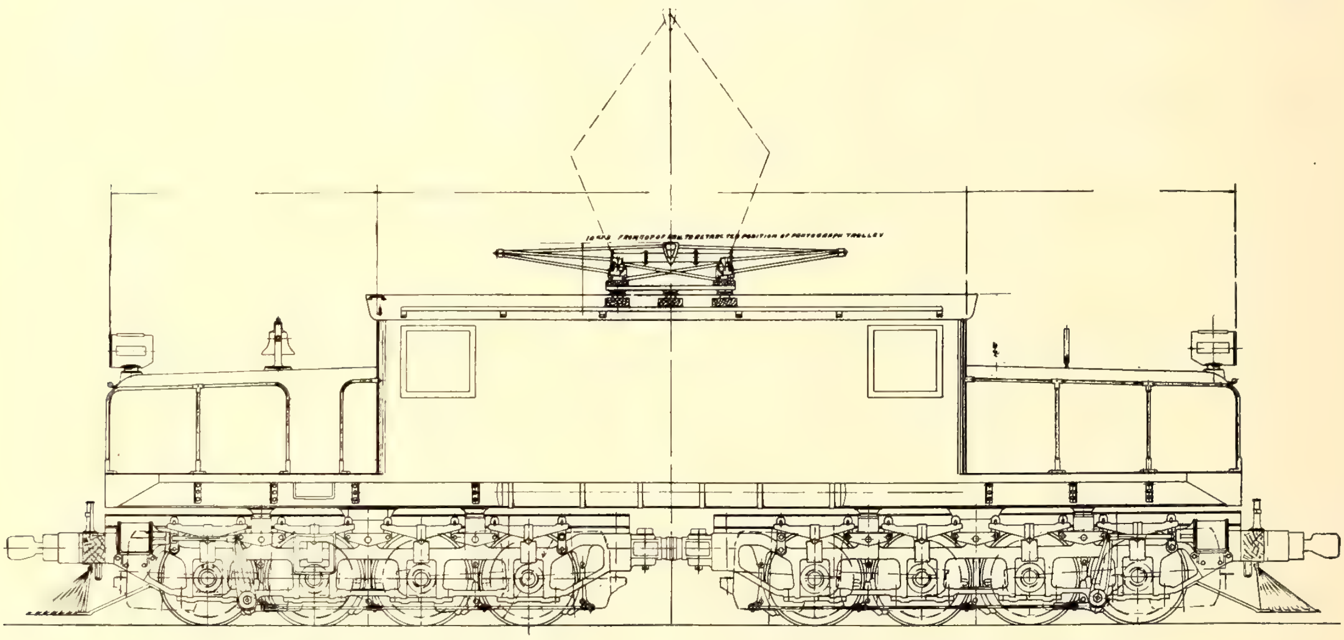


FIG. 14.—160-TON LOCOMOTIVE WITH MOTOR-GENERATOR SET CARRIED IN THE CAB

each truck are four motors, connected two in series, to be operated at a maximum line potential of 1500 volts. The geared motor construction is of the usual standard, but fitted with commutating poles, while the gearless machine has modified bi-polar motors of the New York Central type.

A comparison of the efficiency curves of the two machines is interesting, these showing for each from 87 to 88 per cent on a five-hour load, and falling only to 83 per cent with 50 per cent increase, while at half this load the efficiency of the gearless machine is much higher than that of the geared. Some adequate idea of the capacity of the gearless machine may be gathered from a statement that it will maintain a drawbar pull of nearly 25,000 lbs. at a good rate of speed for several hours continuously, and with natural ventilation. These extraordinary characteristics would, for the class of service for which these machines were considered, amply warrant the additional weight because of the simplicity of the gearless machine.

A very promising type of machine, embodying many of the good features of those which had preceded it, is now under construction by the General Electric Company, for use either on direct current or with a motor-generator set supplied from an alternating-current trolley. This machine is of the four-axle free-bogie type, the drawbar pull being taken through the main frame. On each truck, and forming an integral part with it, are two bi-polar gearless motors driving the middle pair of axles, and at either end of each truck is a pair of leading wheels of similar diameter, which have a limited, spring-resisted side play. The normal wheel-base of each truck is 12 ft., the total wheel-base 32 ft., and the length over all 36 ft. This machine should be capable of an almost unmatched speed and freedom in following irregular curvatures, and with special ease of track approach.

USE OF STEP-UP AND STEP-DOWN TRANSFORMERS

Where the distance is not great, as on the present proposed limited operation of the New Haven road, both step-up and step-down transformers have been omitted, and the 11,000-volt trolley line is supplied from the station switchboard. This means direct connection between an extended

system of overhead working conductors and generators operated at high potential, with one side grounded, with, of course, whatever protection ligntning arresters can provide. Such are the vagaries of lightning, and the uncertainty of the very best arresters, that I cannot but feel that this practice, which subjects costly generating equipments to direct lightning attack and special grounding stress, will not obtain to any great extent, for the possibility of laying up a complete unit of great capacity, steam engine as well as generator, because of a lightning flash or accidental ground, is too great a penalty to pay for eliminating transformers, and is a special handicap upon the possibilities of transmission.

It is certain that standardization should be directed to the construction of generators. Any material increase of potential above that now common means reduced capacity and efficiency, increased danger of breakdown, and greatly increases individual cost, to say nothing of the capitalized risk of failure. Quite aside from the question of cost and efficiency, air cooling, the only possible method for generators, manifestly cannot be safely carried above that which is tolerable for static transformers, which, when wound for the higher potentials, are invariably oil-cooled. The transformer, per se, is the simplest and most flexible device for changing alternating-current volume and pressure, and its moderate cost and high efficiency, taken in connection with the like elements of moderately high potential generators, will leave the total cost and efficiency of generating equipment roughly the same. There will be the added very great practical advantage that the generators not only work at lower potentials, but on closed metallic circuits, are removed from direct contact with working conductors and earth, and have interposed between them and the line at least one set of static transformers, which practical experience has shown to be one of the best generator safeguards against lightning, and which, if broken down, do not involve large and costly units, nor wholesale sacrifice of capacity.

FIELD OF THE SINGLE-PHASE ALTERNATING-CURRENT MOTOR

No one can deny that if the single-phase motor be developed to a high state of weight-efficiency, unhandicapped by excessive weight of the collateral apparatus necessary on a car to utilize it, and if the capacity of conductors, especially steel conductors, for alternating currents can by any discovery be raised, the elimination of moving machinery in, and the simplification of sub-stations would open up a very extended and important field for the use of this type of apparatus.

It seems to me that the present principal hope of usefulness of the single-phase system is on roads of considerable extent which operate an irregular and sparse traffic, and where only a moderately expensive, or what may be called a second-class overhead construction which will keep down the ratio of line investment to that of the balance of equipment, is tolerable. As one departs from this condition, adopts more permanent construction, and faces the problems of denser traffics and higher capacities, and advantages of the single-phase system will disappear, and a superiority of the direct-current equipment, with such improvements as are in sight, become manifest. But whatever may be the future of single-phase operation under the conditions stated, any present claim for it as the preferable equipment for congested service demanding high schedules and great capacity is not worth a moment's thought, for in this field, at least, it cannot touch the direct-current system.

I see no practical necessity to formulate conclusions by averaging conditions, and I cannot conceive the responsible officers of any trunk line road being guided in their determination of what seems best for their own requirements by consideration of what some road thousands of miles removed in location and enormously removed in operating conditions may do.

In any case, the most satisfactory system will be that one which will permit of continuous all-round operation under such conditions as will utilize to the utmost all the beneficial features of electric application. If any one system can be demonstrated to meet these conditions better than all others, then that system will become pre-eminent, no matter what standards may have been adopted or recommended, and no matter what our preconceived opinions may be.

DISCUSSION

W. J. Wilgus, vice-president of the New York Central Railroad, said that he agreed with so many points made by Mr. Sprague that he would hasten to point out rather those with which he disagreed. One of these was the reference to the relations between the men who are now conducting trunk line work and the electrical engineers who wish to electrify steam railroad systems. It was true that some steam railroad officials had looked down upon electrical apparatus as something not capable of handling the heavier traction problems, but recent developments had dispelled this idea, and now they were looking with keen interest into the subject with a full appreciation of the magnitude and dignity of the problem. There had been, however, too much befogging of their minds through electrical controversies about things they do not understand. He suggested that in general discussions the subject should be treated with greater broadness and that steam railroad men should be attracted to present papers on electrification from their point of view to secure an interchange of ideas. Evolution will govern rather than revolution. The railroads must move forward in those cases where the steam locomotive has proven its inability to cope with very heavy service, or where steam operation is undesirable. The New York Central electrification is an example of the success attending where electricity was applied to solve special problems, and the more recent work on the 50-mile stretch between Utica and Syracuse was another application for a somewhat different condition. In the West probably a number of places could be electrified where steam locomotives could not handle the traffic on pusher grades. He wanted it understood that the present New York Central electrical zone was not permanently fixed at Croton, but that at some future time when developments justified it would be extended to Albany, 142 miles from New York. As to the merits of different systems, he would warn the different electrical engineers not to quarrel so much as to frighten the steam men, but rather to point out that every problem had its special features which would be instrumental in the selection of this or that method. For example, direct-current operation at low potential had to be adopted in the New York zone irrespective of other considerations, because the city authorities would not permit the use of high-tension trolleys and the tunnel clearances were also insufficient for overhead construction. As another example, he cited the case of a double track tunnel where the competing companies were offered the widest latitude in the choice of systems. A comparison of the bids showed that for that particular installation direct current was the cheapest in first and annual cost; in fact, 20 to 25 per cent less than its nearest a. c. competitor. Much has been said

also about the cost of overhead single-phase construction, but only a year ago one authority had estimated it at $16,000 per mile, but the actual cost had been $50,000. Even if the a. c. construction is the cheaper it must be borne in mind that the current losses are greater and this extra current is a constant charge. It can be set off against the higher cost of some other form of construction more economical in current. He heartily agreed with Mr. Sprague about multiple-unit systems, for the New York Central had already reaped its reward by the elimination of train delays at the Grand Central Depot formerly caused by the constant shifting to and fro of steam locomotives. Already the station capacity had been increased 33 per cent, and the more rapid acceleration has resulted in the ability to maintain the schedule with a reduced rate of speed between stations. Therefore, in making a selection of a system, relative aceleration should be compared, not only for suburban service, but also for through service. In conclusion, Mr. Wilgus pointed out that the cost of electrification was not the only thing to be considered by a steam railroad wishing to change its motive power, but that many other factors of cost came in train. One of these was the necessity to change the signal system and the expense of this one item was so great that it would surely hinder many possible electrifications unless some radical reductions are made possible in the cost of signal systems for electric lines.

Mr. Stillwell said that he took issue with the author in regard to certain of his opinions. For interurban service the speaker has used, and may continue to use for some time to come, direct-current equipment. For trunk line operation he believes that the 15-cycle single-phase system possesses controlling advantages as compared with any direct-current system that has been suggested or is liable to be developed into an operating system. He regretted that further information was not given in regard to 1200-volt motors. He thought the comparison shown in Mr. Sprague's diagram of a d. c. motor and 25-cycle a. c. motor was defective for several reasons. (1) It compares two motors of equal weight. Had the comparison brought together two motors of equal type the ratio of weights would have been far less than is the ratio of output when equal weights are considered. (2) The weight of the d. c. motor (23 lbs. per hp on the one-hour rating) is very light and indicates that in respect to the relation of weight to output the motor is superior to anything in general use. The latest 200-hp motors offered within the last sixty days to the Interborough Rapid Transit Company by the leading manufacturers of the country weighed, respectively, 28 and 30 lbs. per horse-power on the one-hour rating. On the other hand, the a. c. motor shown in the diagram has a much higher relation of weight to output than other single-phase motors of comparable output in the market. (3) The comparison is for a 25-cycle motor and not for a 15-cycle motor, as recommended by the speaker and Mr. Putnam. The speaker had obtained last week from the engineers of one of the leading manufacturing companies comparative figures relating to 15-cycle single-phase a. c. motors of 200 hp at one-hour rating and 600-volt d. c. motors of the same output. These motors are practically identical in speed when delivering 200 hp. The data in which he was particularly interested were the maximum vertical dimensions and the weights of these motors. The maximum vertical dimensions of the a. c. motor is 36½ ins., that of the d. c. motor 1⅝ ins. less. The weight of the a. c. motor is 6280 lbs.; that of the d. c. motor 6000 lbs.; both of these weights are exclusive of gear, gear case and pinion. The a. c. motor requires a wheel-base 1 ft. longer than is necessary with the d. c. motor. The ratings in the case of both motors are based upon the same rise of temperature without forced ventilation. If in Mr. Sprague's diagram the 15-cycle a. c. motor and the 1200-volt d. c. motor had been compared, the speaker believed there would have been little, if any, difference in dimensions or weight. In some recent estimates made on the cost of the 1200-volt d. c. and the a. c. systems to average trunk line railway conditions operating both freight and passenger service, the first cost of the electrical equipment of the d. c. system exceeded that of the a. c. system by about 50 per cent.

W. B. Potter, chief engineer of the railway department of the General Electric Company, said that he wanted to make clear that neither he nor any of the engineers associated with him had any leaning toward one system as a cure-all. As engineers, they looked at each problem as something to be considered on its own merits. As an example of recent progress in motor manufacture, he mentioned the use of commutating pole motors, and expressed his confidence by stating that he believed this type to be the principal direct-current motor henceforth used for railway work. Several thousand were now being made by his company and other thousands had been ordered. The matter of commutation had limited single-phase development, but he was pleased to say that a single-phase motor could now be produced in which the commutation is as good, if not better, than the ordinary d. c. motor, and in which the armature speed will not be more than 15 per cent higher with a larger air-gap than ordinary. Other advances would also make it more comparable with the present d. c. motor, and this without introducing extraneous resistance, yet would increase the efficiency several per cent and the rating 25 per cent on the hour basis. As to higher d. c. voltage, he wished to suggest, for the sake of simplicity, that 1200 volts should be the next step and not potentials between 600 and 1200. Taking up again the question of "rival" systems, it seemed to him that a sufficient explanation of the standpoint of his company lay in the fact that it was now building 600 and 1200-volt d. c. motors, 6000-volt three-phase motors and 25-cycle single-phase motors.

C. F. Scott, consulting engineer of the Westinghouse Electric & Manufacturing Company, agreed with Mr. Potter in the statement of so-called rival systems. Taking up the paper of the evening, he said he was interested in the author's method of arriving at conclusions so at variance with those of other engineers. To be sure, if Mr. Sprague's assumptions were taken for granted, his conclusions are logical enough, but he did not agree that those assumptions were correct. He showed, for instance, that the alternating-current motor has at light loads a much higher speed than the d. c. motor under the conditions he had taken. There is an apparent conclusion, therefore, that the a. c. motor is lacking in many of the excellent characteristics possessed by the d. c. motor, but the author had failed to call attention to another point, namely, the ready adjustability of speed by means of voltage taps from the transformer. This latter advantage enables the attainment of different torques at different speeds, and thus the a. c. motor may have different acceleration characteristics under the control of the motorman. Another point was that of rail loss. Although the loss per ampere is greater with a. c., the loss per kw may be much less. It would seem that the author assumed the characteristics of the d. c. motor as ideal, and where the other motor has different char-

acteristics valuable in their way he had ignored them. Mr. Sprague had also laid very little stress upon the relative merits of the two systems between the power house and the train. The subject of braking had also been referred to by him with a reference to the supposed inferiority of a. c. motors in this connection. He thought it would be of interest, therefore, to tell the members that a paper had been prepared for the annual meeting of the Institute dealing with electric braking with single-phase motors, in which it has been found that this type lends itself admirably to braking, doing far more than has been possible with the d. c. motor or any other hitherto.

The remarks of N. W. Storer, electrical engineer of the Westinghouse Company, were devoted largely to a consideration of what Mr. Sprague had called differences between direct-current and the alternating-current single-phase motors. These are published in the abstract of the paper in this issue.

(1) "The input of current in one is continuous, in the other, intermittent;" quite true, but the draw bar pull is quite as effective in one case as in the other.

(2) The direct current motor has a solid frame like the single-phase motor. It has further two or more laminated poles bolted in and if the interpole construction is used has as many more relatively small and delicate poles. The a. c. motor as built by the Westinghouse Electric & Manufacturing Company has, in all sizes up to a diameter of 38 ins., field punchings made in a single piece and built up and keyed in the frame, making it as solid a construction as an armature on its spider. A claim for less rigidity in the single-phase motor is hardly sustained.

(3) Coils in contact with iron will dissipate heat much faster than when in the open air. This is especially true of coils in an enclosed motor. The speaker said he had repeatedly noticed motor field coils which had been removed on account of roasting out had shown the insultation in contact with the pole pieces to be in good condition, while other sides were badly roasted. In respect to ventilation of field coils the single-phase motor is superior to the direct current motor. Smaller cross section of coils also allows the heat to be radiated, better with the single-phase motors, and the fact that a large part of the loss in the motor is concentrated in the field iron will enable the motor to dissipate a much larger amount of heat for a given temperature rise than a direct-current motor.

(4) Many thousands of direct current motors are to-day in operation with a clearance of ⅛-in. to 3/16-in. between poles and armatures and in practically all cases where more than 3/16-in. clearance is used it is for electrical reasons. Further, while the smaller air gap used for single-phase motors was at first much feared, the fears have proved to be without foundation and the present clearances of from 0.1-in. to 0.15-in. have proved to be ample and fully as good as 0.15-in. to 0.25-in. on direct current motors because there is no unbalanced magnetic pull.

(5) The torque of an armature is the pull it will exert at one-foot radius. It, therefore, makes no difference in the result whether it is obtained with large flux and few armature conductors, or vice versa.

(6) The armature diameters for a. c. motors ordinarily run from 5 to 15 per cent larger than for d. c. motors of corresponding output. The armature speeds of the earlier single-phase motors were much higher than the speeds of corresponding direct-current motors. At the present time, however, the speed at the nominal rating of the motor is practically the same as that of direct current motors and the maximum operating armature speeds are within the safe limits set for direct-current motors.

(7) Gear reduction, of course, depends upon the speed and the same gear pitch is used for single-phase motors as for direct current motors of the same capacity.

(8) A number of instances have occurred where the single-phase motor has broken down in service on a direct current section of the line, but when the car reached the alternating current section of the line it has been again connected in circuit and operated satisfactorily, indicating that the electrical strains on alternating current are less severe than with direct current.

(9 and 10) In a recent discussion before the Institute, Mr. Potter called attention to certain characteristics of the torque exerted by an alternating motor, especially when it reached the slipping point of the wheels. It was stated that there was an apparent advantage in the pulsating torque because, when the motor starts to slip it does not immediately decrease its mean torque as is done in the case of the direct current motor, but slips in a series of jerks apparently regaining the hold on the rail at every pulsation.

(11) No direct current motors built in the last fifteen years, except those on the New York Central locomotives, have less than four poles. The single-phase motors built by the Westinghouse Electric & Manufacturing Company have four poles for all sizes up to and including 125 hp. The largest single-phase motor thus far built has a capacity of 500 hp. It has only twelve poles.

(12) Concerning "a high torque while standing still." Railway motors are designed to move a train rather than hold it at rest. At the same time, we know that the single-phase motor is amply protected against mistakes of motormen in leaving the current on the motor for a half minute or so with brakes set.

(13) The resistance leads in single-phase armatures are for the purpose of reducing the loss due to the transformer action in the short circuited coil to a minimum. The efficiency is higher than it would be if they were not used.

(14) This is discussed below. We shall have something to say further on.

(15) There is one type of construction to which the single-phase motor is not adapted. This is so far employed in only a single case.

More or less has been said in the paper concerning the lower efficiency of the single-phase motor and inference might be drawn that it is about 10 per cent lower than that of the corresponding direct-current motor. The following table shows the efficiencies of corresponding sizes of direct and alternating current motors at different percentages of their full load torque:

Per Cent of Full Load Torque	D. C. 90 H.P. Motor	A. C. 25 Cycle 100 H.P. Motor	D. C. 200 H.P. Motor	A. C. 15 Cycle 250 H. P. Motor
125	86.25	82	88.8	87.3
100	86.8	85	89	88
80	87	86	89.2	88.3
60	86.5	86.8	88.8	87.7
40	85	86	87	85
25	82	82.5	84	82

From this it does not appear that within the ordinary range of tractive efforts exerted by railway motors the single-phase motor is so far deficient. In fact, it comes remarkably close to that of the direct-current motor.

Concerning the comparison between the 125-hp and the so-called 240-hp motor contained in the paper, I take issue as to the fairness. Motors should be selected on the basis of their speed time curves and in accordance with their par-

ticular characteristics, rather than upon the simple horse power basis. If the author in seeking to compare the two types of motors had taken the 25 cycle, 75-hp single-phase motor referred to later on in the paper his conclusions might have been quite different. The weight which he assigns is 4199 lbs. The weight of corresponding direct current motors is 2,500 to 4,200 lbs. Moreover, if the single-phase motor to which he refers were operated on 15 cycles instead of 25 its output would be 90 to 95 hp, which would lead to conclusions quite at variance with others in the paper. The weight of a quadruple equipment of 90-hp d. c. motors furnished by the Westinghouse Electric & Manufacturing Company would be approximately 20,000 pounds. The corresponding weight of a quadruple equipment of 90-hp, 15 cycle motors with oil insulated transformers equipped for 11,000 volts would be approximately 27,500 pounds; an increase of about 37.5 per cent. This extra weight added to a 40 ton car would amount to about 10 per cent and owing to the greater efficiency in the control of the single-phase motors, the power consumption of the car, including transformers, would in most classes of service be approximately the same as that of the direct-current motor at the trolley and would be much less at the power house. A car for passenger service can be equipped with two 200-hp, 15 cycle single-phase motors giving ample clearance on 37-in. wheels, and that these two motors will operate a car with the same power consumption per car mile as the car on runs as long as five and six miles as would be obtained with a car of the same capacity operated with an equipment of 200-hp direct-current motors. On shorter runs the relative power consumption would be less.

G. R. Henderson, consulting engineer of New York, complimented the speaker on his paper, especially for his statement that electrification is not a panacea for all railroading ills, but that when applied to individual cases intelligently and found suitable for such treatment, satisfactory results may be expected. The speaker cited the cases of certain steam railroads where the load factor was not 10 per cent as being unsuitable for electrification. He also thought the item of first cost a very important one. The cost of a steam locomotive is about $10 per horse-power, while that of power house and lines is about $100 per horse-power. Electric locomotives themselves cost double that of steam locomotives and as the average cost of coal in the United States does not exceed $1.50 to $2 a ton little may be expected from fuel economy. He was pleased to learn that multiple-unit control was not considered feasible for freight operation, and did not consider it wise to attempt to handle heavy trains on steep grades with one man. He believed that electric locomotives would decrease rapidly in number and favor and that, each in its own proper sphere, steam and electric operation would co-operate to the advancement of transportation and the increase in prosperity.

William McClellan, of Westinghouse, Church, Kerr & Company, of New York, expressed his disappointment that so little had been said in the paper about 1200-volt d. c. motors. As to 11,000-volt single-phase operation, however, he was glad to say that from his experience in operating such equipments he had found no difficulties. He did not agree that capacity was so important as the author of the evening's paper would make it, as he felt that in many cases multiple-unit control would be the equipment of future trains. Certainly electrification on a large scale could not come through any 650-volt proposition, but rather would have to be along the lines of high-tension single-phase. Considering the great number of contradictory statements and the general chaos on the subject of heavy electric traction systems he would suggest that the Institute appoint a special committee to study this subject just as it had previously appointed one on high-tension transmission. This method it seemed to him was the only one that would bring the subject on an authoritative basis.

A. H. Armstrong said that he was in cordial agreement with Mr. Potter's remarks about so-called rival methods and about the recent improvements in a. c. and d. c. motors. A few days since he had witnessed the test of a 25-cycle 125-hp single-phase motor which ran at 50 per cent overload with perfect commutation and with only half the usual complement of brushes. One objection that appeared to him with regard to Mr. Stillwell's advocacy of 15 cycles was that so large a proportion of the alternating current generated to-day was at 25 cycles.

Prof. C. P. Steinmetz contributed the final remarks of the evening. He said that so far as the motor was concerned the direct current was more satisfactory than the alternating current, because of the saving of the energy lost in the hysteresis of the field and the transformer loss on the commutator. With the same temperature rise it was possible with the direct-current motor to get either a higher output or a cheaper construction. He thought that the class of service where a. c. motors would be most desirable was where there was a long railway with frequent and irregular service and a considerable amount of freight traffic which is of a fluctuating nature; in other words, where a rotary converter sub-station would show a very poor load factor. He did not share the often expressed objection to the rotary converter. It is an advantage in a system to eliminate some of the links of the chain, but it is desirable to eliminate the weakest link, and that is not the rotary converter, but the motor; the rotary converter is about the strongest link in the chain. Engineers may differ as to the conditions under which a. c. or d. c. is most desirable. The principal thing to guard against is not to adopt any system which will forever preclude going to the other or any specialty such as an odd frequency. At present, after many years of work, all frequencies have practically been eliminated except the 60-cycle and the 25-cycle. At the present time all the heavy power of the country is transmitted at 25 cycles. At this frequency it is not so formidable to use the a. c. motor and then find d. c. motors would be better or to change from d. c. to a. c. But it would be serious to be forced to go to 15 cycles, because that would mean giving up the possibility of securing the benefits of a vast amount of power which is available in the country at 25 cycles. It would be an odd system and as unfortunate as the 40-cycle system finds itself to-day. He said that the commutation of the 1200-volt d. c. motor was infinitely superior to that of any a. c. motor with which he was acquainted except one that he had seen last week and to which Mr. Armstrong had referred. The commutation of this motor was actually sparkless and was just as good as the standard d. c. motor, or probably a little better.

Mr. Sprague, in conclusion, stated that he would reply to the remarks later in a written communication to be inserted in the Proceedings.

The Rio de Janeiro Tramway, Light & Power Company has received two of the six generators ordered from the Westinghouse Company to be used in its water-power development, and the remaining four will be delivered by July 1. The generators are of 8000 hp each.

MEETINGS OF COMMITTEES OF THE AMERICAN STREET & INTERUBAN RAILWAY ASSOCIATION

On Monday and Tuesday, May 20 and 21, meetings of a number of important committees of the American Street & Interurban Railway Association were held at the headquarters of the association at 29 West Thirty-Ninth Street, New York. An account of these meetings is published below.

EXECUTIVE COMMITTEE

The executive committee of the association met at 2 p. m. on Monday. The following were present: Messrs. Beggs, Shaw, Brady, Tingley, Adams and Swenson.

It was announced that letters had been received from Messrs. Goodrich, of Minneapolis, and Bradley, acting president of the Claim Agents' Association, that they would be unable to be present at the meeting.

The past presidents of the association had been invited to attend the meeting, and five of them were present. These were the following: Joel Hurt, of Atlanta, Ga., president during 1894-95; H. M. Littell, of New York City, president during 1895-96; Albion E. Lang, of Toledo, president during 1897-98; C. S. Sergeant, of Boston, president during 1898-99, and Jere C. Hutchins, of Detroit, president during 1902-03. Two of the other past presidents of the association, H. H. Vreeland, of New York, president of the association during 1901-02, and W. Caryl Ely, president during 1903-04-05-06, fully intended to be present, but were prevented by important business at the last moment.

The secretary presented a report in which were considered a number of matters relating to the association work.

The active membership has increased from 200 companies on Oct. 1, 1906, to 242 companies at the present day. The associate membership has increased from 113 individuals on Oct. 1, 1906, to 164 at the present time. A financial statement was presented which showed that the association had received more money from a larger number of active and associate members than had been received up to the 20th of May, 1906.

The secretary stated that the annual reports of the four associations containing the proceedings of the Columbus convention had been published and sent out to the various member companies and to associate members. Five hundred copies of the report of each of the four associations had been bound in paper covers and each member company was supplied with one set of these paper-covered reports. They are all of uniform style and octavo size.

The American Association report contains 472 pages, the Accountants' report 352 pages, the Engineering report 255 pages, and the Claim Agents' report 253 pages. In addition to the paper-covered volumes, the four annual reports have also been bound up in two cloth-covered volumes; the first contains the proceedings of the American and Engineering Associations and the second those of the Accountants' and Claim Agents' Associations. This arrangement of the volumes was made because associate members receive the reports of both the American and Engineering Associations, whereas the reports of the Accountants' and Claim Agents' Associations are reserved for member companies only. Reprints have been made of the address of the presidents before the various associations, of the report of the committee on municipal ownership and of the report on the standard code of rules.

The executive committee considered a number of matters relating to the association work and the plans for the 1907 convention were given particular attention.

The report of the committee on subjects was presented by the chairman, Richard McCulloch, of St. Louis, and accepted. This committee, whose work is referred to in detail below, has provided for a number of most interesting and valuable papers relating to many of the most important problems which are now before street and interurban railway companies.

It was decided to make a departure at the 1907 convention from the custom of recent years of having two sessions a day. It is proposed that the American Association have but one session a day on Wednesday, Thursday and Friday, these sessions being from 9:30 a. m. to 1:30 p. m. It is expected by this arrangement that there will be a large attendance at all sessions and that ample opportunity will be given to all to examine the exhibits of the manufacturers during the afternoon hours of these days.

The question as to whether or not there should be a banquet was discussed at some length, and the general sentiment expressed was that a banquet should be given at the 1907 convention.

THE COMMITTEE ON SUBJECTS

The general committee on subjects, as provided in the by-laws of the American Street & Interurban Railway Association, consists of one representative from each of the affiliated associations and an equal number of representatives from the American association. This committee has charge of the general arrangements of the programs for the Atlantic City convention. In addition to this general committee, each association has its own committee which has direct charge of its specific convention program, including the reports of the committees, the papers to be read, etc.

The meeting of the general committee on subjects was held on the morning of Monday, May 20. Those present were Messrs. Richard McCulloch, of St. Louis, Mo., chairman; Ernest Gonzenbach, of Sheboygan, Wis., representing the American Association; H. H. Adams, of Baltimore, Md., representing the Engineering Association, and Peter C. Nickel, New York, representing Claim Agents' Association.

Among the matters discussed, were the following:

(a) Meeting days of the different associations.

(b) Committee reports and papers to be presented at the various conventions.

(c) Convention halls to be used by the different associations.

(d) Number of sessions to be held by the various conventions and the general arrangement of these sessions.

A bulletin will be issued in the near future from the secretary's office which will contain a preliminary announcement as to the programs of the various conventions, giving outline of the papers which will be presented, the exact dates of meetings, etc.

The Engineering and Claim Agents' Associations will probably meet on Monday afternoon, Tuesday morning and Wednesday afternoon. The Accountants' Association sessions will probably occur on Tuesday morning and afternoon and on Wednesday afternoon and Thursday morning. The American Association convention sessions, as stated, will probably be held on the mornings of Wednesday, Thursday and Friday.

EXECUTIVE COMMITTEE OF MANUFACTURERS ASSOCIATION

The meetings of the executive committee of the Manufacturers' Association were held on the morning and afternoon of Monday. Those present were Messrs. Randall, Ellicott, Evans, Garland, representing Mr. King, of Mans-

field; Martin, McFarland, Peirce, Sisson, Partridge, representing Mr. Wharton, of Philadelphia; Wilson and Baker.

The contract for the use of the Steel Pier was read and approved. The question of the price of space to be charged for exhibit space on the pier was then considered. Full details on this point will be published by Secretary Keegan about June 1 and will be mailed to members of the association.

The Marlborough-Blenheim hotel was selected as headquarters at Atlantic City.

The other principal actions taken were the appointment of Mr. Ellicott as chairman of the finance committee; Mr. Wilson as chairman of the printing committee, and Mr. Peirce as chairman of the badge committee. The treasurer was also made ex-officio a member of all committees having anything to do with the disbursement of moneys.

COMMITTEE ON STANDARDS

The meetings of the committee on standards of the Engineering association were held on May 20 and May 21. There were present the Messrs. Wallerstedt, Larned, Fairchild and Blake. Mr. Adams attended several of the meetings as president of the Engineering Association. Geo. L. Fowler and F. W. Lane, of New York, were also present by invitation. The chairman of the committee announced that a number of previous meetings had been held by the New York members of the committee, and that several tables of statistics had been drawn up containing the information obtained in the data sheets received from member companies. These tables showed in complete form the data on rails, brake-shoes, wheels, etc., supplied by those answering the inquiries.

The subjects of flanges and treads of wheels, brake-shoes, journals and rails were taken up. In the latter investigation the committee will receive the assistance of the maintenance of way committee. A long communication was received from Mr. Evans, of Indianapolis, a member of the committee on standards, outlining the work up to date of the committee on standardization of the Central Electric Railway Association. The chairman announced that another meeting of the committee would be called next month, the place and exact date to be announced later.

COMMITTEE ON CAR HOUSE CONSTRUCTION

This is a special committee appointed by President Beggs to confer with a similar committee of the National Fire Protection Association for the purpose of formulating a set of rules and regulations governing the construction and equipment of modern car houses. The committee consists of the following: H. H. Adams, superintendent of shops, United Railways & Electric Company, Baltimore, Md., chairman; E. J. Cook, chief engineer, Cleveland Electric Railway Company, Cleveland, Ohio; Charles F. Ferrin, architect, Twin City Rapid Transit Company, Minneapolis, Minn.; L. H. Parker, engineering department, Stone & Webster Company, Boston, Mass.; A. V. Porter, architect, New York City Railway Company, New York, N. Y., and Thomas Pumfrey, civil engineer, International Railway Company, Buffalo, N. Y.

The meeting of the committee was called to order at 10:30 on the morning of Tuesday, May 21. A conference with the committee of the National Fire Protection Association was held first, and continued through the greater part of the forenoon. At this conference a tentative set of rules was discussed in a general way by the members of both committees.

After the first conference with the committee from the National Fire Protection Association, the committee of the American Association held a separate meeting which continued until the middle of the afternoon. At this meeting the proposed rules for the construction of car houses was the subject under discussion. Later in the afternoon a second conference was held between the two committees and an agreement was arrived at concerning the rules which had been formulated to govern the construction of modern car houses.

It is the understanding that these rules will be placed before the convention of the National Fire Protection Association on Thursday, May 23, for approval. If approved at that meeting, they will also be brought up for approval at the annual convention of the American Street & Interurban Railway Association next October.

BANQUET

On Monday evening the executive committee and the others in attendance at the meetings of the different committees in session were entertained at a banquet by the Manufacturers' Association. The dinner was given in one of the private dining-rooms at the Engineers' Club, and about thirty in all were present. Vice-President Randall presided in the absence, on account of illness, of President McGraw, and made a most acceptable toastmaster. Speeches were delivered by Messrs. Beggs, Shaw, A. W. Brady and Adams, of the executive committee, by all of the ex-presidents of the association present, by Ex-President D. M. Brady, of the Manufacturers' Association, and by Mr. Peirce, chairman of the entertainment committee of the Manufacturers' Association. Mr. Peirce also entertained the guests with a number of his inimitable dialect stories. It was a most enjoyable affair and lasted until late in the evening.

ELECTRICITY IN TURKEY

Turkey is practically a virgin soil for electrical enterprise. Up to a year ago there was not a single city or town in the 800,000 square miles of Turkish possessions which could boast of a telephone system or of a central station for electric light or power purposes. Now Damascus and Beirut have their electric central stations, however queer it may seem that the former ancient city should lead in progress the important and quasi European cities of Constantinople, Smyrna, and Salonica. Quite recently concessions were granted for electrical light and traction in Constantinople, Salonica, and Brussa. Smyrna, the second city in the Empire, and perhaps the first in commerce and future prospects, seems to have no immediate future for electrical appliances, although perhaps no city feels more the need of them. It is rumored, however, that permission has been granted for the electrification of the 2-mile tramway line between Smyrna and the suburbs on the southern shore of the gulf. Aside from a few isolated plants in mines and private residences, the concessions referred to represent the sum of electrical work in Turkey. Belgium has so far taken the lead in securing large contracts, while Germany, with the exception of the Constantinople concession, nearly monopolizes the smaller business, the material for which has to be imported by special permission from Constantinople. The prohibition now covers everything relating to electricity, even the serviceable electric bells, which cannot be imported except with the approval of the direction of customs in Constantinople. It is persistently rumored that this unaccountable prohibition of electrical apparatus will be raised in the near future, and the concessions lately granted tend to confirm these rumors.

A NEW FORM OF SUSPENSION FOR SLIDING BOW CONTACT

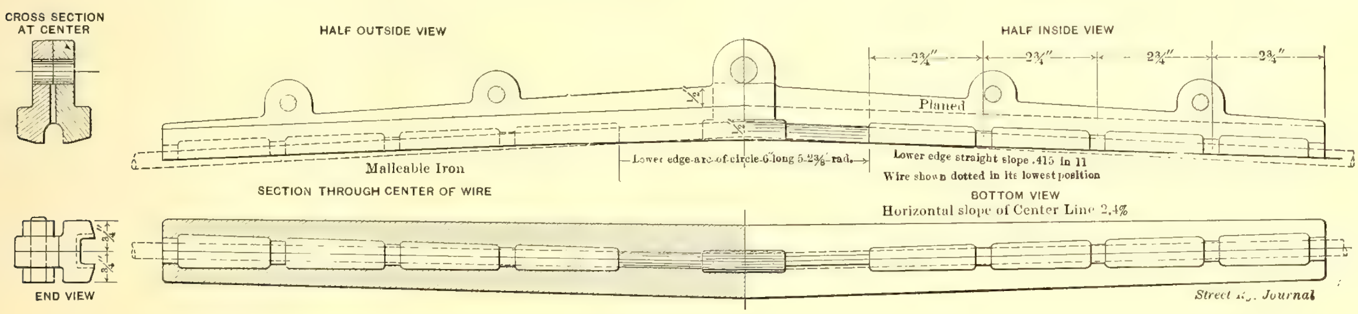
A new form of suspension for contact wires has been designed and patented by Joseph Mayer, of New York, an abstract of whose paper on "Steam vs. Electric Railway Operation for Trunk Line Traffic" before the American Society of Civil Engineers was published in this paper on Dec. 1, 1906. It is described in Mr. Sprague's paper and also in a pamphlet published by the inventor, from which the following description has been abstracted:

The new features of the suspension consist of a new suspender or hanger and a new strain adjuster. The former is designed to greatly reduce the bending strains in the contact wire at the suspenders; the latter reduces the variation in the sag due to changes of temperature and the consequent variation and the maximum amount of tension in the wire. The inventor claims that his hanger is so designed that the bending strains and tensions in the contact wire can be accurately calculated and that spans of 250 to 330 ft. can be safely used without catenary support and without unsafe strains in the contact wire. The proper length of span depends on the amount of ice which may occur on the contact wire and on the amount of variation of temperature of the locality.

The hanger, as shown in the accompanying engraving, consists of two pieces bolted together forming a central clamp firmly holding the wire and two terminal channels. The central clamp corresponds to the ordinary trolley ear. The terminal channels forming the new feature are an addition for the purpose of preventing the sharp bending of the wire at the clamp produced by changes of temperature and by wind pressure. In these channels the wire can bend vertically and laterally in circular curves of large radius. The radius of these curves, which is determined by the shape of the side walls and upper walls of the channels, is calculated so that the bending strain and tension in the wire combined will not exceed a safe limit. The length of the channels is calculated so that the maximum strain in the wire after it leaves the suspender does not exceed this limit. The proper length of the hanger and the curvature of the channel walls, therefore, depend on the amount of ice, the changes of temperature, the length of span and the size and strength of the wire. About one in twenty of the hangers will be a strain adjuster.

The ordinary hangers must be so attached to brackets or span wires that they can move a short distance in the direction of the track from their normal position, so that the change in the length of the contact line produced by the strain adjuster will be approximately equally distributed over all the spans. The hanger illustrated is designed for use with a sliding bow, and to distribute the wear on the bow are staggered alternately 3 ft. each side of the center of the track.

The inventor claims that the suspension is suitable for the highest speeds and severest climates, and that much smaller wires than with other methods of suspension become practicable at moderate speeds. He also claims that the cost of the carrying structure with his suspension is about half that with catenary suspension, while the maximum strains in the wire are much less than in all previous methods. He endeavors to prove all these claims in his pamphlet, which is illustrated by three inset plates and by cuts.



NEW TYPE OF SLIDING BOW EAR FOR LONG SPANS

RAIL SPECIFICATIONS FOR CHICAGO

The Board of Supervising Engineers, of Chicago, representing the city and companies in the rehabilitation of the city system, has awarded a contract for rails to the Lorain Steel Company. The type of rail adopted is that specified by the ordinance of the Council passed Oct. 8, 1906. It is of the grooved section and weighs 129 lbs. per yard. The groove is 1¼ ins. deep and 1¾ ins. wide. The head of the rail is 2¾ ins. wide, and consists of a tread 2 ins. wide with a slight inclination toward the groove and a bevel at the outer edge of the rail ¾ in. wide. The groove is flaring, as in the Trilby rail, but the lip is ¼ in. below the head of the rail. The web of the rail is ½ in. thick, the base is 6 ins. wide, and the height is 9 ins. The specifications under which these rails will be supplied are as follows:

SPECIFICATIONS FOR RAILS FOR CHICAGO STREET RAILWAY TRACKS

1. Type—The rails are to be of the grooved-girder type.

2. Section—The section of the rail shall conform to the specification contained in the revised municipal code of Chicago, as amended by ordinance passed Oct. 8, 1906. A variation in height of 1-64 in. under or 1-22 in. over that specified, and ⅛ in. total variation in width of base only will be permitted, except that 5 per cent of the first 5000 tons may be furnished with a total variation in width of base of not more than ¼ in. The section of rail shall conform perfectly to the fishing dimensions.

3. Weight—The weight will be maintained as nearly as possible (after complying with paragraph A) at the specified weight of 129 lbs. per yard. A variation of 0.5 per cent for an entire order will be allowed. Rails shall be accepted and paid for according to actual weight.

4. Process of Manufacture—A. The entire process of manufacture and testing shall be in accordance with the best current practice, and special care shall be taken to conform to the following instructions:

B. Ingots shall be kept in a vertical position in the pit-heating furnaces until ready to be rolled, or until the metal in the interior has time to solidify.

C. No bled ingots shall be used.

D. Sufficient shall be discarded from the top of the ingot to insure sound rails.

E. Care shall be taken to avoid overheating the steel, and under no circumstances shall a "cinder" heat be allowed; that is, a heat high enough to cause the cinder to run off the steel as it is being drawn from the furnace. This does not apply to cinder which may be sticking to the underside of the steel when drawn from a horizontal furnace, or to the bottom of an ingot when drawn from a soaking pit.

F. The number of passes and speed of train shall be so regulated that on leaving the rolls at the final pass, the temperature of the rail will be the same as the temperature of the 141-lb. rail rolled for the Philadelphia Rapid Transit Company. But this temperature shall, in no case, exceed 2000 degs. F. (this clause to apply to the first 5000 tons of present order only).

5. Chemical Composition—Rails shall conform to the following limits in a chemical composition:

	Per Cent
Carbon (Ave. 0.55 per cent)	0.50 to 0.60
Sulphur not to exceed	0.08
Phosphorus not to exceed	0.10
Silicon not to exceed	0.20
Manganese	0.80 to 1.10

6. Tests—A. One drop test shall be made on a piece of rail not less than 4 ft. and not more than 6 ft. long, selected from each fifth blow of steel. The test piece shall be taken from the top of the ingot. The test rail shall be placed head upward on the supports and shall be subjected to the following impact test under a free falling weight, the height of drop to be 20 ft. If any rail breaks when subjected to the drop test, two additional tests may be made of the other rails from the same blow of steel, also taken from the top of the ingots. If either of these latter rails fail, all the rails of the blow which they represent will be rejected. If both of these additional test pieces meet the requirements, all the rails of the blow which they represent will be accepted.

The drop-testing machine shall have a tup of 2000 lbs. weight, the striking face of which shall have a radius of not more than 5 ins., and the test rails shall be placed head upward on solid supports 3 ft. apart. The anvil block shall weigh at least 20,000 lbs. and the supports shall be part of, or firmly secured to, the anvil. The report of the drop tests should state the atmospheric temperature at the time the test was made.

B. Instead of the drop test, the following may be substituted at the inspector's option: While the heat is being cast, two test ingots shall be made, the first from steel going into the first regular ingot, the other from metal representing the last one. These test ingots shall be 3 x 3 ins. and not less than 4 ins. long. From these, bars at least ½ in. square shall be drawn at one heat by hammering. Each bar, when cold, shall be bent, without breaking, to not less than a right angle. Should one bar from a heat fail, and the other stand the test, a third bar may be taken from a bloom rolled from the ingot represented by the failed one. If this stands the test, it shall be accepted in place of the failed one. If the manufacturer choose, more than the two test ingots may be taken, but they must be from the steel of the first and last regular ingots. If this is done and a test bar fails, another one may be drawn from the duplicate ingot and tested, and, if it stands, accepted.

7. Length—The rails shall be 56 ft. and 58 ft. in length, with 20 per cent of shorter lengths in multiples of 1 ft. down to 35 ft. Rails to be paired as to lengths before shipment.

8. Drilling and Punching—Drilling and punching specifications shall be furnished to the manufacturer from time to time, and will include joint-bolt holes, tie-rod holes, and brace-bolt holes. All holes shall accurately conform to the drawing and dimensions furnished in every respect, and must be free from burrs.

9. Finish—The rails must be free from all mechanical defects and flaws, and shall be sawed square at the ends, and the burrs made by the saws carefully chipped off, particularly under the head and on top of the flange. They shall be smooth on the heads, straight in line and surface when finished, without any twist, waves or kinks, particular attention being given to having the ends without kinks or drop. No. 1 rails shall be free from injurious defects and flaws of all kinds.

10. Straightening—Care must be taken in hot straightening the rolls of the rails so that gagging under the cold press will be reduced to a minimum and so applied that the rails will not be made lumpy. The distance between supports of rails in the gagging press shall not be less than 40 ins.

11. Branding—The name of the maker, the weight of the rail, and the month of the year of manufacture shall be rolled in raised letters and figures on the side of the web, and the number of blow shall be plainly stamped on each rail where it will not be subsequently covered by the splice bars.

12. Inspection—The inspectors representing the railway company, or the Board of Supervising Engineers, shall have free entry to the works of the manufacturer at all times while this contract is being filled, and shall have all reasonable facilities afforded to satisfy them that the rails are being made in accordance with these specifications. All tests and inspections shall be made at the place of manufacture prior to shipment. The manufacturer shall furnish the inspector daily with the carbon determinations of each heat and a complete analysis every 24 hours, representing the other elements contained in the steel. Such analysis shall be made from the average drillings taken from test ingots.

The inspectors shall have authority to reject rails from insufficiently sheared blooms, or from heats, the test pieces of which have failed, or from badly poured heats, or from chilled heats, or from bled ingots. The rails made from insufficiently cut blooms, if otherwise perfect, to be afterwards received as No. 1 short rails, if, after sufficient lengths they have been sawed off, to make them conform to specifications, they shall exceed 35 ft. in length. By "badly poured" heat is meant one, which, from any cause, has been "teemed" without the control of the operator. A "chill" heat is one which by reason of the chilling of the steel has to be either pricked or poured over the top of the ladle. A "bled" ingot is one from the center of which the liquid steel has been permitted to escape. Imperfectly drilled, straightened (except lumpy rails), or chipped or filed rails shall be rejected, but will be accepted if subsequently properly finished. Rails failing to comply with the requirements of paragraph No. 2 will be rejected.

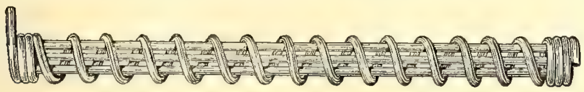
13. No. 2 Rails—Rails that possess any injurious defects, or which, from any cause, are not suitable for first quality, or No. 1 rails, shall be considered No. 2 rails. Provided, however, that rails which contain any physical defects which impair their strength or usefulness and fail to comply with the requirements of paragraph No. 2, shall be rejected, and rails rejected under the drop test will not be accepted as No. 2 rails. Both ends of all No. 2 rails shall be painted while in order to distinguish them. No. 2 rails will be accepted up to 10 per cent of the whole order, at a reduction of $2 per ton in price below that specified in the contract.

Francis H. Dewey, president of the Worcester & Blackstone Valley Street Railway Company, states that through cars will be run between Worcester, Mass., and Providence, R. I., as soon as the track connection between the Worcester & Blackstone Valley and the Uxbridge & Blackstone Street Railway Companies' lines can be made at Plummer's Corner, in Northbridge, Mass. From Providence to Worcester via the steam route is 44 miles, and the electric routes are about the same length. Present arrangements require the trolley passenger going through between Providence and Worcester to change cars from three to five times, according to the route selected. The steam schedule is one hour and forty-five minutes, but the electric cars require three and one-half hours via the Woonsocket short line, or a half hour longer via Pawtucket. The electric lines making up the system are the Rhode Island Company, including the old Pawtucket and the Cumberland Street Railways between Providence and Cumberland Hill, or the Rhode Island and the new Providence & Burrillville road, between Providence and the Woonsocket city line; the Woonsocket Street Railway from either Cumberland Hill or Woonsocket to Millville, Mass.; the Uxbridge & Blackstone road, from Millville to Plummer's Corner in Northbridge, Mass., and the Uxbridge & Blackstone Valley, from the last-named point to the city line of Worcester, into which place the cars are operated over the tracks of the local Worcester system. Excepting the Providence & Burrillville, none of these lines is a high-speed road. With the same exception, they are largely built in the highways.

ANTI-WASTE GRABBER

A device to prevent waste in journal boxes from being carried around by the rolling of the journal and then wedging up between the lug of the box and the journal, depriving it of lubricating oil, has recently been put on the market by the V. O. Lawrence Company, of Philadelphia. The device is called an anti-waste grabber, and is meeting with success in the steam railway field as a preventive of hot boxes.

It is made from copper wire, in the form of a coil, and is stiffened by having three wires soldered on the inside



WIRE ANTI-WASTE GRABBER

to each turn of the coil. At one end of the grabber the wire projects from 1/4 in. to 1/2 in. This projection holds firmly in the waste and prevents the grabber being lost in case a journal box should be open. Its use insures care being taken in packing journal boxes. They cannot be jammed full of waste, as it must be placed evenly and room must be left for the grabber. Again, the weight of the grabber itself has the tendency to hold the waste down, and if it does raise a trifle the grabber will strike the lug of the box and bearing first, preventing further movement. When in this position it is impossible for the waste to get beyond the grabber. Under these conditions, it is claimed that the journals will run at a lower temperature, due to the fact that oil is more freely applied to the journal at all times.

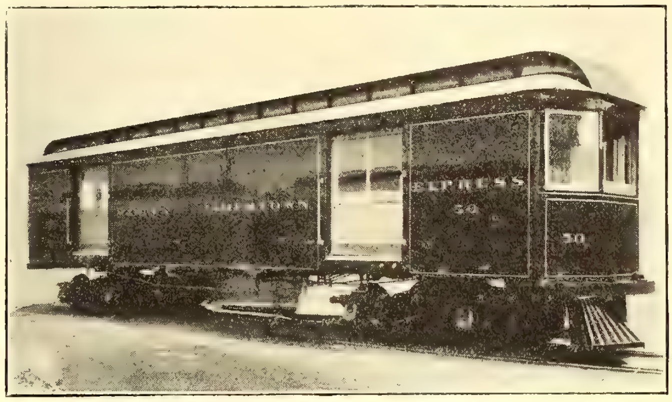
NEW CARS FOR THE WARREN-JAMESTOWN RAILWAY

A number of interesting interurban cars of the Brill grooveless post, semi-convertible type have lately been added to the equipment of the Warren & Jamestown Street Railway. This system, although a small one, operating

EXTERIOR OF PASSENGER CAR FOR WARREN & JAMESTOWN LINE

ten cars over about 20 miles of tracks, is of considerable importance, as it forms the connecting link with the Chautauqua Lake region. On arriving at Jamestown, passengers from Warren can board the cars of the Chautauqua Traction Company, which has its terminus at Westfield, passing the town of Chautauqua en route. Another interurban line running out of Jamestown is the line connecting Lakewood, Celeron and Falconer.

The new cars are of the passenger and smoking type, the seats for the non-smokers being upholstered in leather; those in the smoking compartment in rattan; all seats have high backs and head rolls. The bottom framing is braced with under trusses and the two needle beams are double trussed. The unusual height of the car body from the



EXPRESS CAR FOR WARREN & JAMESTOWN LINE

rails, as shown in the engraving, is due to the fact that the car body was bolstered up on the trucks temporarily for photographic purposes pending their proper adjustment; this makes the pilot conspicuously high from the ground in the picture. The platforms are flush with the floor of the car, and other features are the double steps and steam coach roof. The ventilator and transom sashes have arched tops and are filled with art glass. The inside finish is of golden oak; the ceilings are of three-ply birch. The trucks are of the M. C. B. type. The car company's "Dumpit" sand boxes, angle-iron bumpers and other specialties form a part of the equipment. The chief dimensions follow: Length over end panels, 34 ft. 4 ins.; over crown pieces, 44 ft. 4 ins.; length of smoking compartment, 9 ft. 2 ins.; width over sills, including sheathing, 8 ft. 4 ins.; height from

INTERIOR OF WARREN & JAMESTOWN CAR

floor to ceiling, 8 ft. 5 5/8 ins.; from track to under side of sills, 36 7/8 in.; size of side sills, 4 3/4 in. x 7 3/4 in., with 3 1/2-in. x 6-in. x 3/8-in. angle iron; center sills, 4 1/2 in. x 6 in.; intermediate sills, 3 1/2 in. x 4 3/4 in.; end sills, 5 1/4 in. x 6 13/16 in.; sill plates, 15 in. x 3/8 in.

Along with these semi-convertibles the American Car Company also shipped a 44-ft. baggage and express car of standard character and dimensions and mounted on the same type of M. C. B. trucks.

FINANCIAL INTELLIGENCE

WALL STREET, May 22, 1907.

The Money Market

There has been no material change in the local money market during the past week. The tone was, if anything, a shade easier, but rates for all classes of accommodations remained practically the same as those heretofore quoted. The easier tendency was due to a falling off in the demand from stock commission houses, resulting from a dull and declining securities market, rather than to any pressure of funds upon the market. The banks and other large lenders of money are not disposed to offer with any degree of freedom, the general belief being that better rates will obtain in the near future. The developments of the week were such as to strengthen this belief. Corporate borrowing continued on a rather large scale. The new securities announced during the week include an issue of $5,000,000 5 per cent five-year notes by the North American Company. Of the total amount $2,500,000 have been sold to a syndicate, and the remainder will be retained by the company for future use. The Delaware & Hudson Company has authorized the issuance of $10,000,000 equipment trust notes, and the General Electric Company has decided to issue $13,000,000 5 per cent convertible debenture bonds. The latter issue will be offered to stockholders at par and interest, and payments are to be made, one-half on July 20 next, and the remainder on Jan. 20, 1908. In addition to the above the Interborough-Metropolitan Company contemplate an issue of $15,000,000 three-year 5 per cent collateral trust notes. These notes will not be sold at present, the company, it is said, having provided for immediate requirements by borrowing $3,000,000 for six months at 6 per cent from various banks and trust companies.

The sharp advance in rates for sterling in the local market, together with a decline in sterling and harder discounts at Paris, have increased the probability of gold exports to France. No engagements of the yellow metal have yet been made, and unless the Bank of France should decide to offer interest on the gold while in transit, it is not likely that shipments will be begun this week. It is also the belief in some quarters that should gold exports to Europe become imminent, the Secretary of the Treasury would at once withdraw the special Government deposits made with the banks last winter, which would undoubtedly result in checking the outflow of gold from this side. The European money markets have not changed appreciably, and apart from the slight hardening in discounts at Paris, referred to above, rates at the other principal European centers are practically the same as those prevailing at the close of last week.

The bank statement published on Saturday was decidedly favorable. Loans decreased $1,414,900 and deposits increased $1,681,800. Cash increased $3,406,900, and the reserve required was $420,450 larger than in the preceding week, making an increase in the surplus reserve of $2,986,450. The surplus now stands at $11,472,675, as compared with $10,129,275 in the corresponding week of 1906 and $8,219,975 in 1905.

Money on call loaned at 3 and at 2 per cent, the average rate being about 2½ per cent. Money for fixed periods was obtainable at 4 per cent for sixty and ninety days, 4¼ per cent for four months, 4½ per cent for five months, 4¾ per cent for six months, and 5¼ per cent for nine to twelve months.

The Stock Market

Following upon an almost uninterrupted decline in securities prices for the last ten days, a collapse occurred at the close of the week, which brought a number of prominent issues to, or actually below, the lowest prices of the so-called March panic. A number of the inactive shares and bonds, some of them in the high priced category, fell to the lowest levels within six years. The pronounced long continued stagnation in the market for railway and other bonds has recently compelled syndicates to take over allotments that could not be carried by outside holders, and undoubtedly very large amounts of money are tied up in these loans to capitalists. While the decline was largely the result of professional short selling, still it was evident that forced liquidation was in progress in certain quarters of the market. Public interest in the market continues extremely small, judging from the volume of commission house business, while operations for foreign accounts were unimportant. The crop news was more favorable. Warmer weather was reported in the winter wheat States west of the Mississippi, while in the spring wheat sections planting was making better progress. Notwithstanding these favorable changes in the crop situation trading in the local and Western grain markets continued excited, with prices at the highest in several years. The advance in prices of wheat probably had much to do with the slump in stock values, but sentiment was also chilled by the continued huge borrowings on the part of corporations. While money rates have so far failed to reflect the heavy demands for funds from that source, it is considered only a question of time when rates for accommodations will respond to the heavy demands for new capital. A comparatively small part of these new securities is to be provided for in the near future, the bulk of the payments falling due in the late summer, or at a time when the outflow of money for crop-moving purposes is usually well under way. One factor in the monetary situation which is perhaps causing more apprehension than any other at present, is the strength in sterling exchange. During the week rates for sterling have advanced to the highest points of the year, and on the present basis of exchange here and at Paris gold can be shipped to the French capital. The margin of profit on such transactions, however, is insignificant, but if the Bank of France should allow interest on the gold while in transit, as is not unlikely, shipments of the precious metal will be made. The favorable developments of the week in addition to the improved crop conditions, included unabated activity in the iron and steel trades and continued strength in the copper metal market. Railroad earnings were good and reports from all sections of the country were of continued activity in all branches of trade. These favorable developments were practically ignored, and while prices rallied sharply at the close from the low level the improvement was due largely to short covering.

The traction stocks moved in sympathy with the general market. The news from Albany to the effect that the Utilities bill will become a law practically in its original form was pretty well discounted. The Interborough-Metropolitan has authorized an issue of $15,000,000 three-year 5 per cent collateral trust notes.

Philadelphia

Trading in the local traction issues was comparatively quiet during the past week, and prices continued to move with more or less irregularity. At times pronounced strength was displayed in the active issues as a result of some good buying, but this was followed by a general recession in values. Philadelphia Rapid Transit was the conspicuous feature of the utility shares, both as regards activity and price fluctuations. In the early dealings strong buying advanced the stock from 24⅜ to 25½, but near the close the price ran off to 22½. In all about 15,000 shares were traded in. Union Traction moved in sympathy, and after selling as high as 60 yielded under rather slight selling to 57½. Philadelphia Traction ran off from 94 to 91¾, and United Companies of New Jersey sold at 250 and 249¾. Lehigh Valley Transportation was steady at 23, as was Consolidated Traction of New Jersey, which sold in small amounts at 73¼ and 73½. American Railways sold at 49½, Philadelphia Company at 44, and Philadelphia Company preferred at 45½.

Chicago

It is expected that the necessary 75 per cent of the stocks of the traction companies under the ordinance will have been secured before the time limit expires this week. It is understood that more than 32,000 shares of North Chicago stock have been deposited, which is considerably more than is necessary, but it is said that the deposits of West Chicago shares are somewhat below the required amount. The certificates of deposit issued by the Central Trust Company in New York have been admitted to the unlisted department of the New York Stock Exchange.

Trading in the local traction shares during the week included a large number of issues, but the individual transactions were small. They were Union Traction at 2⅞ and 3¼, City Railway at 180, West Chicago at 28, South Side Elevated at 83 and 84, Chicago & Oak Park common at 3¾, preferred at 13¼; Metropolitan "L" common at 24¼, preferred at 64¾; Northwestern "L" at 23 and 23 ¼,and the preferred stock at 58.

Other Traction Securities

The market for traction issues at Baltimore was quiet. About the only activity was displayed by United Railway incomes, which sold to the extent of about $90,000 at prices ranging from 54½ to 53¾, United Railway 4s sold at 87⅛ and 87, and the refunding 5s brought 83½. City & Suburban 5s changed hands at 109, and Macon Railway & Light 5s sold at 94½. The Boston market was fairly active and decidedly irregular. Early in the week Massachusetts Electric advanced from 17 to 19, but subsequently lost all the improvement, while the preferred, after a sharp rise from 57¾ to 63, reacted and closed at 61¾. Boston Elevated declined from 137 to 136. West End sold at 87 and 87½, and the preferred at 104½ and 105. Boston & Worcester was steady at 26⅞ and 27.

Considerable activity has been shown in Cleveland Electric the past week on the Cleveland Stock Exchange, but at figures ranging from 50 to 51. The last sale of any moment was a 200-share block, buyer 60 days, at 51½. Just before that, 200 shares went at 50. There is a felling that the company will be successful in its contentions with the city. Aurora, Elgin & Chicago remains steady at 34, while Washington, Baltimore & Annapolis securities were in fair demand around prices that have prevailed for some days.

Security Quotations

The following table shows the present bid quotations for the leading traction stocks, and the active bonds, as compared with last week:

	May 15	May 22
American Railways	49½	49¼
Boston Elevated	136	136
Brooklyn Rapid Transit	60	53¾
Chicago City	180	180
Chicago Union Traction (common)	3	3¼
Chicago Union Traction (preferred)	13½	14½
Cleveland Electric	50	50
Consolidated Traction of New Jersey	74	73¾
Detroit United	70	—
Interborough-Metropolitan	22½	19
Interborough-Metropolitan (preferred)	56⅞	54
International Traction (common)	50	50
International Traction (preferred), 4s	71¾	71¾
Manhattan Railway	138½	133¼
Massachusetts Elec. Cos. (common)	17	17
Massachusetts Elec. Cos. (preferred)	57½	57½
Metropolitan Elevated, Chicago (common)	23	22
Metropolitan Elevated, Chicago (preferred)	63	63
Metropolitan Street	—	—
North American	72½	69
North Jersey Street Railway	40	40
Philadelphia Company (common)	43½	43
Philadelphia Rapid Transit	24¼	23¼
Philadelphia Traction	93½	92½
Public Service Corporation certificates	64	64
Public Service Corporation 5 per cent notes	94	94
South Side Elevated (Chicago)	83	83½
Third Avenue	109	109
Twin City, Minneapolis (common)	94	89½
Union Traction (Philadelphia)	59¾	57½

Metals

According to the "Iron Age" the Illinois is the leader in booking orders for forward delivery, and during the week entered 95,000 tons additional, bringing the total for 1908 delivery up to about 250,000 tons. There are some additional large inquiries in the market. Buying for 1908 delivery has been a feature in other departments of the trade. On the whole the foundry iron market has become stronger during the week, although the feeling in the trade persists are unduly high, and that a lower level, if it could be safely reached, would be far less dangerous.

Copper metal continues firm at unchanged prices. Spot Lake is quoted at 25½c. and Electrolytic at 25¼c.

NEW WORK TO BEGIN ON PENNSYLVANIA TUNNELS

Contracts have been let for the only section of the Pennsylvania Railroad tunnels not already begun. They are for building the eastern portals and approaches in Long Island City, and a short stretch of cut-and-cover tunnel just west of the portals. The work for which contracts are let extends to the end of "Sunnyside Yard," the largest electric car yard in the world. The new contracts, known as sections A and B, were awarded to Naughton & Company and Arthur McMullan. The work will be done as a part of the East River division, under the direction of the chief engineer, Alfred Noble. The contracts cover the distance between Thompson Avenue, Long Island City, and the contract of S. Pearson & Son. Under the East River itself considerably more than 40 per cent of the four separate tunnels has been completed.

REPORT OF THE INTERBOROUGH COMPANY FOR THE YEAR—COMPANY BORROWS $3,000,000 AND AUTHORIZES THE SALE OF $15,000,000 BONDS

The Interborough-Metropolitan Company, of New York, reports earnings as follows for the year ended March 30, 1907:

	1907	1906
Gross receipts	$43,353,841	$40,693,671
Operating expenses	21,841,884	21,044,516
Net earnings	$21,511,957	$19,649,155
Other income	1,187,464	1,215,781
Total income	$22,699,421	$20,864,936
Charges	17,956,552	16,766,926
Balance	$4,742,869	$4,098,010
Met. bond int.	3,150,000	2,800,000
Balance	$1,592,869	$1,298,010
Met. St. Ry. div.	666,368	3,639,888
Balance	$926,501	def. $2,341,878
Inter. Met. div.	2,273,990	......
Deficit	$1,347,489	353,100

The Interborough-Metropolitan Company has borrowed about $3,000,000 on six months notes bearing 6 per cent interest and has authorized the sale of $15,000,000 three-year 5 per cent collateral trust coupon notes. The shorter notes and whatever other similar loans may be made meanwhile will be retired on the flotation of the three-year $15,000,000 issue. The company, it was said, expects that it will be able to place the larger issue on more advantageous terms prior to the maturity of the six months' notes.

The $15,000,000 three-year 5 per cent notes, which it is expected will be placed within six months, are secured by collateral of the face value of $15,368,300, but of a much greater market value deposited with the Mercantile Trust Company as trustee. The collateral consists of $8,000,000 three-year 6 per cent improvement notes of the Metropolitan Street Railway Company, of itself a new note issue; 59,700 shares of the 6 per cent guaranteed stock of the Third Avenue Railroad Company; 430 shares of the 18 per cent guaranteed stock of the Forty-Second Street & Grand Street Ferry Railway Company; 5028 shares of the 15 per cent guaranteed stock of the Central Crosstown Railway Company; 1570 shares of the 9 per cent guaranteed stock of the Second Avenue Railway Company, 6955 shares of the Electric Storage Company.

The Interborough Rapid Transit Company raised money early in the year for its own extension and improvement work and the present financing is to supply the needs of the New York City Railway and its subsidiary companies alone. The principal need for the new money arises from the decision to electrify various of the cross-town lines, and it is calculated that the money will be more than sufficient for the purpose, so that President Shonts will have funds to carry out all the improvements he proposes.

CHICAGO TRACTON MATTERS

President Rawson, of the North and West Chicago Street Railway Companies, has sent to the stockholders of these companies a letter notifying them of the extension of time in which they could deposit their stock in order to take advantage of the ordinances recently passed by the Council. The Union Traction Company stockholders already have made the necessary deposits, but there still is a majority lacking on the part of the underlying companies. The letter reads:

"Owing to the large number of stockholders of the North and West Chicago Street Railroad Companies who have signified their intention and desire to the committee and Union Trust Company to deposit their stock with it, to be turned over to the Chicago Title & Trust Company, as outlined in the circular of the committee under date of April 20, 1907, in order to participate in the benefits derived under the ordinances passed by the City Council under date of Feb. 11, 1907, to the Chicago Railways Company, a part of which acceptance necessitates a deposit of a majority of the capital stock of the West and North Chicago Street Railway Companies (excluding the portions of the capital stocks of said companies deposited with the Illinois Trust & Savings Bank, as trustee), the committee has authorized the Union Trust Company to extend the time of receiving the above mentioned stocks up to and including May 22, 1907. You are, therefore, notified that the Union Trust Company will receive for deposit stocks of the North and West Chicago Street Railroad Companies up to and including Wednesday, May 22, 1907.

"Upon presentation of your certificate, indorsed in blank to the Union Trust Company, trustee, Tribune Building, Chicago, Ill., a negotiable receipt will be given for the same. Your stock certificate can be sent with the form of letter appended hereto.

"Yours truly,

"UNION TRUST COMPANY, Trustee.

"By RUFUS F. CHAPIN, Secretary."

THE CLEVELAND SITUATION

In the face of a temporary restraining order the Low Fare Railway Company operated cars for 3 hours, Saturday, on Euclid Avenue to East Fourteenth Street, supposedly on the authority of the franchise railroaded through the Council at Cleveland two weeks ago. A temporary cross-over was laid at Fourteenth Street, so that the cars could change from one track to the other. D. C. Westenhaver, an attorney for the new companies, had the cross-over removed as soon as he learned what had been done.

The Cleveland Electric has notified the Low Fare Railway Company that it will not enter into negotiations for the joint use of its tracks in the down-town district with it or either of the other companies. A tender of $13,500 for the use of the Euclid tracks to East Fourteenth Street was refused Friday. The reason given is that these companies have no rights in any of the streets of the city. In an open leter to the City Council the company also refused the offer of the Low Fare Company to restore the tracks on Quincy Street and Central Avenue, and operate cars over them or to allow it to operate cars over the streets at its own rate of fare pending a decision in the cases now in court. A counter proposition was made to the effect that the Cleveland Electric would at once restore the tracks on those streets and operate its cars if given a franchise at seven tickets for a quarter, and in case the cases are decided against it, sell the tracks at cost to the company which is declared to have a legal franchise.

In Judge Sanders' argument before Judge Phillips in the Isom injunction case last week, he brought out the point that the Legislature had required that consents for a majority of the foot frontage be secured in order to protect people, from the City Council. He said that the Legislature had anticipated just such things as are occurring in Cleveland, and put an obstacle in the way of Councils using the streets as they see fit. Judge Phillips, on Wednesday, May 22, ruled that the Low Fare Company has not a sufficient number of valid consents to make the grant on Central Avenue legal. He has given the company until Friday to restate its case.

At the instance of the Cleveland, Painesville & Eastern, the Cleveland Electric Railway Company was stopped by a restraining order, issued Tuesday, from tearing up its tracks on East Ninth Street, south of Prospect Avenue. This is the line that this and a number of other interurban roads use to reach their freight station and they say they have a contract with the Cleveland Electric for operating over it, which would be violated by the tearing up of the tracks.

B. R. T. FINANCING IMPROVEMENTS OF CONSTITUENTS

Mortgages aggregating $25,000,000 are about to be executed by two of the constituent companies of the Brooklyn Rapid Transit Company to secure the latter corporation upon cash advances made and to be made by it to the subsidiary companies for additions, betterments and improvements. The financing plan is explained fully in the following statement issued Saturday, May 18, by C. D. Meneely, secretary and treasurer of the Brooklyn Rapid Transit Company:

Notices have been or will shortly be sent to the stockholders of the Brooklyn Union Elevated Railroad Company and of the Nassau Electric Railroad Company of special meetings to be held June 10 and 11, respectively, to authorize a mortgage on behalf of the Brooklyn Union Elevated Railroad Company for $20,000,000, and one on behalf of the Nassau Electric Railroad Company for $5,000,000, to secure certificates of indebtedness heretofore or hereafter issued by those companies to the Brooklyn Rapid Transit Company for cash advances from that company to enable the railroad companies to make necessary additions, betterments and improvements to their railroads and equipments.

This is in pursuance of the system of financing adopted some years ago by the Brooklyn Rapid Transit Company, which was, in brief, that instead of each separate company of the system attempting to finance its own requirements by issues of securities, the Brooklyn Rapid Transit Company would raise the necessary funds by the sale of its own bonds, and with the proceeds advance moneys to the constituent companies from time to time and take in exchange the notes or other obligations of the constituent companies for such advances. The reason for this method of financing was primarily that, inasmuch as many millions of dollars would be necessary for the proper extension and development of the railroad system, one form of security with which the investing public would become familiar would be much more marketable than a miscellaneous collection of securities issued by the various companies.

In pursuance of this plan the Brooklyn Rapid Transit Company issued its mortgage dated July 1, 1902, to Central Trust Company of New York, as trustee, for $150,000,000, of which about $61,000,000 were reserved to take up at or before maturity the underlying bonds of the Brooklyn Rapid Transit Company and its constituent companies. The remainder of the bonds were to be issued from time to time to furnish proceeds for improvements, additions, extensions, etc., of the constituent companies, and up to and including March 9 last there had been issued and sold of such bonds $28,107,000, and the proceeds of such sale had mostly been applied to purchasing from the constituent companies their certificates of indebtedness, payable on demand for the actual cost of improvements, additions, extensions, etc.

It was the intention at the time of the execution and delivery of this large Brooklyn Rapid Transit mortgage that the certificates of indebtedness to be purchased from the constituent companies would be secured by the mortgages of the companies issuing the same, otherwise the Brooklyn Rapid Transit Company, as the owner of such certificates, and the Brooklyn Rapid Transit bondholders having a lien on such certificates would be in no stronger position than that of any general creditor of the constituent companies.

This will now be accomplished in the following manner:

The Brooklyn Rapid Transit Company has entered into agreements with most of its constituent companies to furnish from time to time within the next ten years such moneys as each of these companies shall require for extensions, improvements, additions, etc., up to a maximum amount and to take in exchange therefor the certificates of indebtedness of such companies payable on demand, upon condition that not only the certificates of indebtedness thus to be issued and sold to the Brooklyn Rapid Transit Company, but also the certificates heretofore issued, shall be secured by the mortgages of the railroad companies issuing such certificates as collateral security thereto. The Board of Railroad Commissioners has already authorized such mortgages by the Sea Beach Railway Company, the Canarsie Railroad Company and the South Brooklyn Railway Company, and after the approval by the stockholders of the Nassau Electric and Brooklyn Union Elevated Railroad Companies will be asked to give its consent also to the mortgages to be issued by those last named companies.

The mortgages for which consent is requested to the extent that they secure past expenditures do not add one dollar to outstanding capital charges. To the extent that they secured expenditures hereafter to be made they carefully limit such expenditures to the actual cost of additions, improvements and extensions. The certificates of indebtedness cannot be issued at less than par, and must represent such actual cost. Under the terms of the Brooklyn Rapid Transit Company's mortgage, bonds issued under that mortgage must be issued at par for the par of such certificates of indebtedness, and any deficiency arising from the sale of Brooklyn Rapid Transit bonds at less than par must be made up out of the earnings of the company.

DECISION OF MASSACHUSETTS BOARD ON FENDERS

The Massachusetts Railroad Commission issued its decision on the long-pending question of street-car fenders and wheel guards Tuesday, May 21. The question is settled on a basis of compulsory experiment by the companies, and notice is given that the Commission will require various types of fenders and wheel guards on various lines, according as the companies operate in the country or suburbs where roadbed conditions are imperfect and speed is high, or in the city streets, where roadbed is smoother and speed relatively low. The circular follows:

COMMONWEALTH OF MASSACHUSETTS IN BOARD OF RAILROAD COMMISSIONERS.

May 21, 1907.

Circular to Street Railway Companies.

FENDERS AND WHEEL GUARDS

In its annual report of 1904 the Board expressed a lack of confidence in the car fenders and wheel guards then in use upon our street railways and advised experiment with new types. While companies gave some attention to this suggestion during the year that followed, there was manifest on the whole a general indisposition toward any change in equipment. The Board then took up the matter and, having secured an appropriation from the Legislature of 1906, completed in December last an investigation of fenders and wheel guards at home and abroad, concluding the inquiry with a series of tests in Newton. Companies were thereupon requested to give notice to the Board, on or before the first day of this month, of their preferences in respect to these safeguards. That time, subsequently extended two weeks, having now expired, the Board issues the following statement of views and requirements.

PFINGST FENDER

In 1895, after an exhaustive inquiry, the then members of this Board issued a circular stating their conclusions and defining the general principles which should govern the equipment of street cars with safety devices. Although the Pfingst fender was not recommended as better than others, it was one of a class of fenders which, under this circular, companies could use and was the one which they very generally selected.

As stated in our last report, "The record of the Pfingst fender shows many instances when persons have been saved from injury. This, of course, happens when accidents are prevented and therefore when public attention is not drawn to the fact through newspaper paragraph, police report or inquest. On the other hand, this fender has frequently failed to do its work. Upon a large percentage of the surface cars in Boston the fender is useless from the fact that projecting parts of the car so reduce the available area of the platform as to leave no room for catching or holding a person who falls or is thrown upon it."

Notwithstanding the multiplication of patents and the ingenuity of experts, we know of no device in use or exhibited through sketch or model that, attached to a street car moving at varying speed, can be relied upon to always trip a standing person or pick up a prostrate body without injury. It must remain unsafe for young children to play in streets that are occupied by railway tracks, or to cross them unattended, and unsafe for older persons to step carelessly in front of cars. Meanwhile there is need of more effective car fenders and wheel guards. Although applications for the most part call for a further endorsement of the Pfingst fender, we do not share the confidence expressed in it, and cannot approve it to the exclusion of other devices.

AUTOMATIC SAFEGUARDS.

The newer devices are, as a rule, automatic. In passing upon them it is necessary to bear in mind the distinguishing characteristics of the service upon various lines of railway. For example, we believe it would be hazardous to attach to the front end of high-speed interurban cars, operated under conditions commonly met, automatic fenders which might upon occasion so fall or be thrown in the way of the car as to cause a derailment. On the other hand, there would be no such hazard in the use of an automatic wheel guard upon cars as ordinarily operated in city streets. The Board will therefore require an experiment with these wheel guards, though at times in winter snow and ice will undoubtedly interfere with their success.

DROP DEVICES

A fender or wheel guard that must be dropped by the motorman in case of threatened accident is open to the criticism that it complicates his duties at a time when he ought to give paramount attention to the stopping of the car. On the other hand, this device possesses an advantage over the automatic in that it is dropped only when needed and by intelligent action, and so can be carried at a height such as to eliminate risks from contact with obstructions. A very important change in this type of fender or wheel guard is that by which the application of the emergency brake itself drops it into position. A trial of these devices will also be required.

LIVERPOOL LIFEGUARD

Climate and roadbed make it possible in Liverpool to use a guard which is carried so close to the surface of the track as to be very successful in its one purpose of preventing bodies from passing under the wheels. While weather and roadbed construction prohibit upon many of our railways the use of a guard carried so close to the ground, wheel guards have been brought to our notice which possess some of the features of the Liverpool device and which are apparently capable of good work. The Board will require the use of these wheel guards upon selected cars.

RIGID FENDERS

Rigid devices projecting in front of cars are suited to the conditions upon some of our railways, but this type ought not to be confined to the straight platform fender. Whenever any such fender is hereafter used it must be attached to the car at a height of not less than 12 ins. above the track so that it will pass over a prostrate body without maiming or injury. Among fenders of this type are several designed to make it sure that a person tripping and falling upon them will remain there until the car is stopped. Lines of cars will be specified upon which these devices are to be used.

CONCLUSION

It is the purpose of the Board, in the enforcement of these views, to secure actual experience with different types of fenders and wheel guards that promise results better than those attained in the past.

Companies must complete designated changes in equipment on or before the first day of December, 1907, unless prevented by reasons beyond their control, in which case the necessary additional time will be allowed.

The details of the new equipment will be taken up with the Boston Elevated, the Boston & Worcester, the Boston & Northern and Old Colony, and with the Worcester, Springfield and Berkshire systems on Monday, the twenty-seventh day of May, at half-past 10 o'clock, and with other companies at a time to be hereafter named.

The plan of action proposed in this circular is of course subject to any change which may be rendered necessary should the Legislature in the measure now pending before it restrict the power of the Board.

(Signed) JAMES F. JACKSON,
GEORGE W. BISHOP,
CLINTON WHITE,
Commissioners.

A true copy.
Attest: C. E. MANN, Clerk.

OHIO ELECTRIC RAILWAY COMPANY ORGANIZED

The Ohio Electric Railway Company, of Cincinnati, has been incorporated with a capital stock of $100,000, by E. H. Berry, D. J. Downing, S. M. Murray, W. H. Schunert and C. Wilson, most of whom are connected with the Cincinnati Traction Company or the Schoepf offices, and the impression prevails that this is the company that will later control all the Schoepf roads in Ohio. At present the Schoepf properties are divided into three groups. The Indiana, Columbus & Eastern controls the roads about Columbus and Springfield, to the west from Dayton and northwest by way of Lima and Defiance; the Lima & Toledo is in the extreme Northern part of the State, and the Cincinnati Northern commands the situation between Cincinnati and Dayton. It is thought that these three systems will be combined under the new company. The application for its charter states that the termini will be Zanesville, New Paris, Richmond, Ind., Cincinnati, Toledo, Columbus, Washington Court House, Springfield, Defiance, Dayton, a point near Union City, Ind., on the Ohio and Indiana State line; Lima and Ft. Wayne, Ind. The counties through which it will pass are Muskingum, Licking, Franklin, Madison, Clark Greene, Butler, Warren, Montgomery, Preble, Hamilton, Champaign, Logan, Augliaze, Allen, Putnam, Defiance, Henry, Wood, Lucas, Pickaway, Fayette, Darke and Van Wert Counties in Ohio, and Wayne and Allen Counties, Ind. There are to be branch lines from Miamisburg to Germantown, Medway to New Carlisle, Hebron to Buckeye Lake and Newark to Granville.

STRIKE AT BIRMINGHAM

The employees of the Birmingham Railway, Light & Power Company, of Birmingham, Ala., are on strike. President Jemison, of the company, declares that the union will be fought to the end. The city is very quiet, labor demonstrations being prevented by the police. A few cars are being operated on each line, guarded by deputies, and no attempt is being made to operate at night without sufficient police protection.

INDIANA INTERURBANS EXEMPT FROM 2-CENT FARE LAW

In response to a request from the Railroad Commission, Attorney-General James Bingham, of Indiana, has given an opinion to the effect that the 2-cent fare law, passed by the last General Assembly, does not apply to interurbans, but only to steam roads. The question has been raised by various individuals and corporations, several letters having been written to the Attorney-General. He referred them to the Commission, which, in turn, referred them back, and requested an official opinion.

The Attorney-General's opinion is based on the assumption that the Legislature did not intend this law to apply to interurbans; also, on the position that interurbans and steam roads were reckoned as being two distinct classes of transportation companies. Therefore a rate law applying to one need not necessarily apply to the other. The opinion continues:

"The purpose of the act in question was to reduce passenger rates, and it is a notorious fact that the passenger rates on interurban railroads were, at the time of the passage of the act in question, almost without exception, below the passenger rate named in the act, to wit: 2 cents; and it is quite evident that the legislation was not enacted with reference to rates that were already below, or at least not in excess of the maximum rate named, while on the other hand, the steam railroads in the State of Indiana were universally charging a passenger rate of 3 cents a mile.

"It is a part of the history of legislation that amendments to the bill were offered at the time when it was on its passage and under discussion in the General Assembly, by which it was sought to extend the same to interurban railroads and limit the passenger rate of such interurban railroads to 1 cent a mile, and these amendments were defeated on the theory that the act should not be made to extend to interurban railroads; and it is also a matter of common knowledge that interurban railroads are able to operate at much less expense than steam railroads, and to carry passengers at a lower rate a mile than can steam railroads, and it is in view of these facts that the interurban railroads have been enabled to give the cheap passenger rate which has made them popular throughfares for the local travel.

"It is, therefore, my opinion that the act in question has no reference to the interurban, electric or street railways of the State."

The Attorney-General's decision is being criticised and the question will be determined in the courts.

Two questions were thus involved. The first is, whether there is any real difference between the two sorts of railroads, and, second, whether (if there is not) the 2-cent fare law applies to both. The law is comprehensive in its terms. We quote:

"It shall hereafter be unlawful for any common carrier engaged in the carriage of passengers upon a railroad or railroads, between points in this State, to charge in excess of 2 cents per mile for the carriage of an adult passenger, or in excess of 1 cent per mile for the carriage of a passenger between 5 and 12 years of age."

THE STRIKE SITUATION IN SAN FRANCISCO

The United Railroads of San Francisco is now operating eight of its lines with 136 cars, the number being increased steadily since the strike began on May 5. Before the strike, 350 cars was the average in operation. The award of the board of arbitration, announced in March last, was to increase the wages of the men an average of 21 per cent, or to 31, 32 and 33 cents per hour, and payment in accordance with this award from September, 1906, of approximately $50,000, was made by the company in April. The company offered to continue this arbitration scale for one year from May 1, but the men demanded $3 for 8 hours work, or 37½ cents per hour. It is stated that the company can secure all the men necessary to operate its cars, providing sufficient protection is given to the company's property and its patrons. At the hour of going to press it is stated that the company will open five lines, which have been completely tied up since the trouble began. This indicates a complete victory for the company. The officers declare that the United Railroads will operate as a non-union road.

GENERAL ELECTRIC COMPANY ORGANIZES

At the annual meeting of the General Electric Company, held May 14, at Schenectady, N. Y., these directors were elected: Gordon Abbott, Oliver Ames, T. Jefferson Coolidge, Jr., Frederick P. Fish, George L. Gardner, Henry L. Higginson, Robert Treat Paine, 2d, all of Boston; C. L. Coffin, J. Pierpont Morgan, S. L. Schoonmaker, Charles Steele, all of New York; W. M. Crane, of Dalton, Mass.; Marsden J. Perry, of Providence, R. I.; J. P. Ord, of Albany, and E. W. Rice, Jr., of Schenectady.

On May 15, at the directors meeting in New York, the following officers were elected: C. A. Coffin, president; A. W. Burchard, assistant to the president; E. W. Rice, Hinsdill Parsons, B. E. Sunny, J. R. Lovejoy, vice-presidents; M. F. Westover, secretary; H. W. Darling, treasurer and assistant secretary; I. S. Keeler, second assistant secretary; H. P. Schuyler, assistant treasurer; Ed. Clark, general auditor; John Riley, assistant general auditor; S. L. Whitestone, assistant general auditor.

The duties of the various vice-presidents remain the same as before the election.

PHILADELPHIA & WESTERN SOLD

The Philadelphia & Western Railroad Company was sold at auction Monday, May 20, at Westchester, Pa., to Frank H. Brewster, of New York, for $1,000,000. Mr. Brewster, who was the only bidder, acted in the interest of William C. Sheldon & Company and Mackay & Company, of New York, who hold practically all of the stock and the entire $2,149,000 outstanding bonds of the company. The sale was conducted by the Trust Company of North America, a Philadelphia institution, which is the trustee of the $15,000,000 mortgage, and was a friendly proceeding.

"William C. Sheldon & Company and Mackay & Company will be the new syndicate managers," said Joseph S. Clark, general counsel of the company, "and will reorganize the company as soon as the legal formalities have been completed. This will require about three weeks. The new company will put out about $4,000,000 of bonds and bring the capital stock more on a parity with the bond issue than it is at the present time. George J. Kobusch, of St. Louis, while having disposed of the major portion of his holdings to the syndicate, will, however, retain a minority interest. The Philadelphia & Western will open for traffic on Wednesday."

CONSOLIDATION NEGOTIATIONS OF C. P. & E. AND NORTHERN OHIO TRACTION COMPANIES

Negotiations are under way for the consolidation of the Cleveland, Painesville & Eastern and the Northern Ohio Traction & Light Company, both owned by Henry A. Everett and E. W. Moore and their associates of Cleveland. The plan is to exchange the $2,000,000 common stock of the Cleveland, Painesville & Eastern for a like amount of the common stock of the Northern Ohio Traction & Light. The company has outstanding $1,631,000 bonds. Of these, $500,000 debentures bearing 6 per cent interest will be due July 1 of this year. The stockholders will probably take care of this by the purchase of a like amount of 5 per cent consolidated bonds which have been held in escrow for this purpose. This will reduce the interest expense of the company. The capital stock of the Northern Ohio Traction & Light Company is $10,000,000, of which $7,939,900 has been issued. The absorption will take up the greater part of this stock.

The Cleveland, Painesville & Eastern is made up of the Cleveland, Painesville & Eastern and the Cleveland, Painesville & Ashtabula. The latter is a comparatively new property and was taken over only a comparatively short time ago. The length of the two roads is 75 miles, which gives the Northern Ohio Traction & Light system a total of 285 miles of track. Willoughbeach Park is owned by the Cleveland, Painesville & Eastern. Originally it consisted of 100 acres of land, purchased at $500 an acre. Some time ago 20 acres were sold at $1,100 an acre and the remainder is valued at the same. The park proper takes up but 30 acres.

EARLY REPORTS OF THE AMERICAN STREET RAILWAY ASSOCIATION

Secretary Swenson, of the American Street and Interurban Railway Association, has collected and is now offering for sale bound sets of reports of the meetings of the American Street Railway Association from 1884 to date, as well as sets for a lower price with the first, second and third reports missing. Single copies of a number of the reports can also be secured from the secretary.

NEW STREET RAILWAY SYSTEM IN SAN FRANCISCO

A syndicate composed of New York and San Francisco capitalists is said to have been organized in San Francisco and will soon make an application to the Board of Supervisors of that city for a franchise for a system of electric street railways. In the syndicate are Leopold Michels, the Meyersteins and the Brandensteins, of San Francisco, and New York capitalists represented by Leopold Wallach.

Agents of the New York interests have been in San Francisco for several weeks and have completed a study of the streets and the engineering problems to be met in the construction of the proposed new system. Maps have been drawn and every detail said to be arranged. The syndicate lacks only the franchise to make its plans complete. The projected system contemplates a network of lines to cover the city from the ferry to the beach. Franchises for conduits in some places and for the overhead trolley in other streets will be sought. It is stated that a feature of the project calls for a subway. While the exact location of the proposed lines has not been announced, it is known that representatives of the syndicate have made a study of the grades from the ferry out Pine Street into the western addition and from the western addition along Franklin and Gough Streets into the Mission.

PROGRESS OF CONSTRUCTION OF MILWAUKEE NORTHERN RAILWAY

Such excellent progress has been made on the construction work of the Milwaukee Northern Railway, which will open up communication between the Eastern Wisconsin towns of Sheboygan, Port Washington, Fond du Lac, West Bend and numerous others in this populous district and Milwaukee, that the road will probably be ready for operation on at least one division by early summer. Except for short distances in the centers of some of the larger towns, the Milwaukee Northern roadbed is located on its own right of way, and in almost a straight line. There is but one curve on the line between Port Washington and Grafton, and that is one of only 2 degrees. For the rest of the distance almost without variation, except where the road crosses the tracks of the C., M. & St. P. and the C. & N. W. Railroads, the right of way follows a straight line. The absence of grade crossings is a feature which will insure safety from accident and permit a high-speed schedule. Where the road crosses twice, both the Northwestern and St. Paul tracks, subways of steel bridging and masonry abutments or viaducts are used. Just south of the depot at Port Washington the line runs under the Northwestern tracks, and again about a mile and a half outside the Milwaukee city limits. At Grafton the line passes over a steel viaduct 765 ft. long over the St. Paul tracks, and again over a viaduct of similar construction 454 ft. long at Mequon.

The complete power equipment was purchased from the Allis-Chalmers Company, of Milwaukee, and is of standard Allis-Chalmers design, both for gas engines and alternators. The electrical features of the equipment may be briefly described as follows: Three-phase alternating current will be generated in the power house at 405 volts by three direct-connected alternators, each of 1000-kw normal capacity, driven at 107 r. p. m. by Allis-Chalmers twin tandem gas engines, each with a rated capacity of 1500 hp. This equipment, when in operation, will enjoy the distinction of being the largest installation in America of gas-engine driven electric generating units for traction purposes. The main power house is located at Port Washington, and sites for sub-stations have been provided at the following points: Burleigh, Cedarburg, Georgia Avenue, Marblehead, Brown Deer, Cedar Grove, West Bend and Campbellsport.

WORKING MODEL OF NEW MONO-RAIL SHOWN TO ENGLISH ENGINEERS

Descriptions are contained in the English technical press of the new mono-rail system invented by Louis Brennan, C. B., of which a working model was exhibited at the meeting of the Royal Society in London on Wednesday, May 8, and about which sensational stories were published in the daily press here as a result of cable dispatches purporting to describe the system. The editor of "The Engineer," of London, at the invitation of Mr. Brennan, recently visited his house at Gillingham to witness some trials there of a model line, which he thus describes in his own paper:

"Briefly stated, the model mono-railway may be said to consist of a circular section rail laid on wooden sleepers on the ground, or it may be laid on piles, as would be required on the slope of a steep hill. In places the track consists only of a stout steel rope tightly stretched to represent the construction of a bridge across a ravine. The car somewhat resembles in shape a large pontoon or barge. Part of the inside is arranged for passenger accommodation and part for goods. The car is carried on two bogies, one at each end. These bogies are so pivoted that they allowed the car to turn easily on curves, and also vertical movement. By this means it is claimed that the vehicle can run upon curves of even less radius than the length of the vehicle itself, or on crooked rails, or on rails laid on uneven ground, without any fear of derailment.

"Each pair of wheels is coupled, and one in each set is driven direct through gearing from electric motors carried on the bogies. The power for propulsion is derived from a number of small secondary cells placed inside the car. But by far the most interesting part of the carriage is the means adopted for maintaining equilibrium, for it must be at once apparent that the center of gravity of the car is much higher than the center of buoyancy, and consequently it is an unstable body. To overcome this Mr. Brennan has introduced two gyroscopes, mounted on bearings, which run in a partial vacuum. These gyroscopes work in a vertical plane and run in opposite directions; they are connected together by suitable gearing so that their peripheral velocities are equal. This arrangement overcomes the difficulty which would be experienced in turning were they not so constructed. Special means are provided for advancing the precession of the gyroscopes and thereby causing them more quickly to return to the horizontal plane. The gyroscopes were motor-driven and ran at a speed of from 7000 to 8000 revolutions. This mechanism occupies little space, and it was stated that in larger cars it will only be about 5 per cent the total weight of the vehicle.

"The model was built essentially to illustrate the value of the invention for military use, and was therefore designed with a low speed—about 7 m. p. r.—but with good hill-climing capabilities. The trials, which lasted for some time, were successfully carried through. The car was loaded with weights representing 20 tons, and, in order to prove its stability, a weight corresponding to that of fifteen men was thrown suddenly on to the side of the car, and the side of the car on which the weight was thrown gradually rose to restore the position of equilibrium. To show how well the car could turn, an ordinary steel rope, about ⅝ in. in diameter, was laid on the lawn, and round the many turns specially arranged for the purpose the little car wended its way very gracefully. It appeared to experience no difficulty in climbing gradients of 1 in 5, and on one occasion the bank was said to be 1 in 2½; however, this was shot, and the car had a "rush" at it. But, loaded as it was, the climb up 1 in 5 was an excellent performance for so small a car. At the conclusion of the trials one gentleman, weighing nearly 10 stone, was given a ride round the minature track, and he finally crossed the wire bridge, which had a somewhat considerable span. That so small a car could take the weight it did and run so well shows that, whatever be the future of this type of mono-rail, there can be no question as to its success on the small line we had the pleasure of inspecting."

Mr. Brennan is at present engaged upon the construction of a full-sized vehicle, 12 ft. in length, similar to the model just described. It will, however, be driven by a petrol engine of 100 hp direct coupled to a motor. The gyroscope will be 2 ft. 9 ins. diameter, and will have a speed of from 2000 to 3000 revolutions per minute. The road wheels will be power driven, and change gears provided to facilitate hill climbing.

THE BINGHAMTON STRIKE PETERS OUT

The strike of the employees of the Binghamton Railway Company, of Binghamton, N. Y., has completely petered out. The regular schedule of cars is in operation, and the few men who went out are now seeking to be reinstated. Of the 150 platform employees in the service of the company on Friday, April 26, when the strike was declared, only fifty failed to report for duty. Briefly, on Wednesday, April 24, the management of the company learned that an organizer was in the city for the purpose of unionizing the employees, and subsequently was appraised of meetings held that night and the following day. As a result of these meetings a committee composed of three employees of the Binghamton Railway Company, and one Fitzgerald, of either Albany or Troy, as spokesman, called upon the company Friday morning, April 26. As the company refused to treat with the men with outsiders present, the committee withdrew, and at 5 p. m., as before mentioned, the strike was declared. Employees not affiliated with the union were afraid to take out the cars and their fears seemed not to be groundless, in view of the fact that the attempt to maintain service during the evening was followed by considerable disorder. The company, however, immediately engaged new help and with the assistance of the men who did not go out resumed a full schedule of cars within a very few days and now has all its cars in regular operation both day and night. Despite a general boycott in force throughout the city, conditions are improving daily and travel is fast regaining its normal condition. For the first ten days, however, the company did not operate cars after dark, and when strikers and their sympathizers became violent upon any division, cars were withdrawn from that particular line. The contention upon the part of the union has narrowed itself down to recognition, the questions of wages and hours having been waived.

SEMI-ANNUAL A. S. M. E. MEETING

At the semi-annual meeting of the American Society of Mechanical Engineers, to be held in Indianapolis, May 28 to 31, a wide range of subjects will be taken up and discussed. Accommodations for transportation and Pullman car service can be arranged for by addressing the secretary of the society. One of the professional sessions devoted to superheated steam will be held at Purdue University, and an opportunity will be given the guests after the session of going over the university. On Wednesday afternoon, May 29, a visit will be made in special cars to the Atlas Engine Works and the National Motor Vehicle Company. Another excursion on the same afternoon has been arranged for the D. N. Perry Manufacturing Company and to Nordyke & Norman Company.

MICHIGAN UNITED RAILWAYS ARRANGES TO TAKE OVER ADDITIONAL LINES

The Michigan United Railways, of Lansing, Mich., which operates 155 miles of electric railways in Kalamazoo, Battle Creek and Lansing, and connecting Lansing, St. Johns, Jackson, Battle Creek and Kalamazoo, has arranged to acquire, through W. N. Coler & Company, at a cost, it is understood, of about $1,250,000, practically the entire capital stock of the Jackson Consolidated Traction Company, including the holdings of W. A. Boland, and will purchase the minority shares on the same basis. The Jackson company owns and operates 30 miles of track in Jackson and vicinity, including interurban lines to Grass Lake, Wolf Lake, Michigan Center and Vandercook, and has outstanding $1,000,000 capital stock and $712,000 of an issue of $1,000,000 first mortgage 5 per cent bonds, due May 1, 1934. The two companies are to be merged under the name of Michigan United Railways.

PENNSYLVANIA LEGISLATURE ADJOURNS

The last few days of the legislative session at Harrisburg there developed some feeling between the Senate and House over the smothering in Senate committee of several bills in which Speaker McClain and his friends in the House were interested, and the House left "outside the breastworks" 64 Senate bills. One of the bills killed in the Senate was that permitting cities of the third-class to tax the real estate of electric and steam railways and other public service corporations. The Senate passed the Fahey trolley bill, companion measure for the bill drafted to carry out the provisions of the merchants' plan for rapid transit in Philadelphia. This bill had been defeated, but a motion was made by Senator Tustin, of Philadelphia, seconded by Senator Quail, of Schuylkill, both of whom had voted against the bill when it was up before, to reconsider the vote by which the bill failed on final passage. This motion was carried, after which the bill went through the Senate on its way to the Governor. This is the bill which prohibits the granting of charters to any street railway company until it shall first have obtained rights of way and the franchises from local authorities to construct the road.

The House bill fixing 5 cents as the maximum fare which can be charged by electric railway companies in cities of the second class passed the Senate, but the bill requiring electric railway companies to equip their cars with vestibules failed.

The Senate also passed the bill authorizing street railways to divert their routes and tracks. One of the Senate bills which fell in the House was the Brown bill, authorizing street railway and motor power companies to enter into contracts for the sale of electric power.

The Senate passed the House bill authorizing street railway companies to issue bonds for a longer period than thirty years.

The giving to electric railway companies of the right of eminent domain and the privilege of carrying freight, noted last week, are the most favorable measures that were enacted.

UNION ELECTRIC COMPANY AND GENERAL RAILWAY SUPPLY COMPANY CONSOLIDATE

The Union Electric Company and the General Railway Supply Company, both of Pittsburg, have consolidated, and the combined organizations will be operated under the name of the Union Electric Company, with a capital stock of $250,000. The Union Electric Company was organized in 1905 and the General Railway Supply Company in 1896. The offices and warehouses of both concerns are now located at No. 31 Pittsburg Terminal Warehouses. The new company will continue the sale of lighting, railway, power, telephone and marine supplies, and will also continue the agencies carried by the General Railway Supply Company, namely, R. D. Nuttal Company, gears, pinions and trolleys; International Register products; G. E. line material and rail-bonds; Crouse-Hinds arc headlights; Locke high-tension insulators and Wilson trolley clutches, also motor and controller parts for Westinghouse and General Electric apparatus. The officers of the new company are: George W. Provost, president; Percy R. Frost, vice-president and manager of the lighting department; J. P. Provost, treasurer; L. H. Keller, secretary. Thomas M. Cluley has been appointed manager of the railway department.

INDUSTRIAL ENGINEERING & SUPPLY COMPANY ORGANIZED

The Industrial Engineering & Supply Company, S. A., of Mexico City, has recently been organized by a number of prominent business and financial men who have a large acquaintance with the requirements of Mexican trade, to do a general machinery and supply business, and has acquired the four-story building at Alcanceria No. 27, where it will carry a large portion of its stock of goods and where it will make its general headquarters. The president of the company is W. W. Wheatly, formerly president and general manager of the Mexico City Tramway Company, who is also prominently identified with other important business and banking interests in Mexico City and Guadalajara. The general manager is James A. Peirce, who was formerly general superintendent of the Mexico Tramway Company, and who, at one time, was with Rossiter, McGovern & Company, of New York. The general sales agent, William C. Benbow, has been in Mexico many years engaged in selling mining, milling and manufacturing machinery and electric supplies, and is well known in these lines of trade throughout the country. The branch office of the Wellman-Seaver-Morgan Company has been moved from its former location at Second Dolores 10 to Alcaiceria 27, and W. C. Benbow will hereafter act as sales manager for both the Wellman-Seaver-Morgan Company and Industrial Engineering & Supply Company, S. A.

STREET RAILWAY PATENTS

[This department is conducted by Rosenbaum & Stockbridge, patent attorneys, 41 Park Row, New York.]

UNITED STATES PATENTS ISSUED MAY 7, 1907

852,468. Motor Controller; Emmett W. Stull, Norwood, Ohio. App. filed July 30, 1906. The controller is provided with a plurality of drums with segments geared together and arranged so that the "full on" position of the controller may correspond to different speeds for city and suburban traffic.

852,525. Fluid Pressure Brake; William H. Sauvage, New York, N. Y. App. filed Nov. 21, 1906. Consists of the combination with the usual cylinder, piston and brake rigging, of a second cylinder and piston, a pipe extending from a port in the side wall of the first cylinder to a port in the pressure head of the second cylinder, a gripping device connecting the second piston with the brake rigging when the said piston is forced outward and means for releasing the gripping device when the second piston completes its return stroke.

852,628. Automatic Electrical Train Stop; Hiram G. Sedgwick, Mill Valley, Cal. App. filed Nov. 24, 1905. An automatic train stop for use with railroad crossings. Circuits are adapted to set the train stops on one track when trains approach in either direction on the other track.

852,629. Electrical Switch Lock for Railways; Hiram G. Sedgwick, Mill Valley, Cal. App. filed Nov. 24, 1905. Means whereby an approaching train will lock the switch automatically and release the same when the train has passed.

852,630. Railway Signal; Hiram G. Sedgwick, Mill Valley, Cal. App. filed Nov. 24, 1905. Relates to modifications of the above.

852,633. Train Stopping Apparatus; Hiram G. Sedgwick, Mill Valley, Cal. App. filed June 14, 1906. A block system in which sectional track rails are energized by direct potential, and operating rails set the semaphores when they are short-circuited by the axles of a passing train.

852,634. Electrical Train Stop; Hiram G. Sedgwick, Mill Valley, Cal. App. filed June 14, 1906. Relates to modifications of the above.

852,635. Automatic Electrical Train Stop; Hiram G. Sedgwick, Mill Valley, Cal. App. filed Jan. 2, 1907. Contact brushes on the locomotive complete circuits to the air brake apparatus so as to automatically stop the engine in case signals are disregarded.

852,767. Convertible Car; John A. Brill, Philadelphia, Pa. App. filed Nov. 20, 1906. The car has stanchions and movable side panels beyond the floor limits, and a filler for the space between the panel and floor, said filler being hinged to said panel.

852,768. Convertible Car; John A. Brill, Philadelphia, Pa. App. filed Nov. 20, 1906. A filler for closing the space between the panel and floor, consisting of a sliding plate, and projections on the opposing faces of the stanchions for supporting the plate, the car being provided with a horizontal recess below the surface of the floor for receiving the filler.

852,774. Car; Samuel M. Curwen, Haverford, Pa. App. filed Nov. 26, 1906. Means for facilitating the removal of the windows and the storing of the same in roof pockets.

852,782. Convertible Car; Harry E. Haddock, Collinwood, Ohio. App. filed July 7, 1906. A filler for the space under the windows between stanchions comprising a longitudinal plate having depending tongues which are provided with elongated slats and bolts securing the tongues to the stanchions through the slots.

852,808. Metallic Car; Warren M. Smith, Borough of Prospect Park, Pa. App. filed Sept. 17, 1906. Relates to detail of construction of a metallic "semi-convertible" car.

852,816. Car; Charles W. Benjamin, New York, N. Y. App filed Dec. 31, 1906. A "semi-convertible" car providing one sash with a pivot and holding flanges for the other sash so that when the sashes are moved abreast they may be swung together into chambers provided for them, or, vice-versa, they may be swung out of the chambers and into proper grooves to close the windows.

852,849. Fare Register; Adolph O. Schmolinski, St. Louis, Mo. App. filed May 31, 1906. A fare register so constructed that the inspector can impress or print his number or designating mark on a strip of paper arranged inside of the register and thereafter cause the register to become operative by inserting an operating handle therein.

852,851. Motor Controlling Rheostat; Frank J. Seabolt, Schenectady, N. Y. App. filed Jan. 14, 1907. A supporter for electric motors having two separate series of resistance contacts. Provides means whereby one resistance is short-circuited while the other is being varied.

852,912. Car; Warren M. Smith, Prospect Park, Pa. App. filed Sept. 15, 1906. Relates to means for fastening the window sashes in the roof of the car.

852,927. Rail Clip; Charles F. Clawson, Mount Pleasant, Iowa. App. filed Oct. 26, 1906. Comprises an integral bent steel member having apertured sides terminating in jaws adapted to grip the rail base, and a bolt passed through the apertures of said sides to draw the latter together. The clip abuts against the side of the tie.

852,933. Automatic Brake Hanger; Samuel M. Curwen, Philadelphia, Pa. App. filed March 19, 1906. Means for preventing "chattering" of the hanger.

852,969. Trolley Circuit Former; Gerald R. Livergood, St. Joseph, Mo. App. filed Jan. 29, 1906. A lever on the trolley pole is displaced by levers arranged adjacent the trolley wire so as to close the circuit for a sign actuator in the car.

852,978. Trolley; Alfred J. Reif, Allegheny, and Albert L. McCormick, Knoxville, Pa. App. filed June 2, 1906. Clips mounted on the trolley harp and adapted to close over the wire are normally held closed by a spring, but yield when hangers are engaged.

853,126. Rail-Spread-Indicating Device; Joseph A. Shires, Denver, Col. App. filed Oct. 31, 1906. A beam supported beneath the car has a pair of pins depending just outside the track rails. In case of spreading of the rails the pins are pushed outwardly to thereby close an alarm circuit on the beam which is telescoping.

853,135. Combined Railway Cattle Guard and Metallic Cross-Tie; Christopher Switzer and Frederick Sundman, Doe Run, Mo. App. filed Feb. 28, 1907. Details.

853,188. Automatic Curtain Hook and Release for Vestibule Cars; Clyde McCoy and William Morton, Los Angeles, Cal. App. filed April 4, 1906. Provides a bracket adapted to be fastened to abutting ends of cars for automatically releasing one of the ends of the vestibule curtains when cars are uncoupled or separated from each other.

PERSONAL MENTION

MR. JOHN H. DONNELLY, formerly master mechanic of the Toronto Railway Company, is dead.

MR. GEORGE FLETT, managing director of Dick, Kerr & Company, of London, is in New York on a short trip.

MR. F. L. REED, treasurer of the Shelburne Falls & Colrain Street Railway Company, has been elected manager of the company to succeed Mr. E. V. Maling, resigned.

MR. A. E. REYNOLDS, of Crawfordsville, Ind., has been elected president of the Indianapolis, Crawfordsville & Western Traction Company, to succeed the late Mr. A. F. Ramsey.

MR. WILLIAM S. HURLEY, of Brooklyn, N. Y., has been appointed a member of the New York Rapid Transit Commission in the place of Mr. Lewis Cass Ledyard, resigned.

MR. F. A. BAILEY, of the Columbus Railway & Light Company, of Columbus, Ohio, has been appointed superintendent of the Camden lines of the Public Service Corporation of New Jersey.

MR. FRANK SHORTON has been appointed superintendent of the Evansville & Eastern Traction Company, of Evansville, Ind., which will be opened for service between Evansville and Rockport, June 1.

MR. EVERETT F. KYLE has resigned as superintendent of the street railway department of the local division of the Consolidated Railway Company, at Norwalk, Conn., to become superintendent of the Sterling Salt Company's plant at Cuylersville, N. Y.

MR. ROBERT O'BRIEN, formerly in charge of the Claiborne street line of the New Orleans Railway & Light Company as superintendent, has been appointed to the position of division superintendent of the company with headquarters at the Arabella car house.

MR. R. N. BARROWS, formerly purchasing agent of the Washington Railway & Electric Company, and manager and purchasing agent of the Robertson Electric Company, of Buffalo, has recently been appointed Southern sales agent of the

Atha Steel Casting Company, of Newark, N. J., with office in Richmond, Va.

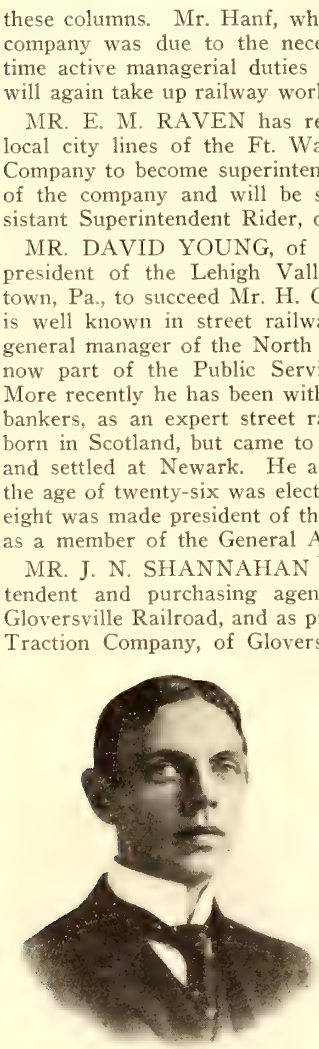
MR. JOHN HANF has tendered his resignation as master mechanic of the International Railway Company, to take effect June 15, 1907, or as soon thereafter as his successor can be familiarized with the company's system. Mr. Hanf was formerly connected with the Philadelphia Rapid Transit Company, the Hestonville, Mantua & Fairmont Park Railway, the J. G. Brill Company and the Wilmington City Railway Company. He has been connected with the International Railway Company since Jan. 18, 1900, and a number of important improvements to the company's property have been carried out under his supervision, the most notable work probably being the rebuilding of the Cold Spring shops, described some time since in these columns. Mr. Hanf, whose resignation from the Buffalo company was due to the necessity of his relinquishing for a time active managerial duties so as to fully recover his health, will again take up railway work after a short rest.

J. HANF

MR. E. M. RAVEN has resigned as superintendent of the local city lines of the Ft. Wayne & Wabash Valley Traction Company to become superintendent of the Ft. Wayne city lines of the company and will be succeeded at Logansport by Assistant Superintendent Rider, of the Ft. Wayne city lines.

MR. DAVID YOUNG, of Newark, N. J., has been elected president of the Lehigh Valley Transit Company, of Allentown, Pa., to succeed Mr. H. C. Trexler, resigned. Mr. Young is well known in street railway circles, having formerly been general manager of the North Jersey Street Railway Company, now part of the Public Service Corporation of New Jersey. More recently he has been with Brown Brothers, of New York, bankers, as an expert street railway adviser. Mr. Young was born in Scotland, but came to this country when a young man and settled at Newark. He at once entered public life and at the age of twenty-six was elected to the Council, and at twenty-eight was made president of that body. Subsequently he served as a member of the General Assembly of the Legislature.

MR. J. N. SHANNAHAN has resigned as general superintendent and purchasing agent of the Fonda, Johnstown & Gloversville Railroad, and as president of the Adirondack Lakes Traction Company, of Gloversville, N. Y., to become general manager of the Washington, Baltimore & Annapolis Railway, now under construction between the cities mentioned in its title and soon to be placed in partial operation. Mr. Shannahan was graduated from Rensselaer Polytechnic Institute in 1894. Entering the employ of the Government he worked for nine months as a draughtsman at the Watervliet Arsenal. This position he resigned to enter the service of the New York Central Railroad at Rochester, N. Y., as inspector of signals. After several years service with this company he became connected with the Fonda, Johnstown & Gloversville Railroad as chief engineer. This was in 1899 and just about the time the Fonda, Johnstown & Gloversville Railroad was being partially equipped for electric operation. In this way during the next four years Mr. Shannahan had charge of building the double-track electric line between Gloversville and Schenectady, and the single-track line between Amsterdam and Hegeman. Jan. 1, 1903, Mr. Shannahan was made general superintendent of the company, in charge of both steam and electric operation and at the same time was elected manager of the Edison Electric Light & Power Company, of Amsterdam. Early in 1904 he was elected president of the Adirondack Company. For several years Mr. Shannahan has taken an active interest in the affairs of the New York State Street Railway Association, of which body he is at the present time the president, having been elected to that office in June, 1906. Mr. Shannahan also is an associate member of the American Society of Civil Engineers and during 1905 and 1906 served as president of the Rensselear Society of Engineers. He will be succeeded in the Fonda, Johnstown & Gloversville Railroad by Mr. W. H. Collins, master mechanic of the company.



J. N. SHANNAHAN

MR. A. C. MURRAY has been appointed assistant general superintendent of the Southern division of the Illinois Traction Company, with headquarters at Staunton, Ill. Mr. Murray was formerly assistant to General Manager Fisher, of the Illinois Company. At one time Mr. Murray was purchasing agent and assistant general manager of the Indiana Union Traction Company.

MR. JOSEPH BUDREAU has resigned as superintendent of construction of the Consolidated Railway Company's lines at Hartford, Conn., to become superintendent of construction of the Scranton Railway Company, of Scranton, Pa. Mr. Budreau was connected with the Hartford Company thirteen years and supervised the work of installing electricity on a number of lines in that city. At Scranton Mr. Budreau will be associated with Mr. Frank Caum, the general manager of the Scranton Company, who formerly was connected with the Hartford company.

THE IMPROVED CONDITIONS brought about in Pennsylvania through the passage by the Legislature of the electric railway bills referred to in the last issue of this paper will undoubtedly result in increasing prosperity for both the country residents and the railway companies of that State. The credit for this reform belongs in large part to the educational campaign conducted by the Temporary Street Railway Association of the State of Pennsylvania in collecting statistics from other States to show the value of interurban roads to the country resident, and draws attention to this organization and its president, Mr. W. E. Harrington. Mr. Harrington is a native of Pennsylvania, having been born in Wilkesbarre in 1866. He was graduated in 1887 with the degree of B. S. from the University of Pennsylvania, where he was the holder of a scholarship awarded by the City of Philadelphia and won by him in competitive examination. Since his entry into the electric railway business he has made a successful record as a street railway operator and engineer. For the eight years ending in 1904 he was general manager and vice-president of the Camden & Suburban Railway Company. After the lease of this company to the Public Service Corporation of New Jersey, Mr. Harrington occupied, for a short time, the position of manager of the New York-Philadelphia Railway and its allied properties, but in July, 1905, accepted the position of operating manager of the electric railway, lighting and gas properties of J. G. White & Company, of New York. In this capacity he was called upon to develop the properties of the Eastern Pennsylvania Railways Company, which owns the gas, electric lighting and railway interests centering at Pottsville, Pa. He is now president of the Pottsville Union Traction Company, the Edison Electric Illuminating Company, of Pottsville and Tamaqua, the Minersville Electric Lighting Company, the Citizen's Gas Light Company, of Tamaqua, and some twelve subsidiary companies. In 1904-05 Mr. Harrington was a member of the executive committee of the American Street Railway Association and has served for a number of years on the standing rules committee and the committee on the promotion of traffic of that body and its successor, the American Street and Interurban Railway Association. He was largely instrumental in the organization of the Temporary Street Railway Association of Pennsylvania and made a number of addresses at Harrisburg before legislative committees on the four electric railway reform measures which have just passed the Legislature. These bills grant, among other privileges, the right of eminent domain and the right of electric railway companies to carry light freight.

W. E. HARRINGTON

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DATE ON WRAPPER shows the month at the end of which the subscription expires. The sending of remittances for renewal prior to that date will be much appreciated by the publishers.

NOTICE TO ADVERTISERS

Changes of advertising copy should reach this office by 10 a. m. Monday preceding the date of publication, except the first issue of the month, for which changes of copy should be received two weeks prior to publication date. New advertisements for any issue will be accepted up to noon of Tuesday for the paper dated the following Saturday.

Of this issue of the Street Railway Journal, 8300 *copies are printed. Total circulation for* 1907 *to date,* 180,050 *copies, an average of* 8184 *copies per week.*

The Development of New Shop Methods

The mechanic with ideas is always desired in a street railway repair shop, and it is probable there is no place which offers to the ingenious man a better opportunity to devise new and more economical methods of getting out work. But it is possible for a man to have too many ideas and not enough practical foresight, with the result that he may cause the loss of considerable time and money by experiments, which in the end prove failures. While successes are usually appreciated by the management of a railway company, it must always be remembered that in the minds of many one failure will be recorded against a man with more weight than can be offset by several successes. This may not be the proper attitude to take, but it is nevertheless that of many persons. A master mechanic with original ideas will often find it advantageous, therefore, to go slowly in introducing new practices in the shops of which he is in charge. He should weigh the amount of time and money that any improvement will cost and strike a balance between that amount and the saving if the invention proves successful, then get the necessary apparatus in working order with the least expense possible. After the device has shown what it will do and what it can be made to do with a further expenditure of money, its development to its final state and the expenditure of more money may be considered. It is a good thing to nurse an idea for some time before actual work on the apparatus necessary to carry it out is begun. When one carries such a thought in his mind for some time before working it out he will often be able to improve upon his original plan through some suggestion he may hear or run across in print that relates to his scheme. These chance remarks or bits of reading matter may help develop the idea, or they may possibly lead to the conclusion that it is impracticable. Thoughts are changed at less expense than an already constructed piece of apparatus, and it is, consequently, best to get them in very definite shape before any work entailing expense is begun.

The habit of weighing ideas well not only gives more assurance that the impracticable ones will be screened out before they have occasioned any expense, but it prevents one from having too many in hand at one time. There are so many processess about car repairing which can be improved that one is likely to begin too many at one time, and, consequently, will not be able to give any of them the attention it deserves. It is not the intention of these remarks to dampen the ardor of those who are not satisfied with out-of-date methods of doing things. Improvement would otherwise be impossible. But if some of those about car shops with more energy than the average would expend the greater portion of this force in thinking out ideas rather than pushing the construction of apparatus embodying them, fewer disheartening failures would result and possibly more progress would be made.

Abusing the Steam Boiler

The steam boiler is fundamentally the most important piece of apparatus in the majority of street railway power plants, and the increased attention now being given to economical methods of combustion is one of the most gratifying signs of the times. In the zeal which obtains to secure low fuel consumption, however, there is no little danger that boilers will suffer from the lack of proper care. Correct firing is the first essential of good boiler management, but there are

other points which ought not to be overlooked in the severe conditions of railway service. It is a question if there is any other piece of machinery which suffers from abuse as quickly as a steam boiler, or which returns such moderate maintenance charges for good treatment.

In street railway plants sudden increases in the load often call for more steam than is momentarily available, and the natural tendency is to rush cold boilers into service by starting a fierce fire on the grates. Unless the fire is permitted to come up gradually, so that all parts of the boiler and its setting may expand evenly, severe strains and injury to the metal are a probable result. The cost of fuel for keeping the fires banked in all extra boilers required for the peak-load is a small matter in consideration of the shortened life and dangers of excessive firing. It would scarcely seem necessary to point out the wisdom of lighting the fires two or three hours before the rush traffic comes on, so that the benefits of gradual heating may be had, if it was not for the practice often encountered of pushing the furnaces too hard at first. The street railway plant has much to learn from the battleship and the ocean liner in this respect.

The frequency with which a boiler should be cleaned depends upon the amount of water which is being evaporated and the quality of the feed-water supply. A chemical analysis of the feed-water and also one of its steam, condensed, should be made certainly once a year, for the purpose of getting a line upon the best methods of preventing scale formation. The analysis of the water is, if anything, more important than the determination of the calorific power of the fuel used. Measurements of the temperatures at water and steam inlets and outlets of feed-water heaters, and, if possible, meter readings of the volume of water passing through the heater in a given time, are useful supplements to the work of the chemist. In cleaning boilers with a hammer and chisel to remove the scale on the plates above the fire and around the stays and braces considerable damage is often done by careless cutting into the metal. An ample supply of light is vitally necessary, yet few boiler rooms are equipped with special plug sockets of sufficient capacity to enable a dozen 16-cp lamps to be used inside the boiler in such work. Another cause of burned sheets is the leaving of a tool or piece of oily waste inside the boiler after cleaning out.

When boilers are being rapidly cut into service there is generally a temptation to open the stop valves too quickly, with the result that the piping water-hammers on account of excessive expansion. Priming frequently occurs at such times with its possibilities of damaging the engines. Boilers operated in multiple should be equalized within at least 2 lbs. per square inch to prevent an excessive rush of steam from one boiler to the other. Anything which causes a sudden fluctuation of the water level is liable to result in excessive pressure and strain. The maintenance of a constant water level within close limits is probably the most important point to attain in the entire range of boiler practice.

Question of Rails

The present time, in which every rail is being taxed to its utmost capacity to carry the equipment which is placed on the track, is not a suitable one in which to quarrel with the product, nevertheless since experience in rails is but slowly gained, it is worth while to begin investigations now for use later on. Every superintendent knows that the rail question is getting more and more serious as traffic grows denser, cars grow heavier, and speeds increase. The general tendency is, of course, toward heavier, and especially deeper, sections and considerably increased hardness. The very deep girder is essentially a tramway rail and must be judged by tramway conditions, while in interurban service the rails are usually standard railroad sections laid on standard roadbed. Now the steam railroads of the country have been gradually finding out that in getting rails specially well fitted to resist the wear of heavy traffic, they have incurred a considerably increased risk of breakage, whether from changed composition or from change of physical structure due to the different proportions of the rails. The facts are brought out plainly in a recent report of the New York State Railroad Commission, as well as in a paper presented on rails at the last meeting of the American Railway Association. So far the troubles have been confined largely to steam railroad service; at all events, no serious complaints about breakages have been made public by the electric railway companies. But it is yet an unsolved problem to which we would earnestly direct the attention of our readers to determine the relation between high-speed electric railway service and heavy railroad service of the ordinary kind with respect to wear and strain on the rails. This much is clear, that for all kinds of service the light rails of twenty years ago have been replaced through dire necessity. There are, however, very few systematic data on the causes and nature of wear of rails on fast interurban lines. Something has been learned about urban conditions, and more is wanted.

The serious wear on the rails and special work of a subway or electric elevated line is naturally to be expected. The wear of the rail head surface into waves is a familiar phenomenon. On such lines, with very frequent trains, many driving wheels, and very frequent stopping and starting, all sorts of wear must be expected. It has not been properly determined, however, in how far sheer chemical hardness, so to speak, can be brought to resist such action without the risks that come from lack of homogeneity. In a general way, one may charge up the breakage of ordinary railroad rails to the bounding action of heavy locomotives, and electric roads are relatively free from it. A serious point to be determined is, how far one can follow purely railroad precedents to advantage in drawing rail specifications. It may well turn out that the relatively fast and light traffic of an interurban system is best met with a slightly different rail both in section and composition from that commonly used on railroads for traffic apparently of about the same magnitude. The life of a rail depends both on the rate at which metal is removed and the amount which can safely be spared, and it may turn out that in some cases sheer weight may have been overdone at the expense of intrinsic wearing properties. To determine this point a large amount of close observation and measurement of wear is necessary, hence these suggestions. Every one realizes that there is a considerable difference between the mechanical action of great weights at moderate speeds and moderate weights at great speed. That the strains un-

der the latter conditions are severe, the necessary reconstruction of the track during the Berlin-Zossen tests showed beyond a doubt. Temporary tests cannot show the results of continued strains, so that very little practical information as to the reaction between track and cars was gained, save with respect to the need of cars in adjusting the running balance of the trucks, a subject which had been hitherto neglected. As a preliminary to the heavy high-speed work soon to be attempted, a study, the more complete the better, of track for fast electric railway service is badly needed. The subject would be an excellent one for concurrent action among the interurban roads now so well organized, and an investigation would quite certainly be productive of much information of a high, practical value.

Electric Trunk Line Operation

Mr. Sprague's paper and the subsequent discussion, which we published last week, form a most interesting addition to the literature of a much mooted question. Mr. Sprague has a combination of varied experience and hard common sense that makes him always instructive, and there is, too, a spice about his remarks regarding alternating-current working and apparatus that gives a certain aroma to his discussion. Omitting details, the real broad necessity for successful operations on trunk line road is a voltage upon the working conductors very much greater than the customary 500 to 600 volts—at least ten times as great if possible, at all events as high as engineering skill permits. Until such high voltages are available heavy electric traction is a mere makeshift, conditioned upon local requirements. The character of the motors, provided they are capable of doing the required work economically and well, is altogether a secondary matter.

There are in existence four distinct schemes of working traction motors from high voltage conductors. These are: (1) the single-phase commutating system of the general type adopted by the New York, New Haven & Hartford Railroad; (2) the Ward-Leonard system, using synchronous converter, permutator, or the like, on the locomotive in conjunction with d. c. motors; (3) the three-phase system with induction motors; (4) a d. c. system either at 1200 or more volts, two-wire, or at twice as much in a self-balanced three-wire system. Until all these systems have really been properly threshed out, it is of little use to go into too great detail as to the theoretical advantages of each. At the present moment only one—the first—has been seriously considered in this country, and even this is nowhere yet actually running upon a scale sufficient to constitute a fair basis for judgment in connection with heavy traction. We had hoped long ere this to see the New Haven work carried out on a large scale as a valuable example, but many months of preparation have gone by without even an approximation, so far as published data are concerned, to practical results. On the other hand, all four systems have been tried practically on the Continent, and sufficiently good results have been obtained from each to show that each has serious claims for further consideration. In view of this, it is plain that any snap-judgment on the subject is unwise. Hence we heartily agree with Mr. Sprague that high-voltage d. c. motors are worthy of thorough trial, and that any attempt at the present time to settle upon single-phase a. c. motors as a finality is decidedly premature. This fact was indicated by the favorable testimony at the meeting in regard to the commutation both of the untried high-voltage d. c. motor and also of a new single-phase motor, showing that the possibilities of each are not yet definitely determined.

Mr. Sprague devotes his attention chiefly to a comparison between commutating a. c. motors and high-voltage d. c. motors. Since experimental data upon both of these are conspicuous by their absence, the discussion of their relative advantages is for the present chiefly academic in character. There are certain obvious objections to the former type, alleged by those most familiar with it to have little practical weight. On the other hand, there are no sufficient data on the type of d. c. motor advocated by Mr. Sprague to enable a fair opinion to be formed regarding it. It looks promising, albeit, as Mr. Stillwell showed in the discussion, comparisons of weight and efficiency made on theoretical grounds are not altogether trustworthy. When it comes to general railway work involving heavy freight haulage, small differences in weight of the locomotive will not count for much and the practical advantage may even rest with the heavier machine. And in freight haulage there are conditions so entirely different from those met in the electric traction hitherto attempted as possibly to invalidate all present conclusions. Certainly until much experience has been gained with high-voltage d. c. motors their capabilities in large-scale work will remain rather a matter of guesswork, like those of the commutating a. c. motor. And the three-phase system or the converter system may finally prove to be superior to either of the others.

Whatever system shall finally be decided upon as preferable for heavy electric traction, the chances seem to us to favor a voltage on the working conductors too high for third-rail distribution. The questions of insulation, which cannot be neglected even at 500 volts, become much more serious at 2000 or 2500 volts. When properly protected and insulated for such conditions, a third rail stands a good chance of being, to all intents and purposes, as costly, complex and troublesome as any overhead system would be. And voltages less than these are hardly to be taken seriously as a way out of the distribution difficulty which will always be uppermost in the electrification of trunk lines. From the work of Thury, it is clear that there has been far more fear of high-voltage d. c. machines than was justified by the facts. The motors of an electrical locomotive for trunk line service can operate under much more favorable conditions than those of a street car, and it does not seem impossible that single motors of 250 or 300 hp for use on 2000 to 2500 volts may be successfully developed, allowing the use of double these voltages in a self-contained, three-wire system. A really high voltage d. c. system with low distribution losses, coupled with the well-known good points of d. c. motors, is not to be sniffed at even by the most hardened advocate of a. c. working. Just now this country has little to show along this line. It is a subject upon which we sorely need light, as well as upon the practical working of large a. c. motors.

THE SYSTEM OF FIRE PROTECTION AT THE PLANK ROAD SHOPS OF THE PUBLIC SERVICE CORPORATION OF NEW JERSEY

BY MARTIN SCHREIBER, M. E.

Probably no equipment subject is more important to railway managements than the fire protection of structures, for while it would be an easy matter to design a building ideal in fulfilling the fire underwriters' requirements, the railway company, unfortunately, is compelled to operate with the means at hand in the most economical manner, to secure even ordinary returns on the investment. Insurance inspection departments frequently offer suggestions that if carried out would interfere with operation. However, there is a point of compromise at which it is feasible to get maximum protection without inconvenience and for minimum expenditure.

In this article the writer will describe how the management of the Public Service Corporation has attempted to attain the happy mean in the fire protection system installed for the Plank Roads shops at Newark. The subject of fire protection was mentioned in the former descriptions of this particular property which appeared in the STREET RAILWAY JOURNAL of July 22 and Sept. 2, 1905, and reference may be made to them to understand fully the general layout of and operating conditions at this particular location. However, the plan shown in Fig. 1 is sufficient to give a clear idea of the relative location of the structures comprising the layout. As effective fire protection depends on other factors besides fire-fighting apparatus, it should be of interest to describe briefly the practice of the company with regard to handling and storing manufactured material and some features of the construction. The shops are of single-story type with concrete floors. The large swinging doors open outward, while the small doors are of the fire underwriters' sliding type with fusible link and chain. Where more than two cars are stored on a single track, as in the paint shop, there is, beside the transfer table, a special-work exit from the building to permit the rapid removal of cars. The paint shop, paint storage, carpenter shop, machine shop, storage house, boiler house, oil house and dry kiln are all separate buildings.

Since the paint department is a very important risk, every pains was taken to reduce the fire risk here to a minimum. Supplies such as oils, paints and varnishes must not be stored in the paint shop under any circumstances, a separate fireproof building being provided for that purpose. The inside view of the paint storehouse, shown in Fig. 3, gives an excellent idea of the orderly arrangement followed. All the material is in charge of one man who serves the men with the necessary amounts and takes care that all material not used in the course of the day is returned at night. This careful procedure makes the paint shop risk almost as low as that of an ordinary shop.

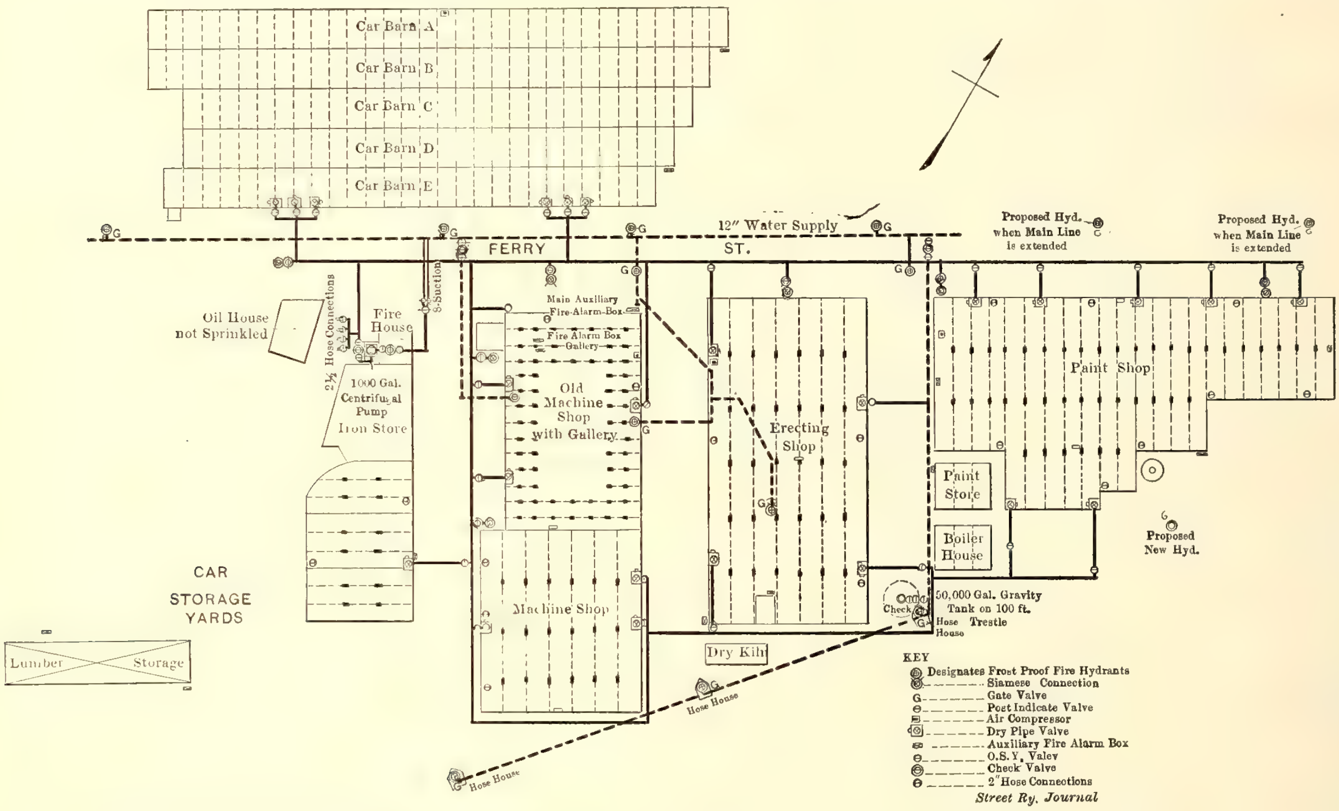


FIG. 1.—GENERAL LAYOUT OF THE PLANK ROAD SHOPS OF THE PUBLIC SERVICE CORPORATION OF NEW JERSEY, WITH KEY TO FIRE-PROTECTION EQUIPMENT

The erecting shop, where all woodworking is carried on, and the mill room create considerable highly inflammable material. The shavings and dust are quickly taken care of by means of a Buffalo forge exhauster that pulls the debris through galvanized iron piping, depositing it in the boiler house. No raw material is stored in these shops, the necessity for this being avoided by a separate building for lumber drying and isolated lumber storage.

Lubricants and oily waste are stored in a concrete fireproof oil house of the type illustrated in the article on the Dunellen terminal published in the March 16 issue of the STREET RAILWAY JOURNAL. In line with the drastic shop rule that material of this character must not be thrown on

the floors or in corners, waste cans are liberally distributed throughout the different buildings on the grounds.

Danger from fires that originate from cast-off greasy clothing carelessly thrown in some obscure corner is obviated by prohibiting the men to store their clothing except in the regular expanded metal lockers supplied for the purpose. These lockers are constructed of expanded metal and stand 6 ins. off the floor, so that the contents are plainly visible and accessible to light and the free circulation of air. They were built by Merritt & Company, of Philadelphia, to the specifications of the company.

In the machine shop, the pits, so often a source of worry to the underwriters, are of the closed type. Despite the advantages claimed as to the cost and convenience of open pits, the closed pit seems more desirable for a truck shop, not only from the fire underwriters' point of view, but from an operating standpoint. Where open pits are used it is difficult to prevent the workmen from throwing pieces of oily waste and scrap under the floor, but with a closed pit such material could be readily detected even in a casual inspection. Open pits are used in the carpenter shop to get sufficient clearance in working on the car bodies or for inspection and final adjustment, but at this point there is little likelihood of danger from hidden oily waste.

FIG. 3.—INTERIOR OF PAINT STOREROOM

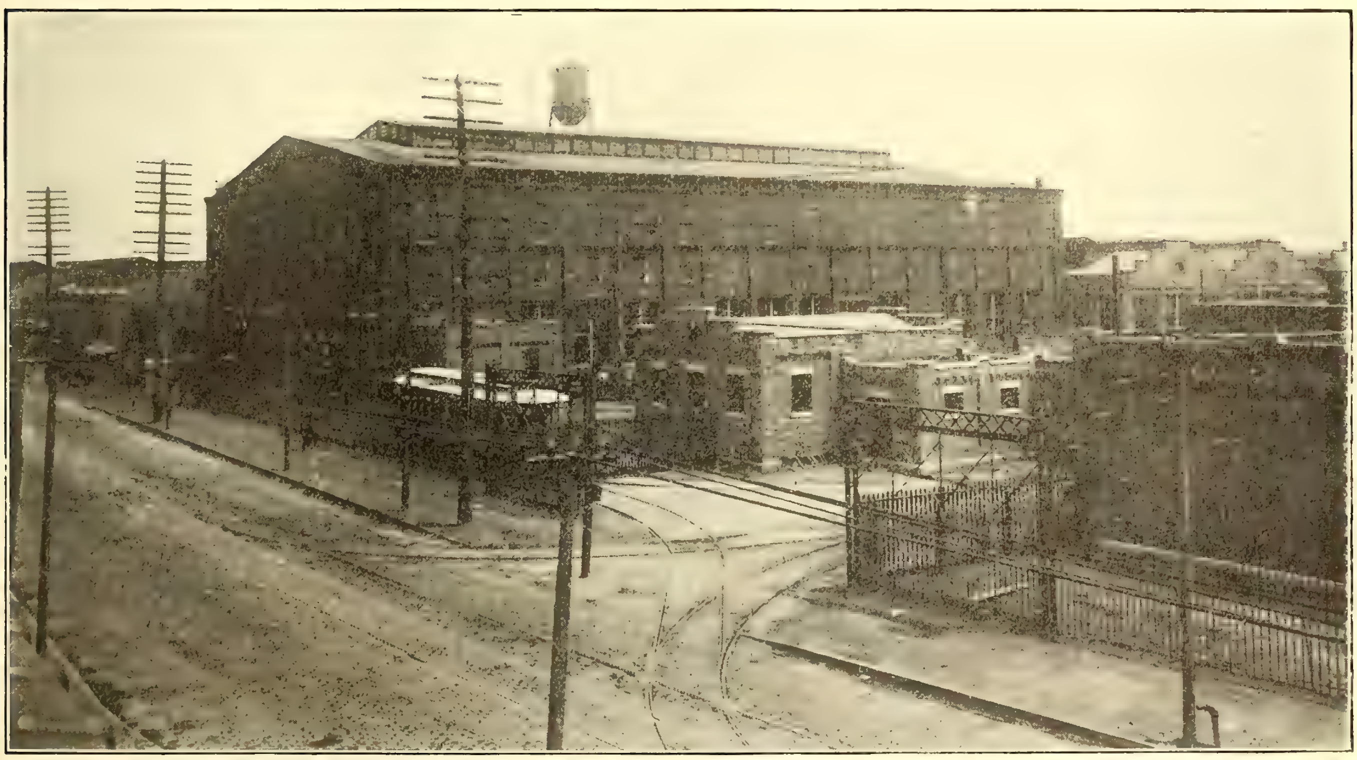


FIG. 2.—GENERAL VIEW OF THE PLANK ROAD SHOPS OF THE PUBLIC SERVICE CORPORATION OF NEW JERSEY, WITH THE FIRE HOUSE IN THE FOREGROUND

HEATING

The heat for the entire property is generated in an isolated boiler house. In the paint shop the required temperature is obtained by direct radiation. Pipe coils are used only on the roof trusses near the skylights, while the rest of the heating is accomplished through cast-iron floor radiators. These are considered preferable to the pipe coils, as each unit is absolutely isolated from the building and fixtures.

The carpenter and machine shops are kept at the desired temperature by the blower system, each having a separate set of heater coils. No air delivery pipes pass through the walls or are in contact with inflammable material in any way. The forges in the blacksmith shop are of the Buffalo down-draft type, so that there is little opportunity for fire to originate from this source. The oil for the Ferguson furnaces is stored in the isolated storage tank shown in Fig. 4.

LIGHTING, POWER AND RAILWAY CIRCUITS

The general inside lighting is by enclosed arc lamps, but incandescent lamps are used around the machines, offices, etc. Both the power and light wiring is carried in metal conduits, following closely the latest rules of the underwriters. Particular attention was paid to the construction of the trolley wiring in all buildings. The trolley is carried on barn hangers properly insulated and bolted to a trough fastened to the bottom of the roof trusses. Circuit breakers are installed at all points where the wires enter or leave the buildings. Inside each building and attached to heavy bracket insulators is a feeder from which taps are made to each trolley wire. A switch or circuit breaker, placed on a pole outside of each building from which a feeder runs to outside lines, permits that particular building to be cut out at once in case of fire. Should a ground occur on a trolley inside a building, it will result in the immediate throwing of the corresponding circuit breaker. As transfer tables between buildings the trolley comes out of one structure and is snubbed or dead-ended at the opposite one, which makes it possible to keep the current away from a particular building and still have power on the wires over the transfer tables for shifting cars.

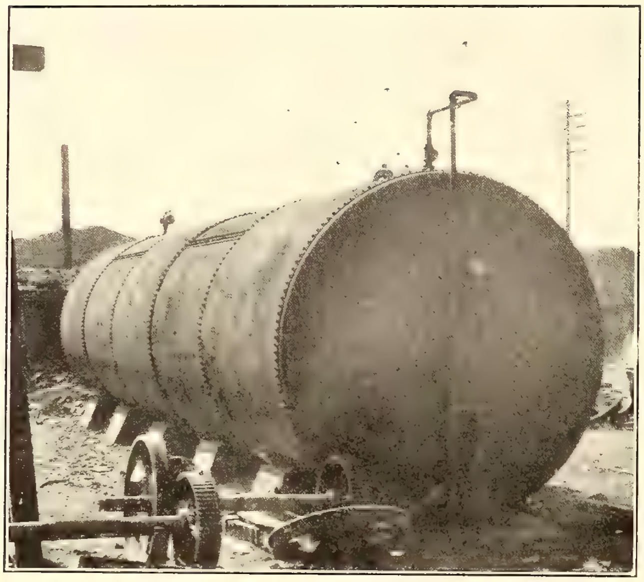


FIG. 4.—OUTDOOR STORAGE TANK FOR CRUDE OIL

THE FIRE-ALARM SYSTEM

When a fire is discovered it is, of course, important to turn in an alarm to the city's fire department, besides taking immediate steps to extinguish the blaze with the local apparatus. Where the facilities for turning in an alarm quickly are combined with fire-fighting means, there is very little chance for a bad fire. The Gamewell auxiliary fire alarm system installed in these premises by the New York & New Jersey Fire Alarm Company seems to meet every requirement for which it is intended. Fig. 7, which shows a fire alarm box conveniently located on the wall of the paint shop, is typical of those over the entire property. The boxes have serial numbers corresponding to different parts of the grounds. There are twenty stations in all, or one fire alarm for every 11,000 sq. ft. of floor area. The apparatus is regularly inspected by the owning company, which is paid an annual fee for keeping the apparatus in working order. Records of tests and inspections are always accessible to those interested in its proper operation.

FIG. 5.—A VIEW ALONG AN AISLE, SHOWING A FIRE EXTINGUISHER, DRY VALVE BOXES, GONGS, ETC.

FIG. 6.—SOME OF THE FIREPROOF METAL LOCKERS FOR THE SHOPMEN

All of the alarm boxes are connected to a box on the outside wall of the main shop. This box will be removed to a street pole, the present location being only temporary. This box is wired in turn to the nearest fire station, which, fortunately, is only 3000 ft. distant. In reality, turning in

an alarm from any of the auxiliary boxes is equivalent to one from a regular city box. To make the apparatus more effective, a return signal is given the operator to assure him the desired result has been attained. Hence, if the alarm is not in working order, something very unlikely, he knows that he must go at once to the nearest city station. Repeated tests have demonstrated that an alarm can be turned in from any of these boxes to the city fire station within twenty seconds.

In the boiler house there is a cabinet containing batteries and two gongs, this arrangement being so designed that one gong rings when an auxiliary alarm box is pulled, while the other gong never rings unless there is a disarrangement of the apparatus, such as an open circuit. Night fires would be detected by any of the four watchmen and engineer on duty from 6 p. m. to 6 a. m. The watchmen operate Newman clocks at the respective stations.

HYDRANTS, HOSE CONNECTIONS AND FIRE PAILS

The system of outside hydrants for the use of the owners and the municipal fire departments is shown in the general layout of the building, Fig. 1. On Ferry Street there are seven frost-proof hydrants. Each has a connection for a 2½-in. standard fire hose and one steamer. Two more hydrants will be installed when the city main is extended at an early date. There are also three hydrants inside the buildings which were installed before the improvement of the property. All of these hydrants are of the Corey solid screen, frost-proof type, which seems to have many advantages for this class of service, as it is quickly opened, easily drained and has no sharp turns to cause material losses of pressure through friction. We have never known any of these hydrants to freeze, even in the coldest weather.

FIG. 8.—THE SPRINKLER ARRANGEMENT IN THE PAINT SHOP FINISHING ROOM

Three other hydrants of the same type placed inside the property line are covered with the underwriters' type of hydrant and hose house, views of which are shown in Fig. 20. Each house is supplied with a 50-ft. length of National 2½-in. cotton, rubber-lined fire hose. Two lengths of hose are connected directly to the hydrants and two are stored on the upper shelf shown in the drawing. The other equipment includes a Dietz brass lantern, fire axes, two 30 in. x 1⅛-in. play pipes, four Tabor spanner wrenches, two ladder straps for holding hose on ladders, rubber washers and one crowbar.

FIG. 7. FIRE EXTINGUISHER AND INSIDE ALARM BOX

Hose conections are also placed in each building. One of these, illustrated in Fig. 6, shows a reel of 2-in. linen hose with a hose pipe and stand secured to the wall. One 2-in hose connection is laid out for every 6000 sq. ft. of floor area. As the buildings are heated in cold weather, water can be kept on these connections at all times.

For every 2500 sq. ft. throughout the entire property there are apportioned two fire pails, one filled with water and the other with sand. The pails are painted red, with large black letters "Fire" stenciled on the side. They have round botoms and are kept covered.

CHEMICAL FIRE EXTINGUISHERS

As a safeguard against a fire in its early stages, nothing surpasses the judicious and timely use of chemical fire ex-

tinguishers. "A little fire is quickly trodden out, which, being suffered, rivers cannot quench." Although this particular protection is not very effective once the fire has gained great headway, it is surely to be commended for use at the start, because its mobility permits it to be brought to the fire in a very short time. In the writer's opinion, too much significance cannot be attached to the liberal adoption of this particular appliance. In this installation one 3-gal. extinguisher is provided for every 2000 sq. ft. of floor area in addition to a chemical engine of 50 gals. capacity in each building. A red glass incandescent lamp is installed near each extinguisher to point out its location more readily in case of a night fire. The fire extinguishers illustrated were furnished by the Tea Tray Company, of Newark, N. J., and the chemical engines by the Woodhouse Manufacturing Company, of New York.

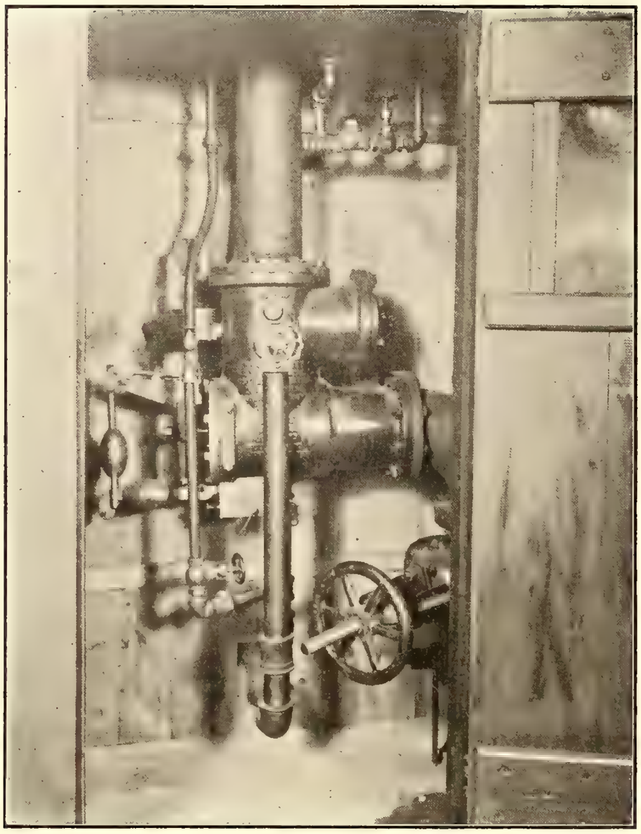


FIG. 10.—ONE OF THE DRY VALVES

THE SPRINKLER SYSTEM

The dry pipe sprinkler system installed throughout is of the non-corrosive type made by the Manufacturers' Automatic Sprinkler Company, of New York. All sprinkler heads are carried from the roof trusses, except in the car house, where aisle sprinklers are also used.

Aisle sprinklers were not required in the shops, owing to architectural conditions, and an approved ceiling equipment only was installed. Fig. 8, which shows the roof of the finishing room in the paint shop, clearly defines the arrangement of the sprinklers. The fittings are of the simplest character, and, where possible, the pipes are bent to avoid their use entirely. Hangers of a special graduated type are employed so that the pipes are easily adjusted for drainage. The horizontal piping is laid to a pitch not less than ½ in. in 10 ft. The arrangement of heads as shown in Fig. 11 follows what is known as the central side feed principle.

The general design of the buildings is very favorable to roof sprinkler protection, as all of the buildings are but one story high and the bottom chords of the roof trusses are only 16 ft. above the floor. Again, the spans are short and there is little waste room among the truss members. The roof proper is of 2-in. plank over 8-in. channel iron purlins, which permits an excellent arrangement for running the sprinkler pipes clear and free on the bottom of the planking between the purlin members. It may be of interest to add that the sprinkler heads over the oil furnaces in the blacksmith shop are the only ones having a high fusing point, as they are arranged for 300 degs. F. instead of the usual 165 degs. F.

BUILDINGS.	Dry Valves.	Heads.	Heads per Dry Valve.	Sq. Feet of Floor Area per Head.
Paint shop	7—6-inch	1,330	233	36.2
Paint store	Included in paint shop.	66	...	30.3
Erecting shop	4—6-inch	671	168	59.6
Dry kiln	None.	14	...	68.1
Old machine shop	3—6-inch	560	187	40.4
New machine shop	2—6-inch	429	214	52.9
Store house	1—6-inch	193	193	68.
Car house roof system	2—5-inch 2—6-inch	1,285	322	...
Car house aisles	2—4-inch	666	333	42.4
Totals	23	5,214	Avg. 226	Avg. 44.5

FIG. 9.—CHEMICAL ENGINE AND FIRE HYDRANTS IN THE PLANK ROAD SHOPS

The sprinkler heads and apparatus used in connection with them are distributed in the different buildings, as shown in the preceding table and also as indicated on the general plan of the property, Fig. 1.

It will be seen from the foregoing table that the layout comes well within the requirements of the underwriters, namely, that no dry pipe valve should serve over 500 heads and that no more than 100 sq. ft. per sprinkler head should be allowed. The table also shows that the property is divided into twenty-three sections, each supplied by an automatic dry valve. As this valve was described quite fully in the STREET RAILWAY JOURNAL of Jan. 28, 1905, it will not be necessary to present another description, but Fig. 10 is interesting, as it gives an inside view of the valve as actually installed at the Plank Road shops. It will be noticed that the valves are housed in wooden boxes provided with a door. Fig. 10 also shows the outside screw and yoke flanged valve under the dry valve so the corresponding section may be cut off inside the building as well as by the post indicator valve outside. The small pipe in the upper right-hand corner has a sprinkler head for the protection of the enclosure. Since this pipe is also used for the air supply from the compressor, a check valve is necessary. The vertical pipe with angle valve that runs from the center of the dry valve is a 2-in. drip to provide for thorough drainage once the dry valve is started. The small pipe on the left is for determining the condition of the water supply, the gage on it enabling the inspector to determine the exact pressure necessary to keep back the water supply until the dry valve is tripped. It is un-

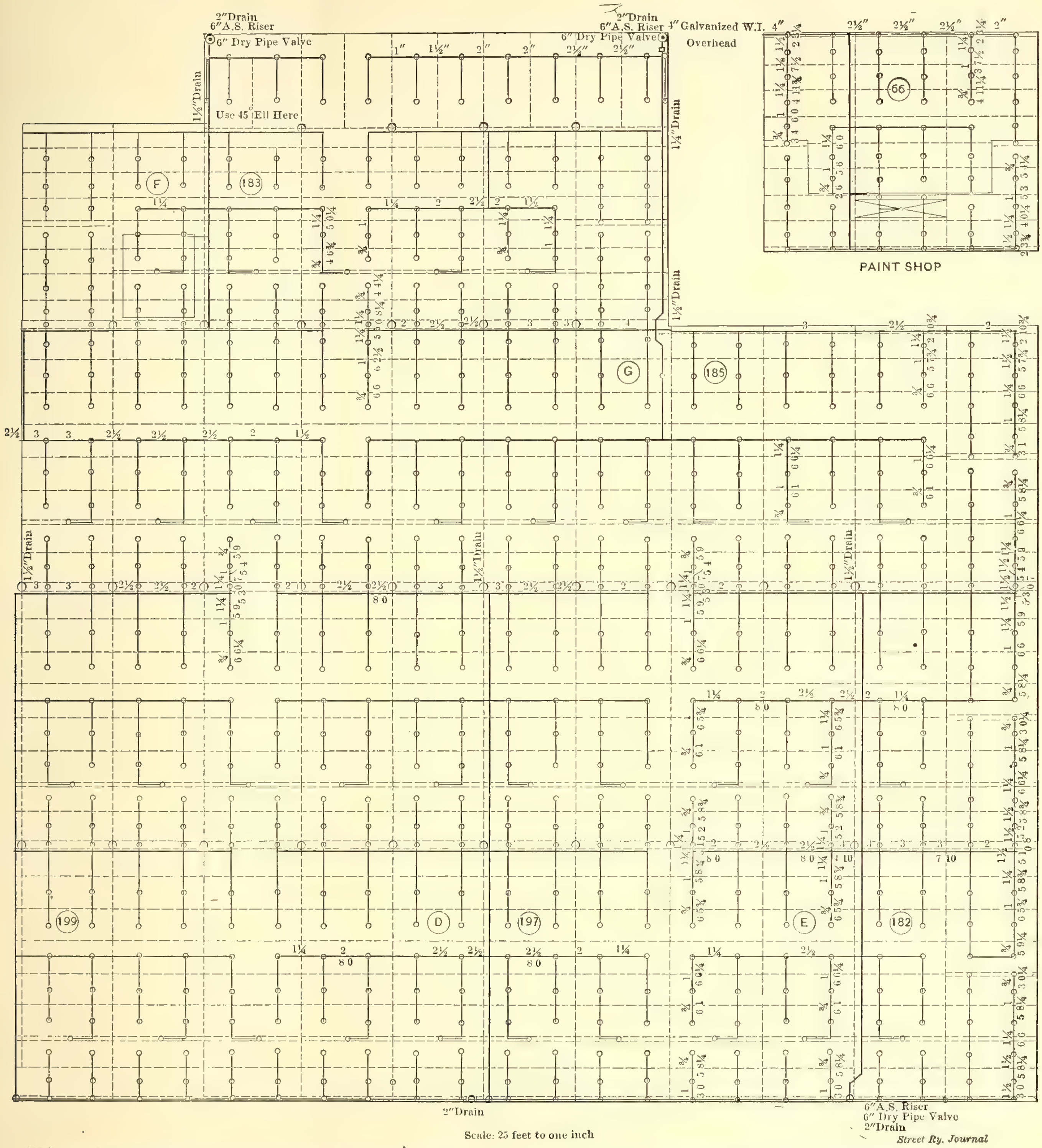


FIG. 11—SPRINKLER LAYOUT IN THE PAINT SHOP OF THE PUBLIC SERVICE CORPORATION OF NEW JERSEY AT NEWARK

derstood, of course, that when a sprinkler explodes the air is thus thrown out and the trip of the dry valve operates to permit water to flow into the proper sprinkler heads. The trip on the dry valve not only closes the circuit which starts the high-pressure pump, but also sounds a gong attached to the outside of the dry valve box, and will also be wired to sound the main alarm in the boiler house. An indicator in the boiler house will point to the number of the dry valve liberated for service, thus notifying the attendant of the exact location of the trouble. The four compressors used in connection with the dry valves are of the Christensen type and located as shown on the general plan, Fig. 1. Each is supplied with an automatic gate governor to insure the balance of the air and the water supply.

MAIN WATER SUPPLY AND HIGH-PRESSURE PUMP

The principal water supply of the system will depend upon the regular city mains in conjunction with the direct-connected, electrically-driven centrifugal fire pump, illustrated in Fig. 13. This pump is of particular interest, as it is one of the first of its kind to be installed in connection with a sprinkler system under the supervision and approval of the fire underwriters. Although the ability of centrifugal pumps to handle large quantities of fluid against low heads has been utilized for some time, manufacturers have only recently developed it to such a satisfactory stage that it has met with approval for discharging water at high pressure. If it can be shown that the centrifugal pump does the work at a reasonable efficiency, it deserves commendation for fire service on account of its simple construction and easy operation as compared with reciprocating engines. The Plank Road pump has a capacity of 1000 gals. per minute at a pressure of 100 lbs. per sq. in. It was manufactured by the International Pump Company after the specifications of the Associated Factory Mutual Fire Insurance Company, of Boston. It is driven at 920 r. p. m. by a General Electric direct-connected 85-hp, 500-

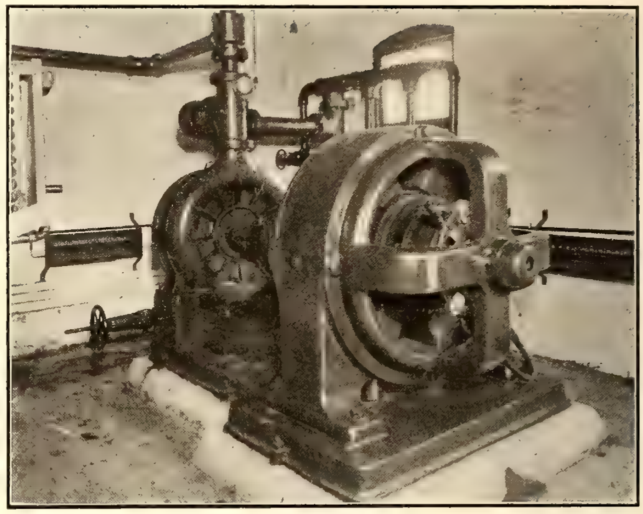


FIG. 13.—CENTRIFUGAL MOTOR-DRIVEN FIRE PUMP

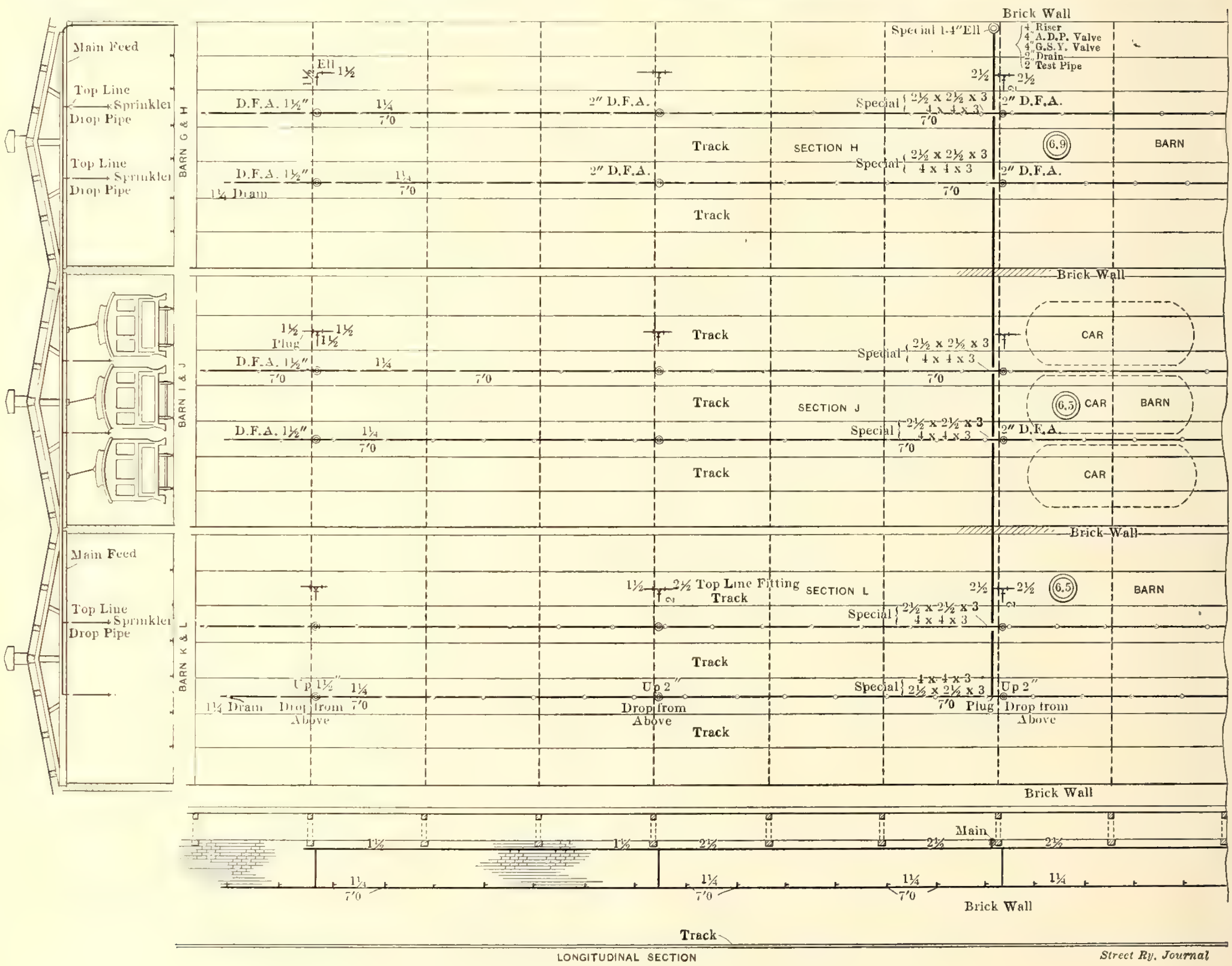


FIG. 12.—PART OF SPRINKLER LAYOUT IN THE CAR HOUSE

volt motor originally built for the standard speed of 800 r. p. m., but adapted for the higher speed required for the show what happened during a test with four hose lines, first when the city pressure of 25 lbs. was applied, and sec-

FIG. 11.—A VIEW OF THE FIRE-HOSE STREAMS WITH THE CITY PRESSURE OF ONLY 25 LBS.

FIG. 15.—ANOTHER VIEW OF THE FIRE-HOSE STREAMS, SHOWING THE DECIDED DIFFERENCE WHEN THE PUMP HAD RAISED THE PRESSURE TO 100 LBS.

pump by the insertion of additional resistance in the field.

The value of this pump is evident from a comparison of the accompanying illustrations, Figs. 14 and 15, which ond, when placing the pump in circuit brought the pressure up to 100 lbs. The difference in the character of the streams is too obvious to call for comment. The pump

house contains a relief valve set at 100 lbs. pressure which has a connection that empties into a funnel-shaped pipe connected to the sewer. The purpose of this funnel pipe

FIG. 16.—ONE OF THE COMPRESSOR MOTORS FOR THE SPRINKLER SYSTEM

is to permit the determination of the quantity of waste water when the pump is operating.

Originally it was planned that when a dry valve tripped

FIG. 17.—FRAMING OF THE NEW FIRE TANK

FIG. 18.—ONE OF THE HOSE CONNECTIONS ALONGSIDE THE SHOP BUILDING

the foreman in the boiler house would signal from the general alarm whistle and then go to the pump room to start the machine. To improve on this idea, a Cutler-Hammer automatic starting box will be installed and so connected that when a dry valve trips a solenoid armature will operate the starting box of the motor. Thus the pumping outfit will be placed on an entirely automatic basis.

AUXILIARY WATER SUPPLY

The auxiliary water supply will be stored in a 50,000-gal. round-bottom steel tank carried on a structural steel tower with its bottom 117 ft. above the ground. As the usual elevation of the sprinkler heads is about 30 ft., the water pressure on the highest sprinkler is about 40 lbs. The sprinkler heads in the roof of the old machine shop are elevated 50 ft., giving 16 lbs. pressure, the minimum

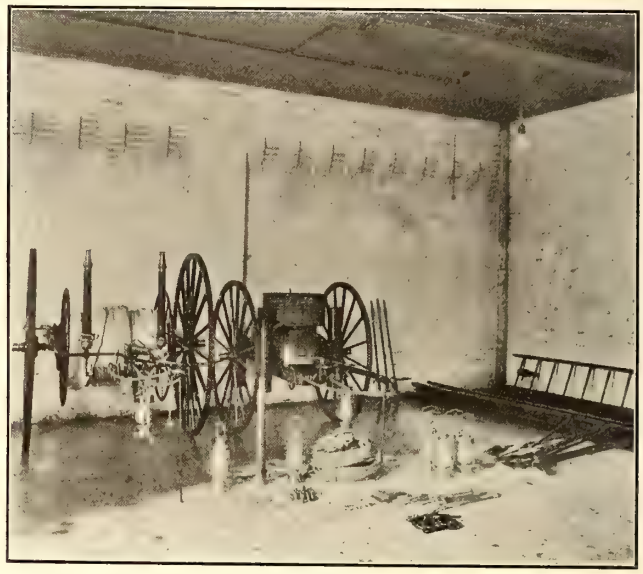


FIG. 19.—CHEMICAL ENGINE, HOSE CART AND OTHER FIRE EQUIPMENT IN THE FIRE HOUSE

allowed by the underwriters. It is evident, therefore, that the greater part of the shop is considerable in excess of the pressure required.

From Fig. 1 it will be seen that the tank is connected in shunt with the regular water supply, an 8-in. pipe running from the bottom of the tank. In this pipe are placed two 8-in. post indicator valves with an 8-in. swing check

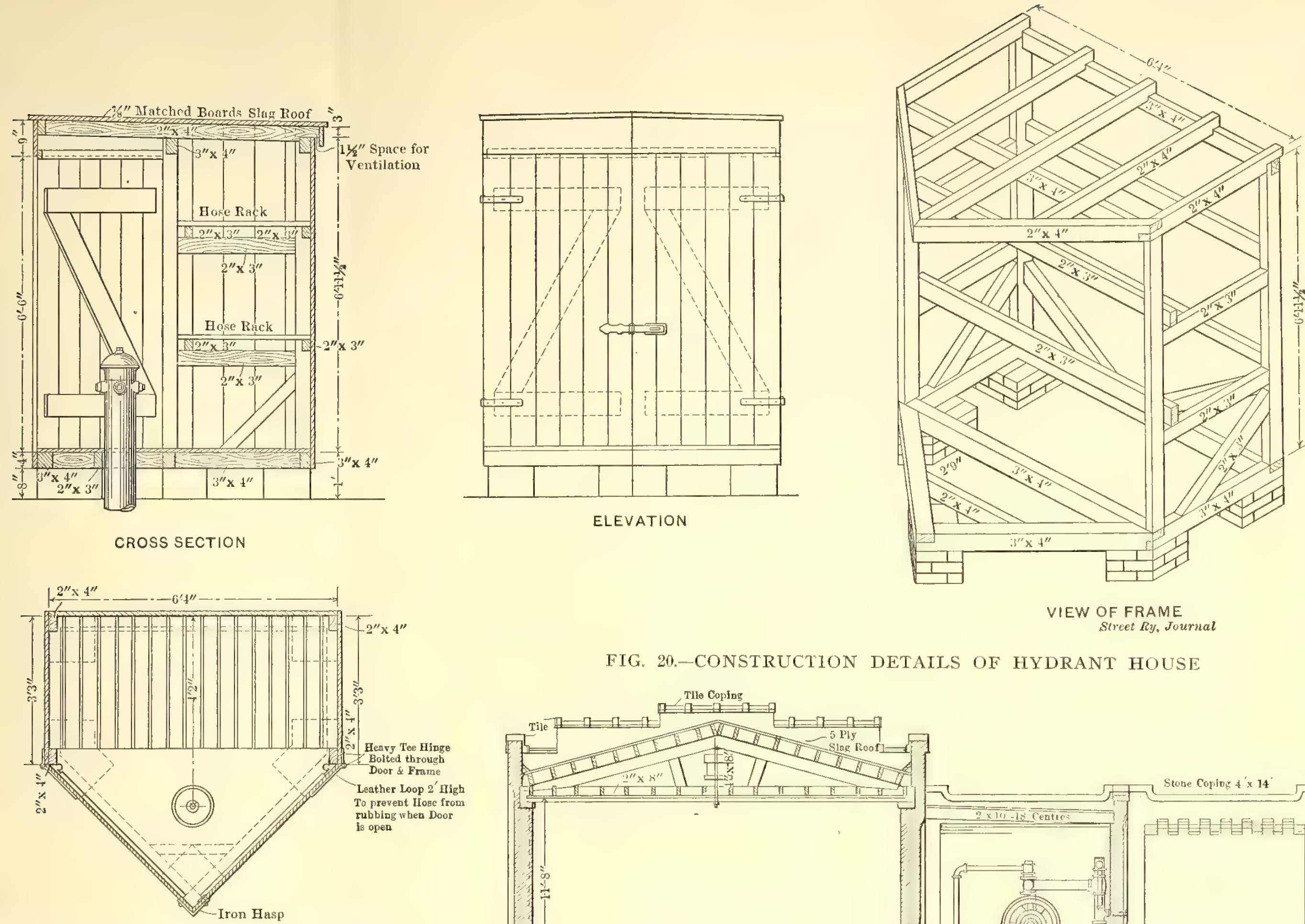


FIG. 20.—CONSTRUCTION DETAILS OF HYDRANT HOUSE

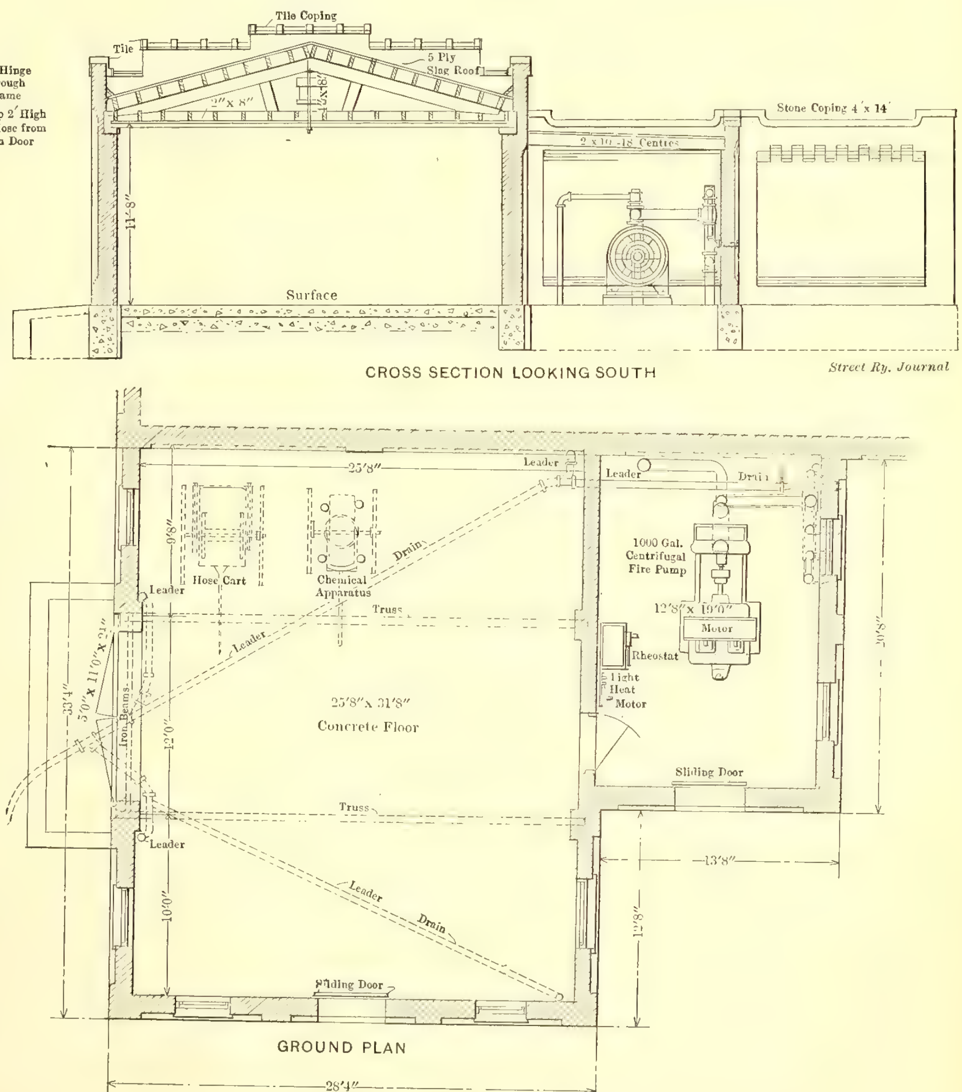


FIG. 21.—PLAN AND CROSS-SECTION OF FIRE HOUSE

valve between them. This arrangement makes it impossible for the pressure pump to force water in the tank without using a by-pass, consisting of a 2½-in. pipe. There is also a 3-in. overflow pipe extending from near the top of the tank to the ground for carrying away water that rises above the required height in the process of filling. A tell-tale shows at all times the exact height of the water in the tank. To prevent freezing, a 1-in. steam pipe is carried from the boiler room to a coil of brass piping in the bottom of the tank. The other end of this coil terminates in a return pipe which brings the water of condensation back to the boiler house. All pipes to the tank will be thoroughly protected from the elements by a wood covering with air-gap insulation. This tank is simply an auxiliary held ready to furnish the required head of water for the sprinklers should there be a failure of the regular water supply. There is also a connection (not shown) between the point *G* in Fig. 1 to a hose house at the rear end of the machine shop.

THE FIRE HOUSE

The fire house is a brick building with concrete floors, constructed as shown in the accompanying plan and section, Fig. 21. The building is divided by a brick wall and fire door into two portions, one of which contains the electrically-driven centrifugal pump previously described

and the other the fire-fighting apparatus of the hose and chemical companies making their headquarters in this structure. The building is entirely isolated from the others, to reduce to a minimum its possibility of destruction by fire. The floor space is ample, being 25 ft. x 31 ft. The large double doors open outward as soon as the latch is released. Fig. 19 is a view of the section devoted to the fire-fighting equipment, which consists of the following: One Woodhouse fire hose cart, including all of the usual appurtenances, and 400 ft. of National standard 2½-in. cotton, rubber-lined fire hose; one No. 6 55-gal. chemical engine made by the Woodhouse Manufacturing Company, of New York, and including 100 ft. of ¾-in. hose, acid receptacle and soda bags; fire axes; crowbars; monkey and hydrant wrenches; Tabor spanner wrenches; extension ladders; ladder straps; fire hooks; Dietz fire lanterns; coils of ½-in. rope, and, in fact, almost everything required for effective fire fighting.

PRIVATE FIRE DEPARTMENT AND MAINTENANCE OF EQUIPMENT

A general plan of the sprinkler system and the other fire protection apparatus will be placed in glass-covered frames mounted on the walls throughout the buildings. A list of general rules recently adopted by the management covering all the different properties operated by the company is submitted below and will be used at the shops:

INSTRUCTIONS TO EMPLOYEES IN RELATION TO FIRE PROTECTION

(1) IT IS THE PARTICULAR DUTY of all employees of this company to use every precaution to prevent the origin of a fire on this property.

(2) IN CASE OF FIRE turn in city alarm at once. Properties with auxiliary alarm systems should have the same in good working order at all times. To operate an auxiliary alarm box which has precisely the same effect as turning in an alarm from the regular city station, break glass and pull down ring. When you hear the box buzz it is an indication that the signal is operated. If you do not know where the city fire alarm box is located look at placard defining its location. In case there is no auxiliary or city alarm box on the property, go to the box located as indicated on this card.

(3) CHEMICAL FIRE EXTINGUISHERS should be placed judiciously and conveniently about the property. The extinguishers must be kept charged and a record of same written on card attached. When not in actual service for nine months, they are to be recharged. In freezing weather extinguishers must be kept in a warm place and returned to their original location just as soon as weather permits.

(4) FIRE PAILS that are placed in pairs. In freezing season salt is to be added to water pail or water is to be substituted with sand. It is imperative that pails are not used for any other purpose than for fire. Pails are to be painted red and be careful that the side upon which the word "Fire" is stenciled in black letters is in sight. In extreme weather, when there is any danger of the salt water freezing, sand should be substituted and the water replaced as soon as weather conditions permit. In exposed places a permanent box for the protection of sand pails will be provided.

(5) FROST PROOF FIRE HYDRANTS are to have wrenches always in place and hose and nozzle attached to hydrant. Hose to be neatly stored on rack or reel. Hydrants are to be clear from all encumbrances, so that it is possible to put them in use at any moment. A wheel may be substituted for a wrench, but if wrenches are attached it should be in some method so that they cannot be removed.

(6) INSIDE STANDPIPES AND CONNECTIONS are to be guarded against freezing by turning off water below the ground line and whenever water is thus stopped a placard is to be placed at connection with these words, "Turn on valve at ——————." Standpipes are also to be connected up with hose line and nozzle, which is to be stored on reel fastened to the wall. All hose and hydrant equipment should be tested at least every two weeks, after which equipment is to be carefully drained and restored to its usual position.

(7) OILS AND OILY WASTE or similar inflammable material should be stored in fire-proof oil house, oily waste being placed in strainer tank. No oils, grease or similar inflammable material allowed on property except in small quantities that are to be immediately put into service.

(8) CLOTHING, especially greasy garments of employees, must not be stored about the building, but retained in regular lockers provided for that purpose, and even in lockers clothing should not be retained there for a long period, and only such articles of wearing apparel as are regularly in use.

(9) ASH CANS—Floors on all property must be kept reasonably neat and clean. Ash cans should be emptied daily. Oily particles of waste, scraps, car sweepings, etc., are to be promptly placed in the regular can provided for that purpose, so that none of the debris is lying promiscuously about the premises.

(10) BOILER PLANTS to be carefully inspected, and it is important to keep the boiler room clean and tidy in appearance, so that ashes do not accumulate. Ashes should not be left under grate until the burnt fuel comes in contact with bottom of grate bars. Ashes should be removed from under boilers once every twelve hours.

(11) WIRING. The wiring for trolley and lights should be systematically examined so that no live circuits are uninsulated or in contact with inflammable material. Portable lights are not to be used, except in special instances, extension incandescent lamps that have well insulated cords and globe protected with guards may be in service.

(12) TROLLEY POLE must be pulled down as soon as the car is placed in the house.

(13) CAR FIRES must be started outside of house. When a car is coming into a house it is to have fire extinguished before entering building and the refuse placed in ash cans. Cars having hot water heaters are to have fires banked before entering car house.

(14) SPRINKLING SYSTEMS to be systematically inspected daily, records made of air and water pressure of dry valves, height of water in tank, temperature, etc., so that the arrangement is properly maintained.

(15) WATCHMAN'S CLOCKS are to be carefully examined each morning, taking special notice to see that the cards have been properly punched at the respective stations.

(16) OFFICIAL HEAD in charge of property will conduct a regularly outlined fire drill at least once a month.

GENERAL PROCEDURE IN CASE OF FIRE

Should a fire be discovered before a sprinkler opens, an alarm will be turned in from a fire box. This will give an automatic signal to the boiler house engineer, who will immediately sound an alarm on the large air whistle. The number of whistle blasts will indicate the building where the fire has been discovered. Should a sprinkler open first, the tripping of the corresponding dry valve will send a similar signal to the boiler house. Electrical push buttons will be installed also in each building and other points about the premises, from any of which a person discovering a fire can operate the alarm whistle by closing the circuit.

One man will be in direct charge of all the fire apparatus, his duties being confined strictly to this feature of the installation. He will register daily the water pressures, air pressures, and make similar records on appropriate blanks. He will also make repairs, but should he discover defects which he cannot correct alone, arrangements will be made to secure the proper means at once.

PRIVATE FIRE DEPARTMENT

Charles E. Remelius, superintendent of rolling equipment, who has charge of the Plank Road shops, is now organizing a private fire department, consisting of six companies in all. There will be three local companies for the paint, erecting and machine shop buildings, respectively, with headquarters at the hose house, shown in rear of

property as laid out on the drawing; also a general hose and chemical company, with headquarters at the main fire house. The two general companies respond to all alarms, while the local companies respond only to alarms that designate the particular building to which they are assigned.

In accordance with the suggestion of the fire underwriters, the private fire department will be drilled at regular intervals and also unexpectedly to test its readiness. This department will be headed by the general foreman as acting chief, and the respective foremen as captains.

DESIGN OF THE FIRE-PROTECTION SYSTEM

Bruce E. Loomis, manager of the Underwriters' Electrical Inspection Bureau of New York, represented the underwriters in co-operating with the company in arranging the protection of the property, and the complete installation was subject to his approval.

NEW ENGLAND STREET RAILWAY CLUB

The last New England Street Railway Club meeting of the season was held at the American House, Boston, on the evening of May 23, President Henry C. Page, of Springfield, being in the chair. The speaker was P. F. Sullivan, president of the Boston & Northern and the Old Colony Street Railway Companies, his subject being the Public Relations and Investment Sides of the Street Railway Business.

Mr. Sullivan pointed out that good operation, important as it is, is not enough to insure business success in street railway work. The broader obligations of the company to the public and the invested capital must also be fully considered. He discussed the history of charter legislation in Massachusetts from 1864 to the present year, emphasized the efforts of local boards of aldermen and selectmen to coerce the companies into making all sorts of unprofitable concessions, and dwelt upon the advantages of the later laws which place the final jurisdiction in regard to locations and alterations of locations in the hands of the Massachusetts Railroad Commission, calling attention, however, to the great burdens of the excise tax which was imposed in the legislation of 1898. Last year the Massachusetts street railways paid $3,550,000 in dividends and $1,923,000 in taxes, or over $1 in taxes for every $2 paid in dividends. The public clamors for additional street railway taxation, yet in the last year street railway companies were taxed at the rate of $14.87 per thousand par value of stocks and bonds, and the average tax rate of the State on all property was $16.10. This shows that the street railway is in no danger of escaping the tax gatherer. The public is entitled to everything fair and reasonable, but unfortunately the public does not stop here. It makes many companies pay for the privilege of losing money. Franchises in Massachusetts are, in a sense, perpetual; but they are not exclusive, and there is a broad difference between such a franchise and a limited franchise which is exclusive.

Touching upon the large development of street railways in Massachusetts, Mr. Sullivan stated that there is now in the State 1 mile of trolley track for less than each 3 square miles of territory, against 17 square miles in New York State and 15 in Pennsylvania. There is in Massachusetts 1 mile of track for each 1200 inhabitants. What this development means in invested capital may be appreciated by the following figures:

In 1865 there were 137 miles of street railway in Massachusetts; in 1885, 376 miles, or an increase of 174 per cent. During this period the income increased 233 per cent, showing better earnings per track mile, and the investment increased 200 per cent. Between 1885 and 1905 came the development of electric traction. Trackage increased 640 per cent, or from 376 to 2777 miles; income increased only 420 per cent, showing a reduction in earnings per track mile, and the investment increased 900 per cent. The ratio of capital to income, expressed in terms of the investment needed to take in $1 of income, was as $3 to $1 in the period between 1865 and 1885, but between 1895 and 1905 it rose to a ratio of $5.50 to $1. Mr. Sullivan paid a strong tribute to the courage of Henry M. Whitney and his associates in the West End Street Railway Company in 1888-9, when that company changed from horse to electric traction on a large scale, stating that if the great risks which capital then took had proved failures, it would probably have retarded the growth of electric traction by twenty years.

Operating men pointed out that the operating ratio was 80 per cent with horses and 60 to 65 per cent with electricity, but they often overlooked the investment necessary to produce this result. Of the leading ten companies in Massachusetts, that do 90 per cent of the whole trolley business, one of the best companies has very low car-mile earnings. Income per car-mile is not the only point, but capital must be considered as well. Higher speed operation means higher running expenses, except in wages of car men, and there is no escape from this conclusion. For purposes of comparison merely, Mr. Sullivan cited two large companies in the State, showing the results of an analysis of their operating figures. Company 1 has an investment of $55,000 per car operated, and Company 2, $236,000. There is no water in either company. No. 1 has a power station investment of $8,400 per car operated, and No. 2, $37,000. The operating ratio of No. 1 is 71 per cent, of No. 2, 51 per cent. No. 1 earned from 7 to 8 per cent dividends, and No. 2 made a showing of 6 per cent; but while No. 1 expended 22 per cent of its income in maintenance and of this 14 per cent in track maintenance, No. 2 spent but 13 per cent of its income in maintenance and but 3 per cent on track upkeep. The ratio of capital to income was as 4 to 1 with Company 1 and as 7.5 to 1 with Company 2.

Speaking of high-speed operation, Mr. Sullivan stated that faster running saves car men's wages, but other expenses tend to increase about in proportion to the speed. Power increases and the investment to produce that power rises. Car maintenance also goes up. The mere cost of power in the case of Company 2 was 2.5 times that of Company 1, and yet coal was about the same in price per ton for each one. The ratio of capital to income is strongly illustrated by the figures of last year in Massachusetts. Of the total track mileage 46 companies owned and operated 760 miles, and these companies registered a total deficit of $122,500. The ratio of capital to income was as $8.35 to $1. When this ratio reaches $20 to $1, and even higher, as it sometimes does, receiverships will come. No State in the Union, no country in the world, has such frequent transportation service as Massachusetts. Interurban roads must take care not to fall into the same pitfalls which have beset some of the surface street car lines. The operating conditions mean heavy capital as compared with the open country and less frequent service of the West.

THE STREET RAILWAYS OF BUENOS-AIRES, ARGENTINA

(FROM OUR SOUTH AMERICAN CORRESPONDENT)

The conversion of the old horse tramway lines of Buenos-Aires to systems of modern electric railways has taken place, and is taking place with such rapid strides in this great city of the south that information on the subject soon becomes obsolete. This article, therefore, is written to keep the readers of the STREET RAILWAY JOURNAL up to date in this matter, giving them the most recent statistics as to the great volume of business the street railways are doing here, the way their business is conducted, the style of cars in use, the various types of construction employed, and such other data as may prove of interest.

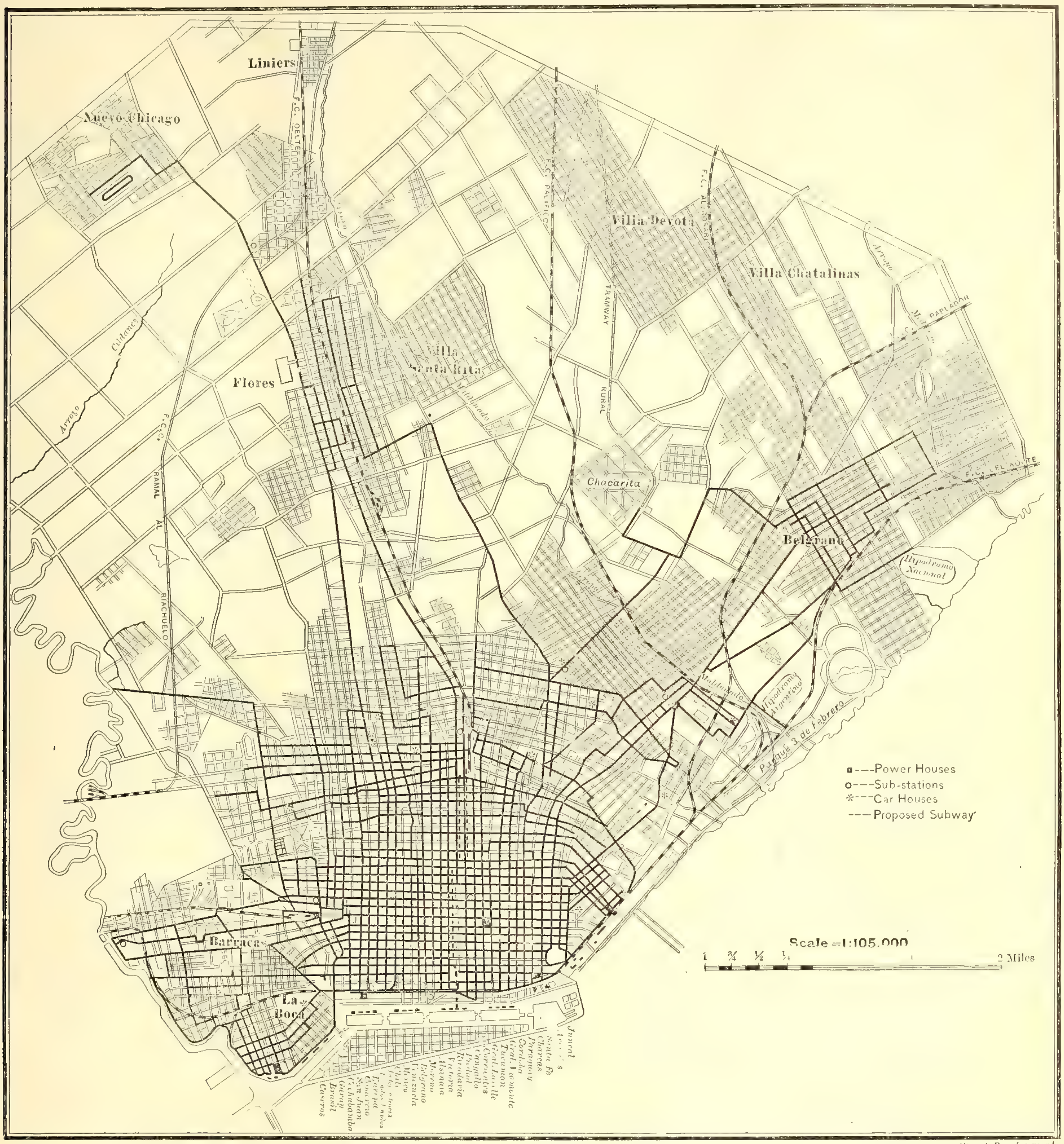
By far the great majority of people in the United States have no idea that some 1200 miles below the equator there is a large, busy city, exceeded in population by only three cities in their own country, namely, New York, Chicago and Philadelphia. Buenos-Aires has passed the million mark, the latest municipal statistics showing it to have a population of about 1,084,113. Keeping pace with the population, the volume of business done, not only in the city but also throughout the entire country, has so increased from year to year that to-day it has entirely outdistanced the improvements and extensions in railways, port works, warehouses and all other devices for controlling it to such an extent that we find the steam railroads of the country utterly inadequate to handle the work through shortage of locomotives and rolling stock. Recently some lines have been so congested as to call for the intervention of the national government, prohibiting the further shipment of goods over these routes until the freight blockades were cleared.

At the port works we find the spacious and splendidly designed docks completed but a few years ago, and then thought large enough to handle the business for many years to come, already far too small. They are so crowded with shipping that many steamers are compelled to anchor for weeks at a time in the Roads (as the outer harbor is called), awaiting an opportunity to enter the docks to discharge their cargoes. This is true not only of Buenos-Aires, but of the other three great ports, at Rosario, Bahia Blanca and La Plata.

PLAZA MAYO, BUENOS-AIRES. VIEW TAKEN FROM GOVERNMENT HOUSE

What is true of the general mercantile situation is also true of the street railway lines. Crowded though the center of the city is to-day with trolley and horse cars following each other in rapid succession, yet they are totally insufficient to carry the people. Perhaps this is due in a great measure to the use of the "Completo" sign, displayed by the motorman of a car when all the seats are occupied,

no standing or strap-hanging being permitted. At the present moment there is an agitation on foot to abolish this relic of horse car days, humane and proper at that time, but out of place with up-to-date electric cars. If this succeeds, it should increase the carrying capacity of to solve. It has not enough streets or surface cars to handle its population properly, and there is much talk of having to build subways such as exist in New York, London and Paris. The nature of the soil is such that this can be easily done, as far as excavation is concerned, and the prob-



Street Ry. Journal

MAP OF BUENOS-AIRES, SHOWING ALL TRAMWAY SYSTEMS, ALSO PROPOSED SUBWAY

the present system by at least 20 per cent. Even this change in practice would not suffice, and it is almost impossible and unsafe to run cars on a shorter headway than is now done in the business district. As can be seen by the map, every street is taken up with a car line, the only exceptions being Calle Florida and the Avenida de Mayo, in the center or business part. Buenos-Aires is to-day confronted with the same problem that New York has had

abilities are that it will be done in the near future. The dotted lines on the map show the proposed route of one of these subways under the principal avenue of the city. It would connect one of the large railway stations with the port, making it easy for passengers coming in from the country to reach the steamers, and vice-versa, besides bringing the suburban towns of Flores, Liniers, Merlo, Ituzaingó, and many others, into close communication with

the city. As another wide centrally located avenue has been suggested to cross the present one at right angles with a crosstown subway its entire length, travel to almost any quarter of the city would be made comfortable and expeditious.

The narrowness of the streets generally prevents double-tracking them, except in some of the wide ones, such as Callao, Entre Rios, Las Heras, Santa Fé, Almirante Brown, Paseo de Julio, Paseo Colon, Montes de Oca, and perhaps one or two more. All cars in passing through streets keep to the left-hand curb in conformity with the municipal regulations. Some are still running in the wrong direction, but these will be changed as quickly as convenient. The changing of these car routes and direction of running has led to a great amount of confusion, even to the every-day rider, and all will be glad when the thing is finally settled. These car routes are designated by colored signs with numbers painted on them placed over the front and rear hoods, plainly visible from a long distance by day and illuminated electrically at night. Though these cars also carry dash signs, giving the names of the streets through which they pass, few, if any, of the regular riders read these, as they know by the roof number just where it goes. The stranger inquiring which car to take to reach a given destination is, therefore, told to take No. 10, or No. 17, or No. 5, and so on, instead of the street car going west, east, north or south. More than half the time he will not know anything about the points of the compass. Little pocketbooks are printed by the companies, giving a map of each route, showing the streets covered by it, and arrows point the direction the car goes in the various streets. These pocketbooks also contain the time table of the various routes, rate of fare, color of the night signals and other useful information.

The cars are of different types, such as closed, semi-convertible, open and double-deck cars. All are equipped with Consolidated fenders. Illustrations of these types, with their hood numbers in position, and data as to the motor equipment, are contained in this article. The contrast between the old-time horse car and the modern trolley is most marked. Some of the former are still running, though they will soon be a thing of the past, and we will no longer hear the ear-piercing shrieks which the driver of a horse car makes on a "corneta," or cow's horn made into a trumpet, as he approaches a corner. The visitors to Buenos-Aires, particularly those who have known the city in former days, will miss these quaint old sounds, for, ear-piercing as they generally are, there are some "cocheros" who are veritable artists in the handling of these horns and capable of producing some very tuneful melodies.

VIEW LOOKING WEST FROM THE PRENSA BUILDING ALONG THE AVENIDA DE MAYO

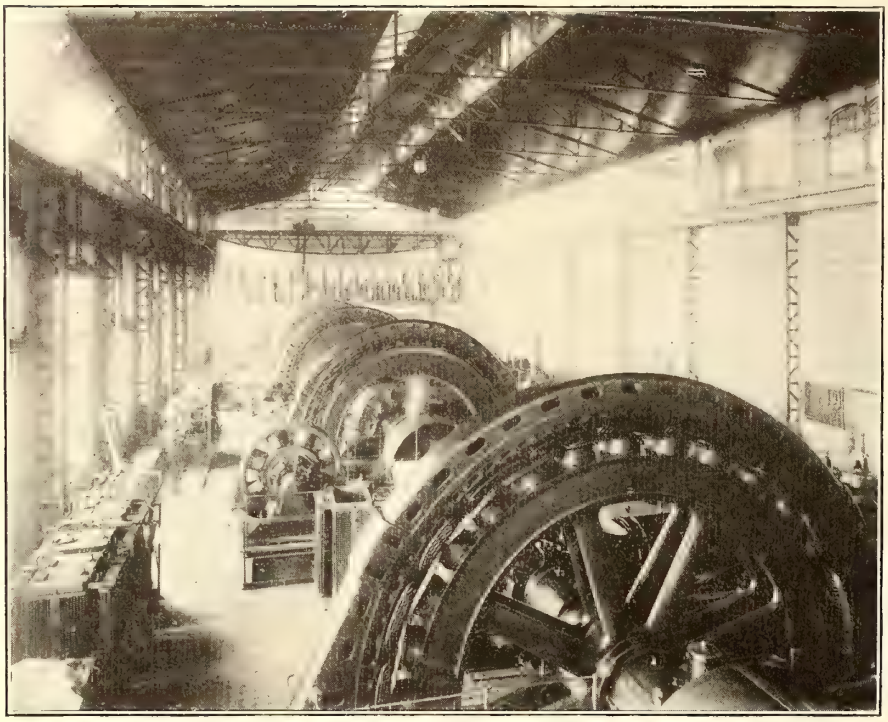
With their exit will go a relic of old Buenos-Aires and a lot of the quaintness and romance one is apt to associate with South American countries.

There are no separate power stations in Buenos-Aires to-day, the entire supply of electric current for railway and lighting work being in the hands of one company, the Compañia Alemana Transatlantica de Electricidad, which, as the name implies, is a German concern. The distribution of the railway current is divided among five power stations at present, though there will soon be a sixth in operation, as the company is to erect a large station in the Darsena Sud. This station will be of 100,000 hp to 120,000 hp, and will be equipped with turbines. All plans and specifications are prepared, and orders already closed for some of the machinery. From this station current at high potential will be carried to the suburban plants now operated by steam power, making sub-stations of them in future. As coal costs close to $10 gold per ton at these suburban plants, the centralizing of the coal-consuming devices under one roof and near the seaboard should effect a great economy. In addition, the Rural Tramways are building a station of 2250 kw output for handling their lines when completed. This station will not have any connection with those of the German company. Some views of these power houses are shown in the accompanying illustrations.

The output of these stations for January, 1907, which,

THE SOUTH SIDE OF BUENOS-AIRES AS SEEN FROM THE TOP OF THE PRENSA BUILDING

A CAR ON THE LA CAPITAL LINE PASSING THE GOVERNMENT HOUSE



INTERIOR OF THE BOCA STATION OF THE GERMAN TRANSATLANTIC ELECTRICITY COMPANY, BUENOS-AIRES

span wire with rosettes in the building walls is the only method possible in the narrow streets. On most of the wide streets ornamental center pole construction is employed, while on some others it is both span and bracket work. Guard wires are compulsory. The average weight of rail used, which is all of the grooved type, is about 87 lbs. per yard, though there is some heavier. It is all laid on concrete foundations, bonded, as a rule, with compressed or pin-driven copper bonds, though some lines have plastic bonds and others cast and thermit welded joints. Pavements vary, some being granite blocks, some asphalt, but the majority consist of wooden blocks on edge.

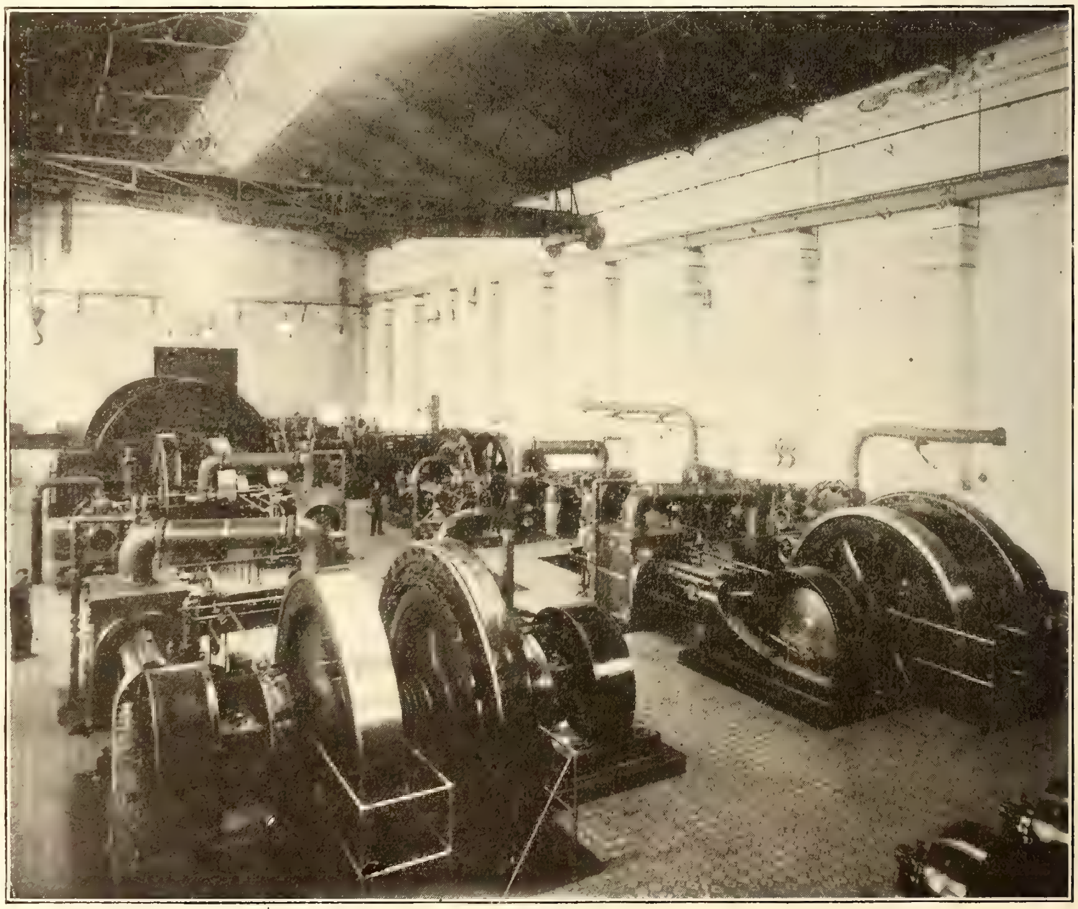
Nearly all feeders in the center of the city are underground. Some of the original installations, however, still maintain the overhead system, which is anything but ornamental.

In track work there is a tendency to drift away from the manganese steel centered frogs and switches, using instead built-up pieces made of regular rail sections, which seem to be giving good results. Many of the lines use trailers, the trailer generally being a workman's car. The space between the trailer and motor car is guarded by a fender of special design to prevent the people who alight from the motor car being hit by the trailer. No registers are used, as the conductor sells tickets. The

of course, does not include the Rural station, was 1,225,820 kw for lighting and 708,448 kw for power, exclusive of tramways and public lighting work. The tramway consumption of power for the same month amounted to 3,788,244 kw. The cost of current for lighting is 13¼ cents per kw-hour, and for power 7 cents per kw-hour, all in gold. All of these power stations are steam driven, some with turbines, but the great majority with reciprocating engines.

It may be that some day in the near future, when the economical transmission of power to distances up to 1000 miles can be counted an assured and tried fact, Buenos-Aires, as well as Rosario and other cities of the Argentine, will be obtaining their power for lighting and tramways from the famous Falls of Iguazú, situated in the northeast corner of the Republic. These falls are much larger than Niagara, having a width of 2 km and a depth of 70 m., with an abundant supply of water all the year.

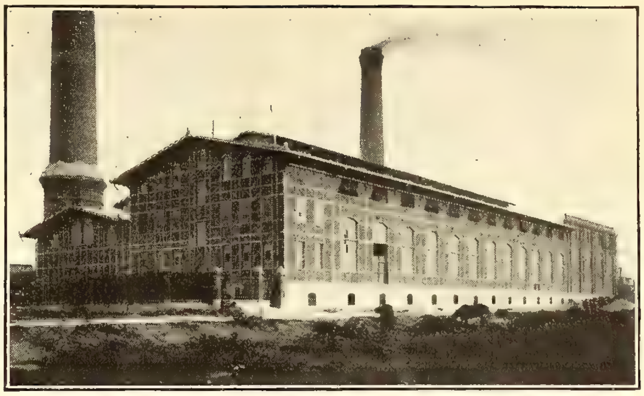
For the overhead construction, iron poles are used wherever possible, while in the center or business section



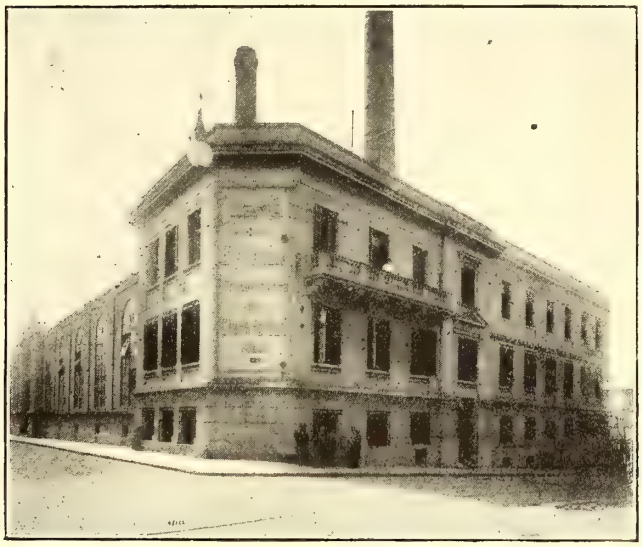
INTERIOR VIEW OF THREE-PHASE STATION, CORNER MONTEVIDEO AND PASEO DE JULIO, OPERATED BY THE GERMAN TRANSATLANTIC ELECTRICITY COMPANY

average fare is 10 cents paper (4.2 cents U. S.) for distances in the city proper, whereas higher rates are charged to the outlying sections and suburban towns, in which case transfers are given. Cars, as a rule, are equipped with cane

TYPE OF RECENTLY CONSTRUCTED SUB-STATION ON THE PASEO COLON, BUILT BY THE GERMAN TRANSATLANTIC ELECTRICITY COMPANY



EXTERIOR VIEW OF THE A. C. STATION OF THE GERMAN TRANSATLANTIC ELECTRICITY COMPANY



EXTERIOR VIEW OF THE GERMAN TRANSATLANTIC ELECTRICITY COMPANY'S DIRECT-CURRENT STATION

EXTERIOR VIEW OF THE THREE-PHASE STATION, CORNER MONTEVIDEO AND PASEO DE JULIO, OPERATED BY THE GERMAN TRANSATLANTIC ELECTRICITY COMPANY, BUENOS-AIRES

seats and backs, of the throw-over type, and are clean and neat.

In the table of statistics attached to this article only the principal lines now in operation in the heart of Buenos-Aires are given. There are a number of others either in course of construction or projected, some of which will operate in the city proper and others run to the suburbs. The most important of the former is the Tramway Rural, whose name is mentioned in the table as a horse road, the statistics being those of horse operation. This system has been almost completely changed over to electric, the first branch having been opened to public travel on March 11 of

CENTRAL CAR HOUSE OF ANGLO-ARGENTINE COMPANY

this year. With the completion of this company's lines, the old horse traction will disappear forever from this city's streets, with the exception of a few non-important short branches of other companies, none of which is in the business center.

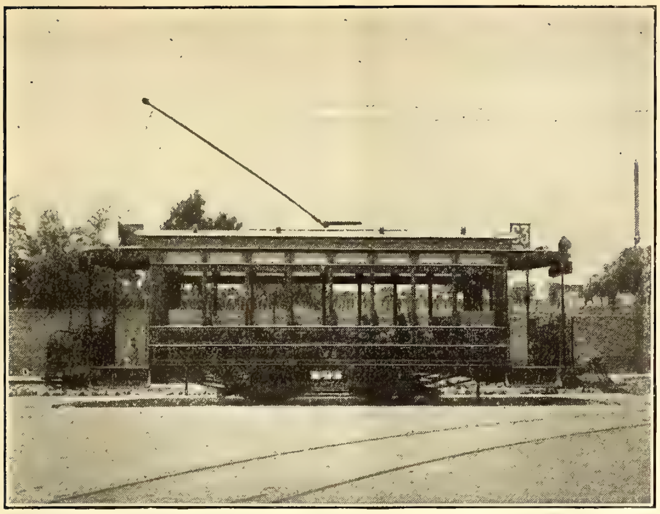
The Lacroze (Rural) Tramways will use Westinghouse motors on their cars, while the power house apparatus is all of the General Electric Company's make. These Westinghouse motors will be the first to be used on any of the city tramways, all the others being of European or General Electric manufacture. Experience with the European versus the American motor during the past ten years—for it is just ten years ago since the first electric railway was installed in Buenos-Aires—has pretty well demonstrated the fact that there is not a line in this city to-day costing less for maintenance of motive power, giving all-round better satisfaction, having fewer breakdowns, than the General Electric equipments originally installed on the Bright and La Capital lines, respectively the first two to be built. Many of the original parts of these first motors are still doing daily service, and, from all appearances, will continue to do so for some time to come. What is true of the motors is also true of the cars furnished these original lines, for after ten years of wear and tear carrying a population that is not of the elite, as the city lines are accustomed to carry, they are in far better condition to-day, both as regards looks and durability, than many of the more recent ones and cost much less for maintenance.

THE FLORES CAR HOUSE OF THE ANGLO-ARGENTINE TRAMWAY COMPANY

Of these lines not mentioned in the table, there is the Quilmes Brewery line, a private electric railway running from the city to the brewery at Quilmes, and owned by the brewery people. Entering the city by the Barracas Bridge, it runs over leased city lines to various distributing stations in Buenos-Aires.

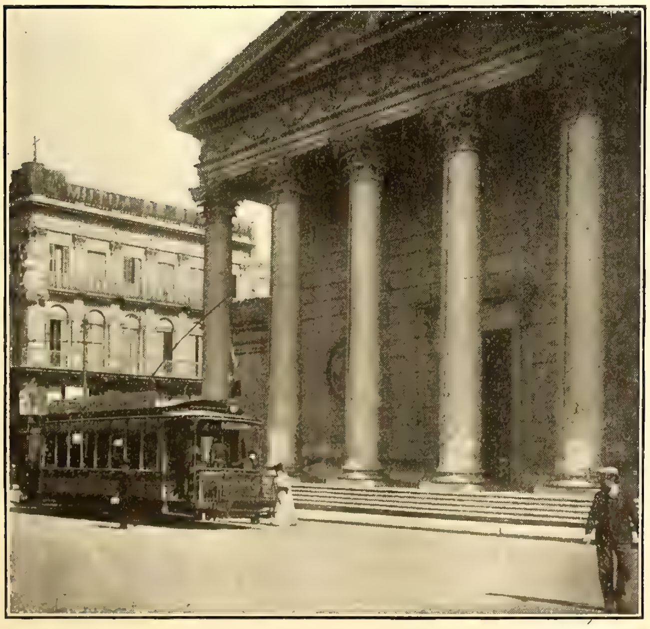
Another line in course of construction is the Tramways Electricos del Sud, which is destined to run from the Plaza de Mayo, in the center of the city, to Barracas, Lanús, Banfield, Lomas, Temperly and Adrogué, the last named being about 12 to 14 miles south of Buenos-Aires. All of these points are on the main line of the Great Southern Railway, except Adrogué, which is about 1½ miles from Temperly. As the Great Southern is the Pennsylvania of the South, as far as size is concerned, and as this proposed

LAS HERAS CAR HOUSE OF GRAND NATIONAL COMPANY

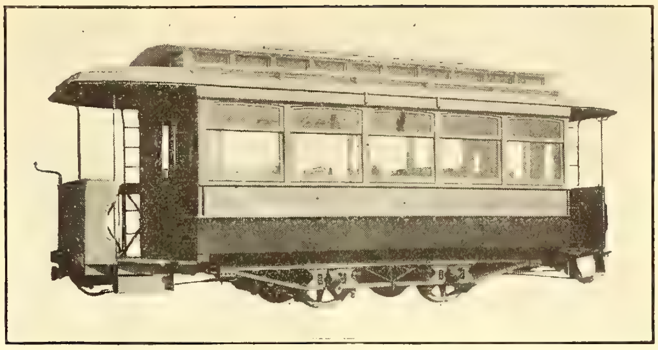


CAR OF GRAND NATIONAL COMPANY

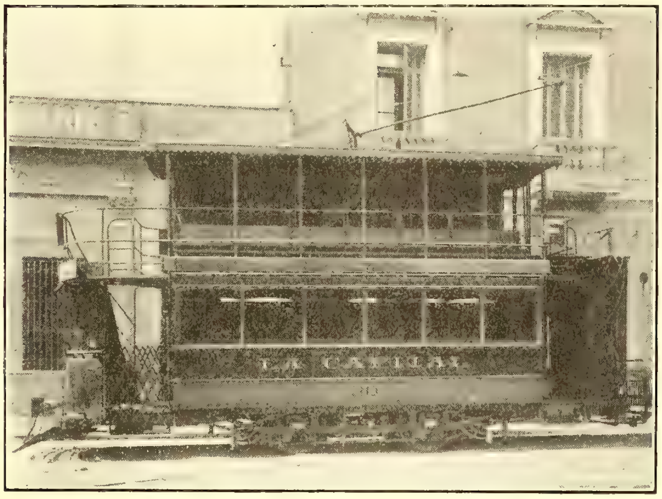
CAR OF BUENOS-AIRES ELECTRIC TRAMWAY COMPANY AT CORNER OF CORDOBA AND RIO BAMBA STREETS



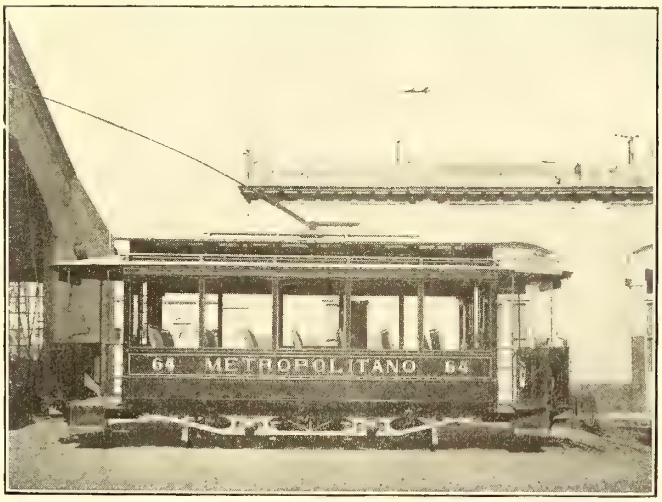
CAR OF BUENOS-AIRES & BELGRANO COMPANY AT CORNER OF RIVADARIA AND SAN MARTIN STREETS



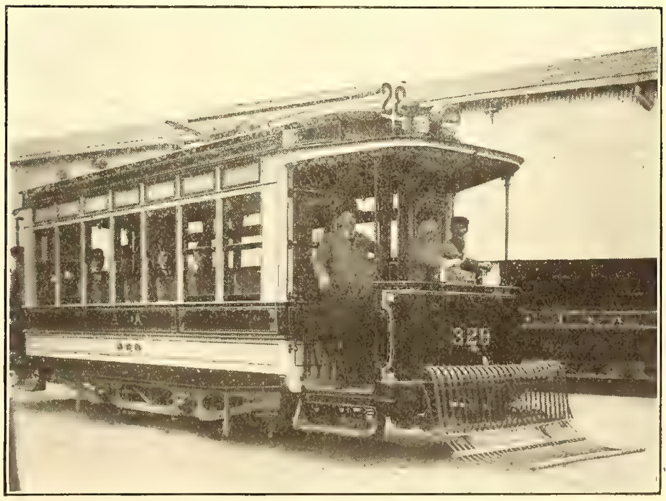
ANGLO-ARGENTINE AMERICAN SINGLE-TRUCK CAR



CAR OF LA CAPITAL COMPANY



CAR OF METROPOLITANO COMPANY



ANGLO-ARGENTINE SINGLE-TRUCK CAR

TABLE OF STATISTICS

	Anglo Argentine	La Capital	Gran Nacional	La Neuva.	Metropolitano	Buenos-Aires and Belgrano.	Tramway Electrico de Buenos-Aires.	Tramway Rural.	F. C. C. Argentine.	Total.
Kilometers electric..	157.944	55.514	81.666	Included in Gran Nat'l.	32.900	57.758	35.933	....	....	421.715
Kilometers, horse....	8.034	2.899	8.000	....	....	....	....	42.094	1.300	62.327
Number of cars......	Elec.....707	Elec..... 93	Elec.....342	....	Elec..... 90	Elec.....184	Elec..... 85	....	....	Elec.... 1,501
	Horse... 85	Horse... 40	Horse... 70	....	....	....	....	Horse...177	Horse.....2	Horse....374
Cars in daily service..	Elec.....535	Elec..... 66	Elec.....145	....	Elec..... 55	Elec.....107	Elec..... 58	....	....	Elec......966
	Horse... 2	Horse... 2	Horse... 15	....	....	....	....	Horse...100	Horse... 2	Horse....121
Make of cars........	St. Louis and Dick Kerr.	Brill & Dick Kerr.	Dick Kerr & Co.	....	German....	Brill, Barney & Smith, Dick Kerr.	Jackson & Sharp, Dick Kerr.	....	....	....
Style of cars.........	Closed......	Double deck and closed.	Closed......	....	Closed......	Closed and open.	Closed and open.	Closed and open.	Closed......	....
Motor equipments...	A. E. G and Dick Kerr	G. E.......	G E and Dick Kerr	....	A. E. G....	G. E. and Dick Kerr.	G. E. and Dick Kerr.	....		....
Brakes.............	Rheostatic..	Hand.......	Hand......	....	Rheostatic..	Electric disc.	Electric disc.	....		
Gross earnings, 1906.	Paper. $9,161,812	Paper. $2,017,449	Paper. $3,526,175	....	Paper. $1,171,432	Paper. $2,194,378	Paper $852,830	Paper. $1,628,386	This line belongs to the Central Argentine Railway. No data obtainable.	Gold. $9,014,210
Net earnings........				Not obtain	able.					
Car miles run, 1906..	....	....	....	....	....	....	....	....		
Pass'grs carried, 1906.	....	....	....	....	....	....	....	....		200,689,354
Passengers carried in January, 1907.....	7,556,630	2,061,969	3,139,913	....	962,595	1,600,931	729,538	1,302,771	17,365,878	
Gross earnings for January, 1907.....	Paper. $745,028.65	Paper. $193,863.88	Paper. $317,557.41	....	Paper. $97,539, 19	Paper. $187,102.98	Paper. $79,975.76	Paper. $140,768.50	Paper. $563.05	Gold. $747,138.60
Authorized capital...	£2,900,035	£1,400,000	£625,000	£415,000	....	£850,000	£250,000	£875,000	....	

trolley will parallel it almost all the way, a keen competition can be looked for, for a while at least, the result of which will be watched with interest. Was this line being equipped with the long, well-furnished, high-speed interurban cars so common in the United States, instead of short 28-ft., comparatively slow-speed cars, like those in use on the city lines, it would have a much better chance of accomplishing its aim. To compete for suburban business with this large steam system, a trolley system must, first of all, be cheaper, give a more frequent service, and make the distance in about the same or better time. This cannot be done with small cars or the use of low potential current as a motive power.

CAR OF ANGLO-ARGENTINE COMPANY

A high-speed, up-to-date line is projected from Buenos-Aires to La Plata, the capital of the Province of Buenos-Aires, and distant from this city about 30 miles. It is proposed to run these cars at 100 km (62 miles) an hour.

Still another high-speed line is projected from Belgrano (now a part of Buenos-Aires) to the Tigre, a well-known summer resort on the Lujan River, that would also parallel a steam road and pass through a number of well-populated towns. It would be naturally a summer road and should count on a good business from November to April.

At the time this article is written, a large fire has just occurred in the erecting and repair shops of Boeker & Company, of this city, who do most of the assembling of new and repair old cars for the various tramway lines. Among the cars in these works at the time were a large number of new Lacroze electric cars that had not yet been put in service, some erected, some partially so, and a number still unboxed. In all, they lose about thirty-seven new cars. The Quilmes Brewery line also loses some cars.

Advertising signs are frequently used on the outside of the cars, as is done in London, Berlin and Paris, but which are seldom seen in the United States. In addition, the interior of the car is generally used for this

TRAIN OF ANGLO-ARGENTINE COMPANY

purpose, as it is in cars of American electric railways.

In the United States, when cars get bunched on a double track system, the inspectors are accustomed to turn some back, using the first convenient cross-over for that purpose to cover the road and keep up something of the regular schedule. This is not practiced in the streets of Buenos-Aires, because of the excessive red tape necessary to accomplish it and the interference of the municipal authorities. The result sometimes is that great numbers of cars belonging to the same line are going in the same direction more than half of them empty, while the return part of the system is uncovered, greatly to the disgust and loss of patience on the part of the traveling public and the frequent missing of train connections.

If the present plans are consummated, the existence of a large part of it, if not all of the independent lines in Buenos-Aires, will soon be a matter of history. This will be brought about by the organization of the General Buenos-Aires Tramway Company (Compania General de los Tranvias de Buenos-Aires), a Belgian corporation, whose announced purpose is to consolidate all of the street railways in Buenos-Aires. The ample financial backing announced of the company insures the consummation of its plans. The headquarters of the company are in Brussels, and its capital stock is 65,000,000 francs. Of this 65,000,000 capital stock 45,000,000 have already been subscribed. The remaining 20,000,000 are reserved to retire the 100,000 francs common stock of the Anglo-Argentine Company. The directors are J. Allard, of Brussels; Eugene Baelde, of Brussels; Chevalier de Bauer, president of the Bank of Paris and the Netherlands, Brussels; R. Boulvin, director of the Parisian Street Railway Company; L. Cassel, banker, Brussels; Ch. Cicogna, president of the General Belgian Company of Electrical Enterprises; Viscount de Jonghe, director of the General Company of Light Railways; V. Fris, Senator and president of the International Bank of Brussels; J. Hamspohn, director of the Allgemeine Electricitäts Gesellschaft, of Berlin; D. Heinemann, manager of the Financial Company of Transportation and Industrial Enterprises, of Brussels; Leon Janssen, president of the Brussels Tramway Company; M. Lazarus, manager in London of the National Bank of Discount of Paris; J. Lowe, director of the Allgemeine Electricitäts Gesellschaft, of Berlin; H. Monnon, assistant manager of the Brussels Bank; W. Mueller, of Berlin; O. Oliven, of the Allgemeine Electricitäts Gesellschaft; Alfred Peltzer, of Verviers; Franz Phillipson,, of Brussels; A. Solomonsohn, manager of the Discount Bank, of Berlin; H. Stern, managing director of the Bank of Brussels; T. Frame Thomson, manager of the Grand National Company, of Buenos-Aires, and M. Wigand,

A PART VIEW OF IGUAZU FALLS, WHICH ARE 2.5 MILES WIDE AND 230 FT. HIGH. IT IS POSSIBLE THAT THESE FALLS WILL SOMETIME BE USED TO OPERATE THE TRAMWAY LINES IN BUENOS-AIRES

CAR OF GRAND NATIONAL COMPANY

STREET RAILWAY COMPETITION IN ENGLAND—ITS CRITICAL EFFECT UPON STEAM RAILROADS

BY ADAM G. WHYTE

Probably there are not many steam railroad men who are ready to follow President Tuttle, of the Boston & Maine Railroad, mentioned in your recent issue, when he suggests that short-distance traffic should be surrendered to the trolley lines. Where an interurban steam line is paralleled by an electric line there must, of course, be a certain amount of adjustment, but it is an adjustment which at least precedes, rather than follows, the hauling down of the flag. However, as the question of surrender is being debated, it is highly interesting to note the similar capitulation which is taking place in Great Britain. Practically all the big steam lines there admit that the suburban traffic no longer pays them, and many of them are accordingly taking steps to reduce the short-distance train service. In London, where the forces have been most active, the change is most conspicuous. The allied South-Eastern and Chatham railways, for instance, have abandoned the service which connects Plumstead, Blackheath and Greenwich across London with the Great Northern Railway. They have reduced the North Kent and Bexley Road services, and canceled many trains on the Crystal Palace and Catford loop-lines. The Ludgate Hill and Victoria services are also to be reduced. These changes are expected to result in the saving of several thousands of pounds yearly in wages and expenses. They are typical of what has already taken place, or is about to take place, both in London and in the Provinces. It may be stated confidently that all the steam railway companies engaged in suburban traffic are giving serious attention to the elimination of unremunerative trains on routes also served by electric street railways. In the course of the summer other reductions are expected to be announced by some of the London railroads. In one or two instances stations have actually been closed.

The situation is well summed up in the following passage from the London "Daily Telegraph":

> Local traffic has largely transferred itself from the railways to the road vehicles. From their termini in London to six miles beyond in almost every direction there is but a small proportion of the former patronage of the railways. By particular trains on particular lines the change is really pathetic. Some six or seven years ago, for instance, the last suburban train leaving Victoria station, on the Metropolitan extension, was one of the busiest throughout the day. People from the theaters, late workers, and others bore it a loving affection. They crowded to it and filled it from end to end. What is the case now? All these crowds will be found climbing on to the cars beneath Big Ben and along the embankment, or mounting the motor 'buses anywhere between Westminster and Piccadilly, Charing Cross and Blackfriars. Victoria Station in that section is a comparatively deserted place; the train steams off with its compartments much less than half filled, and the people are conveyed homewards so rapidly and cheaply by the new ways that there is no likelihood of the old conditions being revived. Look at the map, and you will find that the line of the South Eastern Company runs almost parallel with the highway right to Maidstone, passing through many towns of considerable size. Once they had a large shopping traffic between all those towns, but now there are tramways nearly the whole distance running alongside the railways, stopping at countless places, and charging trivial fares. The transference of custom was inevitable and natural. And what has happened in London has happened throughout the Provinces. Short distance suburban railway traffic is becoming less and less an important part of the services; the trains cannot comply with the whims and choice of the people, but the trams and 'buses are accommodating.

It is necessary to recognize, however, a very important difference between the situations in America and England. American trolley lines are practically all under private control and their competition with the steam railroads is the rivalry of one business undertaking with another. But British tramways are, in the majority of cases, municipally owned and municipally worked. They pay nothing for their right of way; any road widenings which they involve are charged, for the most part, against the general district rate and not to the tramways account. They are managed by committees of politicians who are less concerned with organization on a business basis than with the securing of popularity by concessions to the public. The scale of fares has been determined by promises made at election times, with the result that it has been forced lower than prudent business considerations would permit. The facility with which losses may be met out of the rates or concealed by the confusion of municipal accounts, or by inadequate allocations to reserve, maintenance and depreciation, enables local authorities to continue making concessions which no undertaking worked on ordinary business lines could attempt. An artificially low standard of fares has thus been set for municipal tramway services, and the tramway companies are obliged, by pressure from the local authorities who control their franchises, to adopt the same standard. The steam railway companies, which have to compete with the subsidized tramways, are compelled to follow in the same direction or lose the business. In many cases they followed as far as they dared, and hoped to recoup themselves with increased traffic. But the result has been such that they now prefer to lose the traffic. And the irony of the situation is revealed in the fact that the railway companies are among the largest taxpayers and have to provide, out of their profits, the money to meet the losses on the tramway undertakings which are filching their business by unfair competition.

The situation has grown so serious that Sir George Gibb, deputy-chairman of the Underground Electric Railways Company, of London (the company associated with the name of the late Mr. Yerkes), publicly stated recently that none of the passenger transportation companies in London was doing business at a profit. There is a definite movement among the companies towards an increase in fares to a remunerative level, and they are all pressing for the appointment of the London Traffic Board in order that the question may be referred to a permanent and responsible body of experts. Now that the London County Council, which has hitherto been the great anti-business force in London, has passed from the control of the progressives into the hands of the municipal reformers, who are pledged for efficiency against sentimental socialism, it may be possible to bring about some reform. But the steam railroads are not awaiting the problematic outcome of an unpopular agitation. They are meeting the situation in two ways, the first of which has already been described. They are reducing suburban business to a minimum along the routes where tramway competition is keenest, and they are also making most strenuous efforts to develop the longer-distance traffic. Hitherto the bulk of the daily business traffic to the London termini has been from suburbs which have gradually been absorbed into London itself. Beyond a 10-mile radius or even a 6-mile radius the bulk of "bread-winners traffic" has been comparatively small. The train service from outlying districts was infrequent and slow, owing to the congestion of suburban trains at termini where the accommodation at rush hours was quite inadequate. It was the

ambition of the late Mr. Yerkes to get over this difficulty by the combination of tube and tramway, which, with a low, uniform fare, would enable the bread-winner to live much further out of London than he does at present. But the realization is likely to come from the railroads themselves. They are relieving the congestion of the terminal lines by reducing the short-distance suburban service, and they are putting on fast trains for business men even from places up to 50 miles from London. By means of these trains and reduced season ticket rates they hope to develop a large daily traffic which is quite independent of the socialistic vagaries of Town Councils.

The new train arrangements between London and Brighton may be taken as typical of how the companies are going to work. Brighton is 50 miles from London, and the special business trains will do the journey in one hour and ten minutes. Second-class season tickets are offered at £25 per annum, which works out at about 1/7d. per business day, or ¼d. per mile. The rates are so low that some critics have imagined that the Brighton Company is jumping from the municipal devil into a deep sea of its own contriving; but as the South-Eastern, Great Northern, South-Western and Great Eastern Railways are making similar concessions, the economic aspect has evidently been carefully studied by a sufficient number of experts. The point is, of course, that the daily business trains are to be regarded from the railroad managers' point of view as special excursion trains, where the volume of traffic is closely pre-determined. Such traffic can be carried profitably at a very low rate. Probably the companies are also calculating upon an increase in general traffic, both passenger and freight, as a collateral to increased bread-winners' traffic to such places as Brighton.

As matters are still in the experimental state, it is impossible to do more than indulge in forecasts. But the railway companies are confident that the low rates, rents, and taxes, the cheaper cost of living and the healthier conditions of regions beyond the 20-mile radius will make the country or seaside home quite a feasible and attractive proposition to the London business man of moderate means. It is quite possible that a great revolution in the conditions of living will be brought about by the cheap business express train. But perhaps the chief point of interest to the American railroad manager is the virtual confession, which this new departure involves, that short-distance suburban business has lost its attraction to the British railway. It is an exhausted field, rendered barren by the depredations of municipal invaders acting in the name of the public. Full compensation for this loss may ultimately be secured by the growth of the long-distance traffic, which in any case is more readily worked at a profit by a steam railroad. The attempt is not without heroic qualities or lacking in particular interest to American railroad men, but in view of the difference in circumstances President Tuttle must not regard it as a confirmation of his pessimistic views about the necessity of surrender to the competing trolley.

LOS ANGELES ANNUAL FLOWER FESTIVAL ATTRACTS GREAT CROWDS

It is officially estimated that the interurban electric railways carried to Los Angeles from Southern California points more than 100,000 passengers to see the floral parade of La Fiesta de las Flores on May 10. Cars were operated every five minutes between the hours of 8 a. m. and 11 a. m. Pasadena sent more than 20,000 people.

DISCUSSION ON SINGLE-PHASE TRACTION

Apropos of the discussion on single-phase traction at the meeting of the American Institute of Electrical Engineers last week, that occurring at the March meeting of the Chicago branch of the Institute will be of interest. It followed the presentation of a paper on the subject of electric railway systems by W. J. Davis, of Schenectady.

James Hessin, general manager of the Bloomington, Pontiac & Joliet Railway, said that the single-phase system managed by him had proven a success from an operating standpoint. Records show that a car mileage of from 75,000 to 85,000 miles is made with one turning of the commutator and that one set of carbon brushes usually lasted 5000 or 6000 miles. The cars, he said, weighed 35 tons and were geared to 42 miles an hour. Trailers were frequently hauled.

In reply to a question from E. F. Gould, electrical engineer of the Aurora, Elgin & Chicago Railway, as to the relative cost of maintenance of d. c. and a. c. overhead systems, Mr. Davis replied that the line material had in the past been the weakest part of the a. c. system, but good overhead material was now being gotten out. The a. c. system had not been in service long enough to get actual figures on the maintenance of its overhead, but the speaker did not think the catenary construction would entail as great expense as ordinary d. c. overhead construction.

William A. Blanck, electrical engineer, Chicago, thought that by putting sub-stations 32 miles apart, as mentioned in Mr. Davis' paper, the liability to interruption of service would be increased because of the extent of line depending on one sub-station. He wondered if for this reason alone it would not be advisable to place the sub-stations closer together. Mr. Davis did not think this a sufficient reason for increasing the number of sub-stations, but said it might be well to put cut-out switches on poles at frequent intervals, so as to cut out a section of the trolley for repairs in case of break-down. Mr. Davis added that instead of having sub-stations close together, he expected to see the time when sub-stations would be eliminated entirely.

To the additional question of Mr. Blanck as to whether or not the necessity of running the alternating-current cars over portions of direct-current systems in order to get into terminal cities was not a point against the a. c. system, Mr. Davis said that the a. c. motor was built to operate as well with direct current as with alternating current. He said that sometimes a 600-volt, direct-current system and a 6600-volt alternating-current system could be combined advantageously. He mentioned one instance where on a road about 70 miles long it was desired to operate two or three-car trains under fifteen-minute headway on about 15 miles of the line and to send single cars at intervals of an hour over the remainder of the line. If the single-phase system were used throughout the length of the line all of the cars, about twenty-five or thirty, would have to be supplied with single-phase equipment, and the expense would be considerable. By using direct-current on the short portion of the line with the heavy schedule and alternating current on the remainder, it would be possible to operate the system with all but about five of the cars equipped with direct-current apparatus. This, of course, would lessen the investment. Mr. Davis added that at full speed the alternating-current motor has a 2 per cent to 3 per cent better efficiency when operating on direct current than when supplied with alternating current, chiefly because the core losses are smaller. As the number of stops per mile is in-

creased, however, the rheostat losses with direct current offset the better efficiency, so that with stops about 1 mile apart the motor efficiency when operating on either of the two systems is about equal.

As to telephone and telegraphic interference, Mr. Davis said that there was considerable trouble in the early days, but that in the last year it had been found that with proper transposition and sometimes by putting transformers in the telephone lines all trouble was avoided. He said that a current of 150 amps. in the trolley was found sufficient to operate telegraph instruments when the telegraph lines were 12 ft. or 15 ft. distant.

Mr. Blanck wanted to know if with the alternating-current system, it was necessary to bond both tracks. He wondered if one track could not be reserved for use in connection with a signal system. Mr. Davis said that usually both the tracks were bonded, but on account of the smaller current this was not absolutely necessary, especially if the bonded rail was connected to a ground wire. He thought that it would be perfectly safe to use one rail in connection with the signal service operated with a frequency different from that of the trolley current if the bonded rail had connections with a ground wire.

H. R. King asked concerning the character of the generating equipment in the 1200-volt, direct-current system. Mr. Davis said that two 600-volt rotary converters were connected in series to obtain the desired voltage. This was considered advisable because of the difficulty of obtaining good commutation and the danger of flashing over with a high-voltage, direct-current machine. When operating on the 1200-volt system, the four motors of a car are connected in two sets of two motors in series.

A GRAPHIC METHOD OF DETERMINING TIE-ROD SPACING IN TRACK LAYOUTS

CLAUDE W. L. FILKINS, M. C. E.
(With Wm. Wharton, Jr., & Company, Inc., Philadelphia, Pa.)

The following graphic method of determining tie-rod spacing is rapid, gives results within a sixteenth of an inch, and requires no knowledge of advanced mathematics. The mechanical manipulation is stated briefly on the two-page supplement in this issue, but the underlying principles require a more detailed description.

In two concentric circles, two arcs included between two radii bear a fixed relation to each other. If r = inner radius, R = outer radius, g = radial distance between the curves, I = inner arc, E = exterior or outer arc and D = difference in length of inner and outer arcs; then

$$Er = IR$$
$$D = E - I = Ig \div r = Eg \div R.$$

Hence to find the difference between the two arcs, divide either arc by its radius and multiply by the radial distance between the curves. Having one arc, the other is thus readily obtained.

Let d = difference in length for a unit length of arc of radius r (or R as the case may be) and for any fixed gage g. Then $d = g \div r$ or d varies directly as the reciprocal of the radius, g being constant. Referring to the supplement in this issue, lay off from O the reciprocals of r to scale, erect perpendiculars, to scale, equal to the corresponding values of d as derived from the equation above and connect the upper ends of the perpendiculars. The result will be an oblique straight line passing through O. For other values of g, other oblique lines are obtained. Produce these oblique lines to the line AB marking the intersections to correspond to the value of g used in each case. Hence to find d erect a perpendicular at the point indicated by the radius r, find its intersection with the oblique line drawn from O to the given value of g on AB and scale the perpendicular. But in order to obtain readings for 10 ft. of arc, the perpendicular has been divided into ten times as many divisions as would have been necessary for an arc of 1 ft. and marked along the vertical CD to correspond.

For an arc less than 10 ft. take the proportional part of the difference thus: Follow vertically downward from the value of the given arc, as indicated along the top of the chart, to meet the oblique line joining O with the point on CD indicating the difference for 10 ft. of arc; then follow horizontally to CD and read the required difference. For an arc greater than 10 ft., break up the arc into lengths of 10 ft. and a shorter one, find the differences for the 10-ft. lengths and the shorter one and add the results. If the radical distance g be greater than 6 ft., break it up into portions less than 6 ft., proceed separately for d, and add results.

Illustration. Given r = 60 ft., g = 4 ft. 8½ ins., I = 6 ft. 6 in.; required E. From r = 60 ft. (lower horizontal scale) follow vertically to a straight line from O to 4 ft. 8½ ins. on AB, and from its intersection follow horizontally to CD and read 9⅜ ins. +. This is the difference for 10 ft. of arc. Join this reading on CD to O by a straight line and find the point on it directly beneath 6 ft. 6 ins. (upper horizontal scale), follow horizontally to CD and read 6⅛ ins. Hence the outer arc E = the inner arc increased by the difference = 7 ft. 0⅛ in. Observe that for the same r and g any number of differences may now be read off without further manipulation of the chart. Sixteenths or smaller fractions of an inch may be accurately estimated.

The oblique straight lines through O may be obtained temporarily by means of a straight edge, by means of a fine straight line drawn upon a thin arm of celluloid, or by means of a fine thread fastened at O. A clamp or weight will hold any of these devices in place. If the chart be mounted, local distortions should not take place. Uniform shrinkage will not destroy the accuracy of the chart.

The above graphic method may be used to obtain the spacings of ties, tie-rods and yokes in track work, of radial members in arches and structures, and wherever similar arcs on concentric curves are employed.

Derrah's "Street Railway Guide" of New England for 1907 has been issued. This work was first published ten years ago, and has grown in size correspondingly with the extension of the electric railway lines from 26 to 128 pages. Briefly, all points reached by trolley from Boston are arranged in alphabetical order, points from Providence south of Boston and Worcester are similarly arranged, as are also places from Worcester west of Boston and north of Providence. A person in Providence, for instance, who wishes to travel by trolley to some point north of Boston, will find in his own schedule the data regarding the trip to Boston, and under the Boston schedule the route to the point he wishes to reach. The points that are covered are the essential ones of where to go, how to get there, how much it costs and how long it takes. The descriptive matter has all been thoroughly revised. The cover bears a very tasteful design and shows a party of people riding in an open trolley car.

CHART FOR SIMILAR SPACING ON CONCENTRIC CURVES

Compiled by CLAUDE W. L. FILKINS, M.C.E.

DIRECTIONS FOR USE

Given the inner radius, the radial distance between two arcs and the length of the inner arc, required the length of the corresponding outer arc.

(a) Set a straight edge or thread to pass through *O* and the proper division on *AB*.

(b) From its intersection with the vertical for the given radius, follow horizontally to *CD* and note the accurate reading for this point. This reading is the difference in length between the inner and outer arcs for 10 ft. of inner arc.

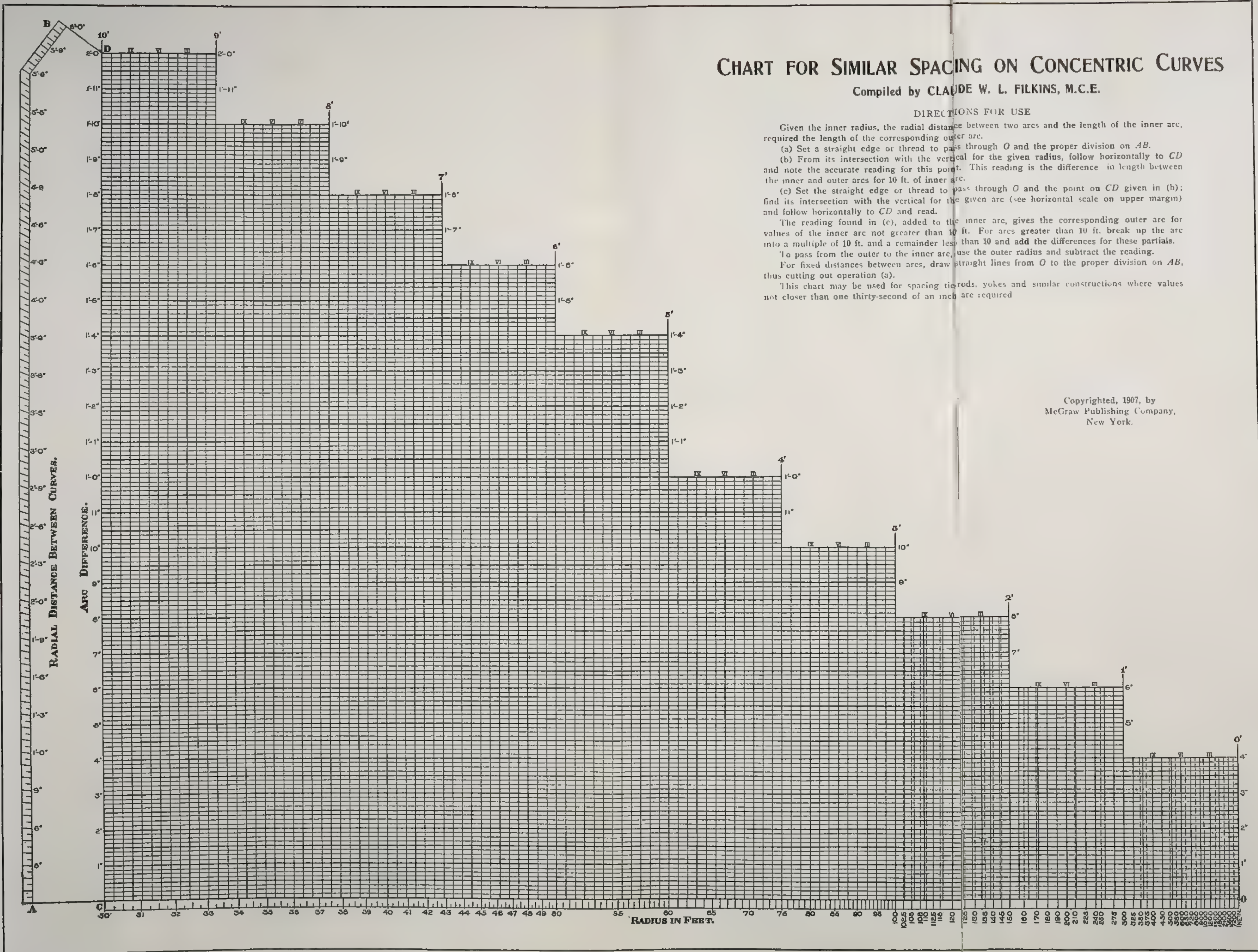
(c) Set the straight edge or thread to pass through *O* and the point on *CD* given in (b); find its intersection with the vertical for the given arc (see horizontal scale on upper margin) and follow horizontally to *CD* and read.

The reading found in (c), added to the inner arc, gives the corresponding outer arc for values of the inner arc not greater than 10 ft. For arcs greater than 10 ft. break up the arc into a multiple of 10 ft. and a remainder less than 10 and add the differences for these partials.

To pass from the outer to the inner arc, use the outer radius and subtract the reading.

For fixed distances between arcs, draw straight lines from *O* to the proper division on *AB*, thus cutting out operation (a).

This chart may be used for spacing tie-rods, yokes and similar constructions where values not closer than one thirty-second of an inch are required



ELECTRIC CAR BRAKING *

BY H. T. PLUMB
Assistant Professor of Electrical Engineering at Purdue University.

Every citizen living in a town where cars are operated on steep hills or at high schedule speeds has a right to say whether his life shall be jeopardized by the failure of one link that connects brake-staff and brake-shoe; but before he can talk intelligently he should know something of the theory and practice of car braking.

Fig. 1 shows an ordinary speed-time-distance curve. A careful examination of the distance curve *l—n* will show that the vital part of the braking process during an emergency stop is at the very beginning, from *c* to *d*. During the first ten seconds the distance passed over is about as great as that during all the remaining twenty-three seconds. It is, therefore, essential that an emergency brake should not only be capable of producing a high average rate of deceleration, but should be practically instantaneous in its action.

The braking curve *c—f* is not a straight line because it takes an interval of time *c—d* for the brake-shoe to grip the wheel, and because the coefficient of friction between the shoe and wheel increases somewhat at very low speeds *e—f*. From *d* to *e*, however, the deceleration is nearly constant at about 1.6 mile per hour per second. The average deceleration is 1.6 miles per hour per second, while the maximum is twice this value. In the foregoing the braking pressure has been assumed to remain constant. An experienced motorman would have reduced the pressure somewhat at *e* to avoid the sudden change in acceleration at the end.

The total time required to stop an electric car may be divided thus: The interval from the instant when the motorman first perceives the danger or the necessity for a stop

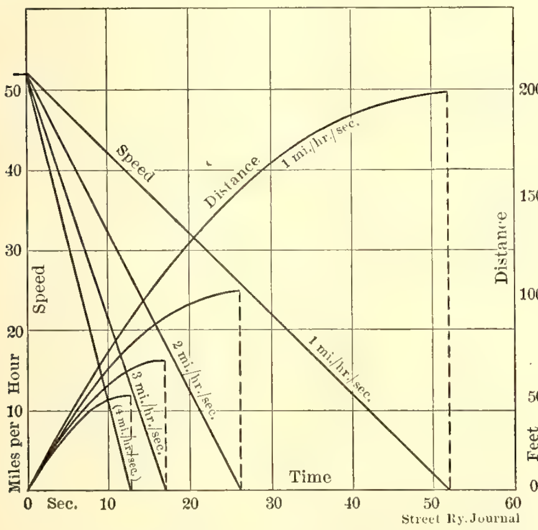


FIG. 2.—SPEED-TIME AND DISTANCE CURVES FOR BRAKING FROM 32 MILES AN HOUR

till his hand begins to turn off the power; the time to turn the controller to the "off" position, pull the sand lever and move the air brake handle; the time the air piston is taking up the slack in the brake rigging and setting the shoes against the wheels, and in which the brake-shoes "take hold" or "grip" the wheel surfaces; and the remaining time, during which the brakes are exerting their full force in stopping the car. Evidently the first three intervals are quite as important as the last, although they may not take as great a portion of the time.

In Fig. 1 the rate of deceleration is 1.6 miles per hour per second. Fig. 2 shows the result of braking the car at other rates. These theoretical speed-time and distance curves are similar to those shown at *c—f* and *l—n* in Fig. 1, and represent braking from the same speed. The curves show the importance of quick application in case of

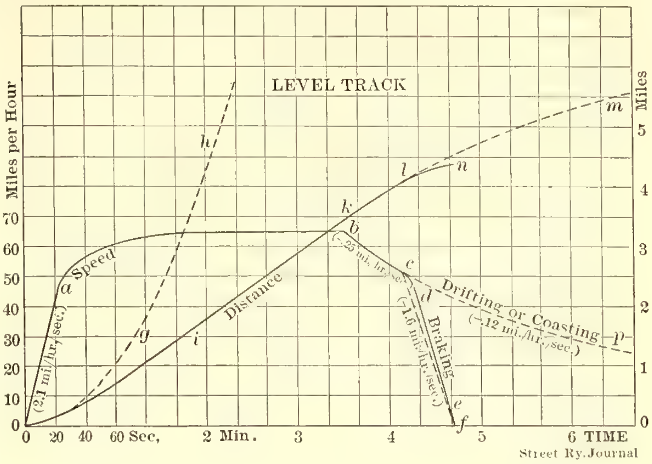


FIG. 1.—ORDINARY SPEED-DISTANCE CURVES

emergency braking. During the first half of the time required to stop, the car travels three-fourths of the total distance, while in the last half of the time the car travels only one-fourth of the total distance; hence any fault in the brake apparatus is more serious at the beginning than at the end of the braking period.

Fig. 3 shows the speed-distance curves corresponding to these several rates of deceleration. The curves are of considerable interest because they show at a glance the distance required to stop a car running at various speeds,

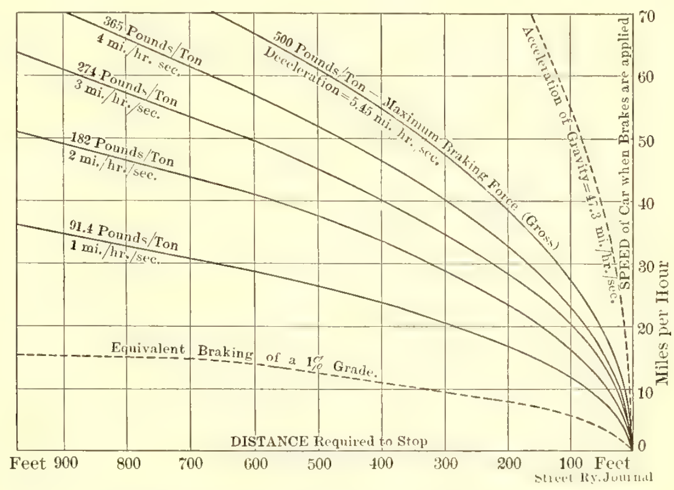


FIG. 3.—SPEED-DISTANCE CURVES CORRESPONDING TO SEVERAL RATES OF DECELERATION

with different rates of braking. Thus, the shortest possible distance in which a car could be stopped from a speed of 30 m. p. h. is 125 ft. With the ordinary hand brake, which does not have an average retardation much above 1 m. p. h. p. s., the distance required to stop the car from 30 m. p. h. is about 700 ft. This would be the "dangerous space" which such a car carries ahead of itself. It is important to shorten this danger space as much as possible.

The maximum deceleration is on the assumption that the maximum coefficient or friction between a rolling wheel

* Abstract of a paper presented at the Indianapolis meeting of the Indiana Engineering Society.

and the rail is 25 per cent. This corresponds to a gross braking force of 500 lbs. per ton weight of the car. As a matter of safety, the retardation must never reach this limit, for if the wheels slip they will lose their advantage because the coefficient of friction of a sliding wheel is only about half that of a rolling wheel.

There are other reasons why the braking force must never reach the theoretical limit. The coefficient may be reduced

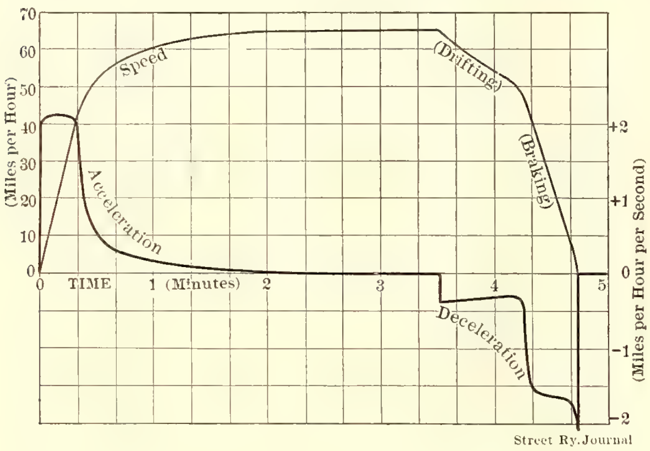


FIG. 4.—ACCELERATION AND SPEED CURVES

because of a slippery rail due to mud, wet leaves, etc. The effective weight on each wheel is changed at the time of braking because the car pitches forward onto the front axles. Thus the rear wheels might skid, although the average braking force was safely proportioned to the total weight of the car. The last objection can be partly overcome by a proper proportioning of brake levers.

Such speed-distance curves are most useful in answering questions after accidents have occurred: "What is the shortest possible distance in which the motorman might have stopped the car?" etc. Of course, it must be known

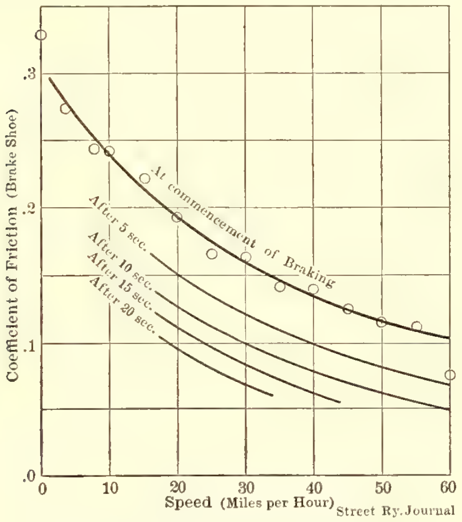


FIG. 5.—COEFFICIENT OF FRICTION AS AFFECTED BY SPEED AND TIME

approximately what braking force each kind of equipment is capable of exerting. Thus, for example, in case of emergency the ordinary hand brake might exert a retarding force of 90 to 100 lbs. per ton weight of the car and we would refer to the 1 m. p. h. p. s. curve. With an air brake the retardation might be somewhere between 1.6 and 2.3 m. p. h. p. s.

The acceleration (Fig. 4) is the rate the car changes its speed. This change may be positive when it is caused by the motors, or negative when it is due to train resistance and to braking. The acceleration at any time is the tangent of the speed-time curve. Hence the speed curve can be calculated by a point-by-point method. (See Mailloux, Trans. A. I. E. E., Vol. XIX., p. 1035.)

As soon as the car starts the acceleration rises almost instantly to a maximum value. It is approximately constant at this high value while the controlling resistance is being cut out. It then decreases in value, at first rapidly and then slowly. If the speed finally becomes constant then the acceleration is zero. At the instant the power is

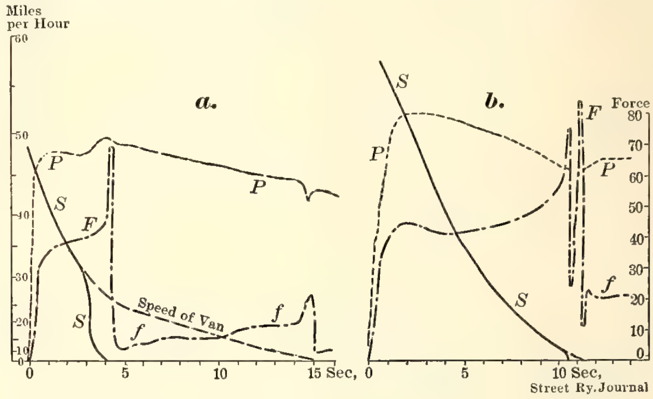


FIG. 6.—CURVES SHOWING THE EFFECT OF SKIDDING

shut off the acceleration becomes negative, the car slowing down because of train resistance. Notice that the deceleration is less as the speed diminishes. The motorman begins to apply the brakes at four minutes and ten seconds and soon afterwards the deceleration increases to a value of about 1.6. If the air pressure in the brake cylinders is constant we might now expect the deceleration to remain constant till the car stops. Notice, however, that it gradually increases as the speed decreases until just before the car stops the deceleration suddenly reaches a high maximum value (2.8) and then drops back to zero when the car has stopped. It is this last sudden increase which an experienced motorman will avoid by releasing the braking pressure somewhat just before the car settles to rest.

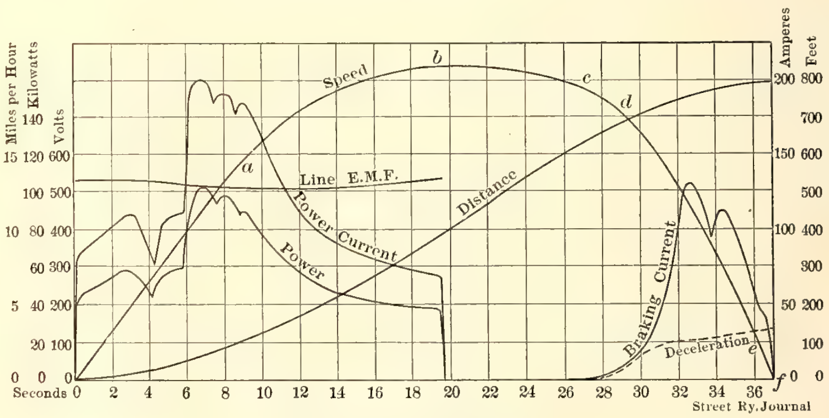


FIG. 7.—BRAKING TEST OF A SINGLE-TRUCK CITY CAR WITH MAGNETIC BRAKES

The reason for this peculiarly shaped deceleration is more evident from Fig. 5, which shows how the coefficient of friction is affected by the speed and the duration of braking. Each point is the average of from twenty to ninety separate observations. These are the famous tests made by Galton and Westinghouse in 1878. Notice how rapidly the coefficient diminishes with time and how much less it is at the higher speeds. These tests were made with cast-iron brake-shoes on steel tires.

Fig. 6 is also from the Galton-Westinghouse tests, and

shows clearly why the braking force should never approach too near the maximum limit. In these diagrams the line P represents the pressure applied to the brake blocks. The line F shows the retarding force of the brake blocks upon the wheels before the wheels slipped, and f shows the force while the wheels were sliding on the rails. The line SS represents the peripheral speed of the wheels in miles per hour, which, when there is no slipping, is equal to the velocity of the train. The abscissa shows the seconds duration of the test.

In test a the brake pressure P was kept approximately constant, but as the speed decreased the coefficient of friction increased so that the effective braking force F approached too near the limit. The wheels lost their "bite" on the rails, stopped revolving, and the braking force ff was reduced to less than one-third of the friction produced between the brake-shoes and the wheel when the brakes were applied to allow the wheel to continue revolving. It required fifteen seconds to stop the car, whereas it might have been stopped in half of that time if the pressure P had been reduced somewhat as the speed decreased or if the rail had been well sanded before slipping commenced. In test b the brake pressure P was reduced as the speed diminished, and as a result there was practically no skidding of the wheels.

There are two general classes of brakes, those which act on the track directly and those which act upon the rotating portions of the car. Some brakes combine both of these principles.

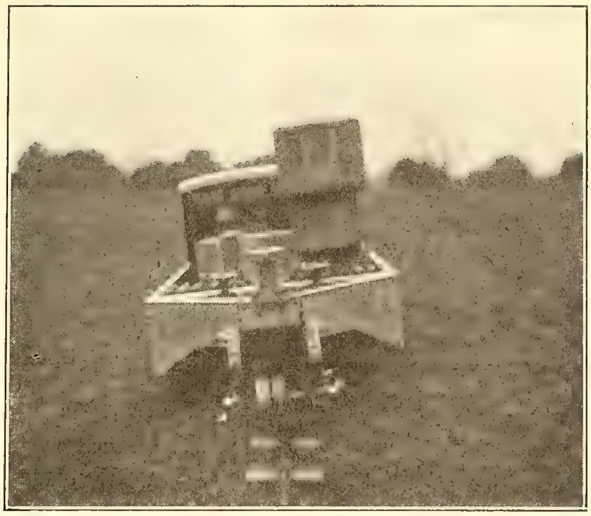
A powerful means of braking a car's speed is the torque of the motors themselves, either by attempting to run backward because of current reversal, or by acting as generators. One or both of these methods is commonly used by motormen in cases of emergency braking. Either may be very effective in the hands of an intelligent, self-controlled motorman, but is liable to fail when not skilfully used because too great a torque may cause the wheels to skid and lose the advantage of static friction between the wheel and rail.

The speaker then explained the construction of some typical wheel and track brakes and concluded with the presentation of Fig. 7. This gives the results of a braking test on a single-truck city car equipped with magnetic track brakes, and is reproduced from the report of the Electric Railway Test Commission. The speed during acceleration is represented by the curve o—a—b. The car was then allowed to drift from b to c. The brakes were applied from c to f, and the approximate deceleration during that time is shown by the broken line. The average retardation was about 2 miles per hour per second.

THE BRENNAN MONO-RAIL

In the last issue of the Street Railway Journal a brief description was published of the Brennan mono-rail line, invented by Louis Brennan, C. B., and exhibited by him at the meeting of the Royal Society in London on Wednesday, May 8. Photographs and additional details of the experimental system have since been received. Pictures presented herewith show cars in operation. One picture, in fact, shows how the car rights itself when unevenly loaded.

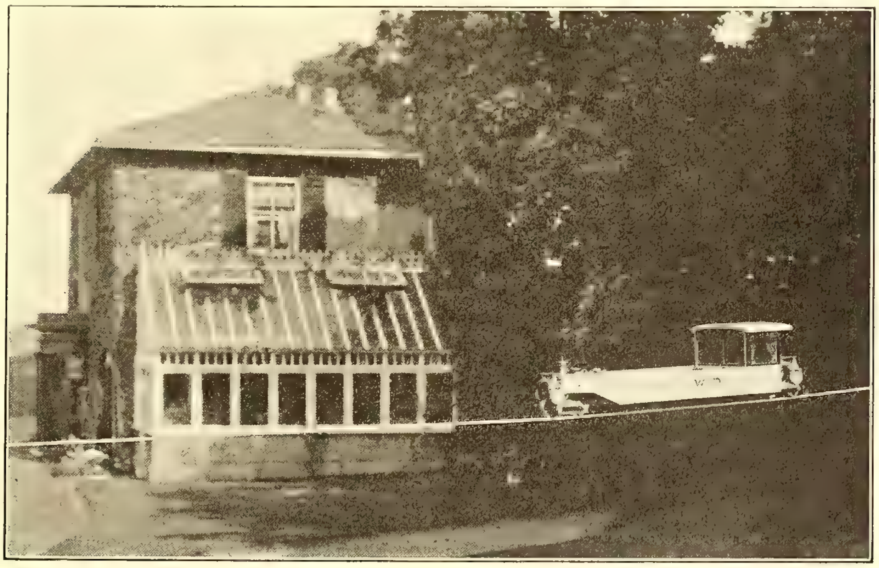
The feature of the system is that each vehicle is capable of maintaining its balance whether it is standing still or moving, notwithstanding that the center of gravity is several feet above the rail, and that wind pressures, shifting of load, and centrifugal action, or any combination of these forces may tend to upset the car. The mechanism consists essentially of two fly-wheels in vacuum, mounted so that they



EFFECT OF UNEQUAL LOADING ON MODEL

can be rotated in opposite directions by electric motors and their gyrostatic motion utilized. If the driving current is cut off, the wheels, it is said, will run for some time at sufficient velocity to impart stability to the vehicle.

The road wheels are placed in a single row beneath the



MODEL IN CENTER OF WIRE ROPE BRIDGE WITH 50-FT. SPAN

center of the vehicle, instead of in two rows near the sides as usual, and are carried on bogies or compound bogies, which are not only pivoted to provide for horizontal curves on the track, but for vertical ones also. By this means the vehicles can run upon curves of even less radius than the length of the vehicle itself, or on crooked rails or rails laid over uneven ground, without danger of derailment. Further particulars were published last week.

The motive power may be steam, petrol, oil, gas or electricity, as considered most suitable for local conditions. In order that the vehicle may be able to ascend steep inclines, the wheels are all power driven, and change gears are provided for use in hilly country.

MEETING OF THE CENTRAL ELECTRIC RAILWAY ASSOCIATION

The regular bi-monthly meeting of the Central Electric Railway Association, held May 23 at Indianapolis, was one of the most interesting and successful during the life of the association. The meeting was in the Claypool Hotel, where the Ohio and Indiana Associations amalgamated nearly two years ago. The attendance was fully up to the average, the interest and enthusiasm unsurpassed and the sessions held strictly to business by President Nichols.

President Nicholl called the meeting to order promptly at 10 a. m., and, after the usual introductory remarks, announced that the next meeting would be held at Columbus, Ohio, on the fourth Thursday of September. He stated that the financial affairs of the association were in a flourishing condition, but while the supply men are doing nobly, the finances are not coming in as rapidly as anticipated, due to the fact that several traction companies and members are delinquent.

Mr. Nicholl announced that three new companies had joined the association since the last meeting, viz.: Marion, Bluffton & Eastern, Chicago & Interurban Railway Company and the Fort Wayne & Springfield Traction Company. Six new members had also been added to the list. Mr. Spring said that inasmuch as the association had taken an active part and received favorable consideration at the national convention at Columbus, he moved that the association send a committee of two—one the president and one other selected by the president—to represent the association before the American Street & Interurban Railway Association at Atlantic City. The president said he would announce the committee later.

The first paper was the following, on "Modern Train Dispatching," read by J. K. Gray, train master of the Western Ohio Railway Company, Lima, Ohio.

MODERN TRAIN DISPATCHING

Not until recently have the managers of electric railways given very much attention to the most important part of train operation, the dispatching of trains. They have, however, lately come to realize that it is just as important to dispatch electric trains safely as steam trains. Both should be operated as nearly in the same manner as conditions will permit. There are still some electric roads that operate without a train dispatcher, but use the car house foreman or some centrally located, trusted employee, who does this as a kind of a side line along with his regular duties. This system seems to work very well where trains run slowly. When a train arrives at a given meeting point, in most cases the motorman calls up the car house or shops and says to the acting dispatcher, "This is Brown at Siding No. 4, Jones is not in sight"; the acting dispatcher will say, "Jones left Yorkville fifteen minutes late, stay there until he comes," which they do, making a collision impossible; or if the telephone is not in working order the crew just sits down and waits for the opposing train.

The modern dispatching system is handled by a trustworthy man, preferably taken from the train service, where he has been for a period of time long enough to acquaint himself with every inch of the property, and is thoroughly competent to hold a position where safety to both passengers and property must be assured regardless of cost and the speedy operation of trains.

The dispatcher's office should be in a large, well-ventilated room with plenty of light, and the door locked to all, for the presence of any person in the dispatcher's office is liable to distract his attention and cause him to make a mistake. His office should be centrally located as nearly as possible so he can communicate with the trainmen distinctly, directing the movement of trains in addition to the movements provided for in the rules and time card.

When the printed time tables, showing the meeting and passing points, the time of all scheduled trains and the rules directing how these trains are to proceed with relations to each other, are studied, thoroughly understood, and faithfully observed by all, collisions will not occur.

There should be a good desk set where the telephone line is on the same poles on which the high transmission line is carried, for it has happened that a live high-tension wire has fallen on the telephone line and had no bad effect whatever on a desk set; where the telephone line is on a separate line of poles, a cordless telephone board equipped with two-way cams and numbered drops will give excellent service, but a live high-voltage wire falling on a line connected with this box will render the same at once unfit for service.

Form O—109. 40m C9-06.

THE WESTERN OHIO RAILWAY CO.—TRAIN ORDER.

Order No.................. Date.................. 190...

To Motorman and Conductor.

No.............. Motor.............. at Siding..............
1 Meet No.............. Motor.............. at Siding..............
2 Meet No.............. Motor.............. at Siding..............
3 Meet No.............. Motor.............. at Siding..............
4 ....
....
5 Report at Siding..............................
6 Proceed to Siding.............. against No.............. and report.
7 No.............. of this date is annulled between.............. and..............
8 No.............. will run ahead of No.............. to..............
9 Run as.............. Section No.............. from.............. to..............
10 Will run Extra from.............. to.............. and return to..............

Complete at..............M .... Dispatcher......

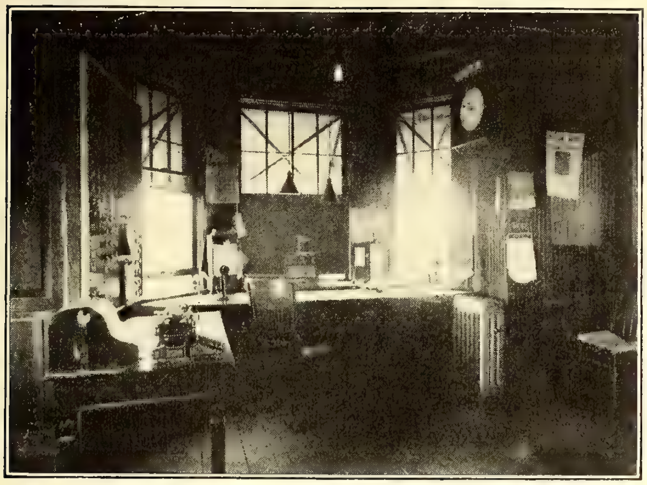
FORM OF TRAIN ORDER

A regular train sheet must be kept and all train movements recorded just as soon as any train reports or is reported, and when one dispatcher relieves another all orders must be written on the prescribed form and placed in a conspicuous place so there will be no misunderstanding. There should be three dispatchers daily, each working an eight-hour shift, to produce good results.

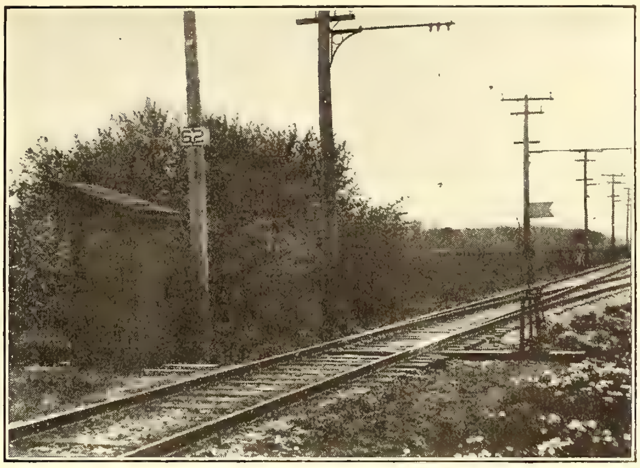
To obtain good results from trainmen, they are first required to pass the examinations specified by the company, which include eye, ear and physical stripped. If they qualify, they are given a rule book and time card, with instructions to study carefully. The student is then placed on a train with a competent man, who teaches him everything possible pertaining to his division. After the recruit has learned a division, he is called to the office and examined thoroughly, especially on train orders; after he has become acquainted with all the divisions he is again subjected to an examination. If he understands the rules and train orders thoroughly, he is then permitted to operate a train with an old trainman, either motorman or conductor, as the case may be.

To obtain orders from the dispatcher on the road I represent, the motorman or the conductor, as the case may be, steps into a telephone booth, 3 ft. x 3 ft. x 8 ft., with a window in each side, 18 in. x 24 in. He gives one short ring which calls the dispatcher, then tells his train number and siding number to the dispatcher, who gives such or-

ders as are necessary; the trainman repeats the order as it is given and writes the same on the prescribed form, making two copies by the use of carbon paper. He then repeats the order to the dispatcher, who checks it from in a clip fastened on the window sash directly in front of the motorman, and the conductor places his copy in a clip in the rear end provided for him. Thus both orders are in plain sight until the same is fulfilled, superseded or



INTERIOR OF DISPATCHING OFFICE



TELEPHONE BOOTH ON LINE

THE WESTERN OHIO RAILWAY COMPANY

Train Sheet.

Dispatchers { ....from............M. to............M. / ....from............M. to............M. / ....from............M. to............M. / ....from............M. to............M. }

For..................the..................day of..........................190....

Power { On.,............M. / Off..............M. }

Extra Trains			South Bound Trains									North Bound Trains			Extra Trains	
Motorman								Motorman								Motorman
Conductor								Conductor								Conductor
Train No.								Train No.								Train No.
Motor No.								Motor No.								Motor No.
Findlay 2.3 Siding 121 4.8 Siding 119 7.5 Siding 117								Findlay 2.3 Siding 121 4.8 Siding 119 7.5 Siding 117								Findlay 2.3 Siding 121 4.8 Siding 119 7.5 Siding 117
Rawson 9.7 Siding 113 Mt. Cory 13.2 Siding 109								Rawson 9.7 Siding 113 Mt. Cory 13.2 Siding 109								Rawson 9.7 Siding 113 Mt. Cory 13.2 Siding 109
15.9 Siding 107 16.3 Bluffton 19.2 Siding 105 22.3 Beaver Dam								15.9 Siding 107 16.3 Bluffton 19.2 Siding 105 22.3 Beaver Dam								15.9 Siding 107 16.3 Bluffton 19.2 Siding 105 22.3 Beaver Dam
25.7 Siding 103 28.9 Siding 101 31.0 Siding 99 32.3 Lima								25.7 Siding 103 28.9 Siding 101 31.0 Siding 99 32.3 Lima								25.7 Siding 103 28.9 Siding 101 31.0 Siding 99 32.3 Lima
Siding 4 34.4 Siding 5 35.0 Siding 8 35.3 Siding 10								Siding 4 34.4 Siding 5 39.0 Siding 8 35.3 Siding 10								Siding 4 34.4 Siding 5 35.0 Siding 8 35.3 Siding 10
35.9 Siding 11 39.8 Siding 14 40.5 Siding 17 Cridersville								35.9 Siding 11 36.8 Siding 14 40.5 Siding 17 Cridersville								35.9 Siding 11 36.8 Siding 14 40.5 Siding 17 Cridersville
41.7 Siding 20 46.5 Siding 26 47.9 Wapakoneta Siding 27								41.7 Siding 20 46.5 Siding 26 47.9 Wapakoneta Siding 27								41.7 Siding 20 46.5 Siding 26 47.9 Wapakoneta Siding 27
50.8 Siding 32 53.9 Siding 35 56.9 Siding 38 57.9 St. Marys								50.8 Siding 32 53.9 Siding 35 56.9 Siding 38 57.9 St. Marys								50.8 Siding 32 53.9 Siding 35 56.9 Siding 38 57.9 St. Marys
58.0 Siding 41 59.9 Siding 53 62.7 Siding 57 65.4 Siding 59								58.0 Siding 41 59.9 Siding 53 62.7 Siding 57 65.4 Siding 59								58.0 Siding 41 59.9 Siding 53 62.7 Siding 57 65.4 Siding 59
67.8 Celina								67.8 Celina								67.8 Celina

the original order transmitted, and if it is correct the dispatcher will complete the same by giving the time and his initials. The motorman retains one order and gives the other to the conductor, who reads the order over to the motorman before the train is allowed to proceed, thus causing a double check. The train order is then placed annulled. We prefer the motorman, but permit either the motorman or conductor to receive orders from the dispatcher, for the purpose of avoiding the least possible delay. Our telephone booths are located at the switch point of sidings, so when the conductor opens the switch to allow his train to take a siding he is right at the telephone booth,

while the motorman is on the car probably 100 ft. from the booth. Hence, by having the conductor report and receive the train order we save sometimes two to three minutes. In towns or cities the motorman invariably takes the orders, as the conductor is busy at the rear platform while at stations.

The telephone is used entirely for train dispatching on our road and excellent service is obtained. Eighty miles of the system consists of two No. 9 galvanized iron wires carried on cross-arms in the usual manner, on the same poles underneath the high transmission lines, and transposed every ten poles to prevent interference from parallel power and feeder lines; 32 miles consists of two No. 12 copper lines constructed the same as the iron line, with the exception of the transposition which is rolling every ten poles.

On this line all the dispatching and commercial conversations are carried, keeping the line very busy at times; but if proper attention is given to the telephones and telephone line, good results will be obtained. There are twenty-eight telephones on the line at all times and thirty-eight 'phones located in telephone booths that have cut-out switches. By connections, using just the ordinary one-way switch, the dispatcher can communicate with Dayton, a distance of 60 miles; with the Toledo city limits, a distance of 94 miles; with New Haven, Ind., a distance of 72 miles, and with Springfield, a distance of 70 miles.

This road is divided into three divisions, viz., Findlay-Celina Division, 68 miles, operating seventy-eight passenger trains and eight freight trains; the Wapak-Piqua Division, 32 miles, operating fifty passenger trains and four freight trains, and the St. Marys-Minster Division, 12 miles, operating twenty-four passenger trains and four freight trains. Besides the foregoing trains we operate a line car and work-train daily except Sunday.

DISCUSSION

In the discussion which followed, J. W. Moore, of the Indianapolis & Cincinnati Traction line, asked how Mr. Gray handles work trains. Mr. Gray replied that work trains are all run as "extras" on his road. Any time a train of any class is met a report must be sent to the dispatcher and if the crew cannot get him it must remain on the siding until the regular train comes along.

G. E. Burrows, of the Indiana Union Traction Company, wanted to know how the freight trains were operated. Mr. Gray replied that freight trains were also run "extra," coming in the same class as the work trains. They go on the siding and remain until communication is secured with the dispatcher and then are not permitted to move without orders. It is a standard rule that every train going into the switch must report it; everything is extra from there. When there is a special car, the aim is to run that on a second order like freight trains.

Mr. Burrows asked what method was pursued in furnishing trainmen with orders. Mr. Gray said they furnished the motorman and conductor each with a copy of the order. Both are held responsible for the movement of that train. It is impossible for them to get away from the responsibility, as both have orders to correspond with the order in the dispatcher's office.

F. D. Carpenter, general manager of the Western Ohio Railway, said that the subject under discussion was a very important one, and as the paper read outlined the manner in which a road is operated, he would naturally like to hear some criticism. If no criticism was aroused, he would begin to think they were all right. He wanted suggestions from the train dispatchers present, as he was endeavoring to avoid accidents, and if any one could offer something better than he has, his company would adopt it.

Mr. Spring said that a matter of great importance discussed about recently was whether it is better to deliver orders to the motorman, the conductor, or both. There is a diversity of opinion of this matter and he wished that the members could effect an agreement on this point, and one he would like particularly to have discussed by the dispatchers. Some operators say that the order should be given to both, and others that the conductor or motorman alone be held responsible.

President Nicholl said Mr. Spring's suggestion was a good one, and he believed it would be a good thing for the association to decide who should take the order.

Mr. Baldwin, of the Indiana Union Traction Company, was appealed to, and replied that his company's plan was for the motorman to take the order and give it to the conductor.

Mr. Golda, of the Indiana Union Traction Company, said their system is in excellent condition, but perhaps they could improve it. They get trains over the road in excellent shape, free from accident and with very little line trouble. Their way of handling extra trains continually is successful. They have two lines, and in case the dispatcher's line is in trouble, the general line is used. The dispatcher's boxes are used at the sidings, where the work trains receive their orders to use the main track. Any extra trains approaching in either direction are notified at points north and south of the position of the work train. That order affects all of them, unless it is very important that they give way to the extra or work train ordered against.

Mr. Gray was asked how trains were operated in case of total disability of the train dispatcher's line, and how the cars were handled. He said they could not be blocked. He was asked how far that extends and how far they can operate by signals when lines get out of order.

Mr. Gray replied that they had had some trouble with telephone lines because of being placed on the high-tension arms. They have located telephone booths every 5 miles. In case of trouble with the dispatcher's line they cut out that section and depend on the long-distance telephone. If the telephone is out of order, it is up to the crew of the regular car to protect the other cars by the correct display of green flags. He said they like to have trains on time, but they look to safety first.

President Nicholl asked Mr. Gray what he could do when both telephone lines and long-distance lines were down. He replied that he had never been up against that proposition. In such cases, however, when both lines come down there is nothing to do but stay there. They have never had to contend with that situation, and what they would do had never occurred to them.

Mr. Merrill said, as to whether the conductor or motorman should receive the order, there should be some law or system back of all that. The most important thing is a rule as plain as possible to tell what trainmen must do under circumstances. These are the fundamental principles of a satisfactory system. Time tables are helpful, but the question as to how the movement shall be governed is simple in connection with this whole matter. Nothing pertaining to electric railways to-day is of more importance than the question of train dispatching and the movement of trains, and nothing is likely to lead to standardization better than a uniform system of train dispatch-

ing. Therefore, he suggested the adoption of a standard system of train orders and train dispatching, with the rules adopted observed to the letter.

President Nicholl said the American Association had gone into the plan of rules, and also the New York Association had taken steps to adopt a system of rules and this association has a committee to adapt a book of rules. He thought it advisable to take up the matter and either adopt the American Association rules or change them to meet the conditions in this territory.

Mr. Spring said he fully concurred in what had been said, and suggested the appointment of a standardization committee to report at the next meeting so the report may be carried to the next national meeting. He said every man has a different method, but in case of standardization every one would know what to do in case of emergency. On motion of Mr. Spring, President Nicholl appointed the following standardization committee on rules for train dispatching: F. D. Carpenter, general manager of the Western Ohio Railway; C. N. Wilcoxon, general manager Cleveland & Southwestern Railway Company; C. D. Emmons, general manager Fort Wayne & Wabash Valley Traction Company; C. A. Baldwin, superintendent of transportation Indiana Union Traction Company, and F. J. J. Sloat, general manager Cincinnati Northern Traction Company.

Mr. Hutchinson, of the Westinghouse Company, said he was very much interested in Mr. Gray's report, as it occurred to him it is safer when the order goes to both the motorman and conductor, and the conductor is given a copy of same. He said the conductor's responsibility should not end at that point. Mr. Hutchinson related incidents of two bad accidents due to motormen forgetting their orders. If the conductor was compelled to go forward and consult with the motorman a half mile before the meeting place was reached, there would be less chance of going past the meeting point. He said he did not know that such a rule prevails on any of the roads, but thought it should. As far as the standard system of dispatching is concerned, he believes it is a matter that will have to emanate from the National Association. He thought that a committee appointed by this association would work up to great good, and would enable the committee to take its recommendations to the National Association. Doubtless they were aware that the American Association had adopted a standard code of rules, and he would like to have the conductor's responsibility increased. President Nicholl said it was his understanding that the National Association had passed upon such a system.

M. C. Stern, of the General Systems Company, of Dayton, Ohio, then read the following paper on "Modern Train Dispatching":

MODERN TRAIN DISPATCHING

Train dispatching is as important as the very rails over which your cars are run, and the more the system of dispatching is freed from unnecessary red tape, the better the service and the greater the results. There are many reasons why this subject is of prime importance. Let a wreck occur, and the press, seeking popular favor, in these strenuous days of public service animosity, sends broadcast a censuring report in glaring headlines. Then the legislator, striving to serve his constituents for further elevation in his political ambition, is also inclined to be hostile to the railroad company.

Since double-tracking is an expensive luxury, the dispatching of trains on single tracks should certainly be so well designed as to protect life and property and improve the schedule, for the greater number of daily trips a car can make, the greater is the earning power.

The people are not unjust when they demand safe travel, and there is not a single railway official, in my mind, who aims to refuse that demand, for all books of rules contain severe and pointed instructions regarding the safety of passengers and the protection of property; more especially when we consider the fact that, as carriers of passengers, the greatest responsibility rests upon the officials.

While I may say that no matter how perfect a system may be, man may err and ill consequences follow, I do claim—claim absolutely—that methods should be adopted, not only to improve conditions, but also to prevent such errors and increase the responsibility of those connected with the operating of trains, from the dispatcher to the crew. This will develop their mental powers to their proper capacity, thereby making them more reliable and hence more valuable.

A perfect dispatching system depends upon at least five factors: responsibility; elimination of verbal messages; convenient and frequent means of receiving messages; proper erection, correct installation and maintenance of signals, telephones and records; and judicious economy. Verbal messages are entirely void of any security, for it is an easy matter to shift blame from one to another when no evidence can be brought forward to place the blame on the right man. Written messages, singly or even duplicate, likewise fail in completeness, as it is surely an easy matter to destroy such orders and thereby darken the search for the cause or the party responsible. That course is likely to be followed in ninety-nine cases out of a hundred if an accident occurs or there is any other possibility of a call "on the carpet."

The triplicate secret method is the beacon light across the sea of controversy, and casts its rays clearly upon all the facts. Hence, I suggest the issuance of three distinct copies over autographic dispatching registers, which may be placed in booths, on cars or wherever else messages are received. These machines produce three full copies of each train order, one for the conductor, one for the motorman and the third is retained in a private receptacle under lock and key for audit and checking by the proper road official.

Messages are sent in the following manner: The dispatcher, having a machine at his desk, records in duplicate each message that he issues, one discharged from the machine, the other retained in a locked receptacle. As the message is given, the conductor writes the order as he receives it, repeating the same to obtain the dispatcher's "complete" when he signs his name to the order, thus declaring his full understanding thereof. A like course may be followed by the motorman reading and repeating the message, signing his name with a declaration like that one of the conductor. Thus we have the signature of the dispatcher, the conductor and the motorman constituting an unbroken chain of signatures which are indisputable, undeniable and absolutely certain, above all, stamping indelibly upon every man's memory the responsibility that rests upon him.

A majority of roads use the combined booth and station means of receiving orders, while some few employ the portable telephones on cars. For obtaining orders at booths, the conductor, as a rule, should call the dispatcher, who, in turn, will give such orders as are necessary, whereupon the conductor should write the same plainly, with-

out any abbreviation (which is quite important) on the dispatching register, reading and repeating the same as before mentioned. If the motorman should also read and repeat the same to the dispatcher, it can be done as stated. At stations the agent should call the dispatcher upon the approach of the car to ascertain if any orders are to be given; if so, the conductor is signaled, or the order may be taken by the agent, read and repeated to the dispatcher for his O. K., signing same in a space provided therefor, giving to the conductor upon his reading, repeating and signing same, both the original and duplicate—one for himself and the other for the motorman—taking a signature from the motorman on his (the conductor's) copy. If portable telephones are carried on cars, jack boxes are installed at proper points or turn-outs, switches, etc. In such cases the motorman usually calls the dispatcher, giving necessary information as to car number, time, etc., while the dispatcher gives the order, both the motorman and himself writing it as given over the register. The message is read and "completed," then re-read and repeated by the conductor.

The motorman's copy should be placed on a clip directly in front of him, serving thus as a notice and a most excellent reminder. The third or secret copy is beyond the crew's reach and ever ready for immediate inspection. Now this operation does not occupy unnecessary time, for it works with clock-like precision, and the men readily become accustomed to its operation, taking a single order under even heavy conditions in a time never over thirty to forty-five seconds.

The dispatcher's office should be entirely separate from all other offices. A strict forbiddance should be maintained relative to permitting any one to enter except on the most important business.

The switchboard that I find very highly recommended is of the cordless type, since the desk is entirely clear for the dispatcher's sheets, and overcomes the tendency of getting out of repair at critical times.

The telephone provides immediate and direct comunication, and consequently commends itself far in preference to the telegraph. The lines may be single or duplicate, the latter preferable, since in this manner the second line provides connection with agents, stations, power house and general headquarters, the first being exclusively for dispatching.

Many roads have, in addition to their private lines, either Bell or independent telephones, or both, thereby giving every available means of communication; yet the rules regarding the use of telephones should be clear, limiting it on the dispatch lines to strictly dispatching business. This will prevent cross talk or useless conversations regarding orders, thereby improving the schedule and creating discipline and respect.

The standard steam road train sheets seem exceedingly well adapted to interurbans for recording the movements of trains and meetings as they occur. The train order form should be arranged to avoid unnecessary rewriting and worded to be clearly understood by all. Keep your orders clear and simple and avoid all abbreviations.

It may be regarded as good, in the use of triplicate copies, to have a white sheet for the motorman and a yellow sheet for the conductor. The record copy should be white because it shows the carbon better, is retained as a basis of positive information about all dispatching matters and is carefully scrutinized by the proper authorized official.

The question of booths is solved in the octagonal shape covered with corrugated iron, with a peaked roof. This booth should be securely anchored by lag bolts into posts driven into the earth, making it perfectly secure and avoiding its being carried away by winds or mischievous youngsters. Furthermore, it should be well lighted, having a southern exposure for daylight, and the opening of the door should connect the light circuit.

Let your telephones be of the best type, fastened to the wall of the booth; place the dispatching register on a shelf in a position to write orders with perfect ease, the left hand holding the receiver while the right hand falls naturally on the dispatching machine to register the order.

The summary resolves itself into judicious economy. Let not the first cost of installation play any important part, for, once installed, the best always produces results—good seed means good product, and money well planted, well invested in a thorough dispatching system, yields immeasurable returns, bringing back, in satisfaction alone, far more than it cost, and giving a service that cannot help but receive the hearty endorsement of the public, since its demands will have been met to a far greater degree than anticipated.

DISCUSSION

Mr. Gray asked Mr. Stern if the train crew received the order all right would it not correspond with the order on the book? Mr. Stern replied that it would; that the orders were all numbered.

At this point, F. D. Norveil, of the Terre Haute, Indianapolis & Eastern, said he thought it would be of great interest to the association to hear Mr. Button, and the president introduced Mr. Button, general manager of the Telegraph Signal Company, Rochester, N. Y.

Mr. Button, as a representative of the Telegraph Signal Company, said they have a signal against danger operated by the dispatcher any time when occasion requires. For instance, when any cars are running under schedules and he wishes to communicate with it at the next station, this signal gives the dispatcher an opportunity at any time to call for any train crew in his district in a short period. When a company has its time table governing the movements of trains, it has gone a long way toward the solution of its system, but the dispatcher, unless he has ready support at every station, is constantly at a disadvantage. He said: "If you send an order to station C and A, wishing cars Nos. 1 and 2 to meet at station B, both stations receiving the order simultaneously, you think you have absolute safety, but you are still leaving the barn door open for the horse to be stolen if you do not provide against the fallibility of the man who holds the order for the operation of the trains and have their rights restricted. The moment you place an order for the operation of a train restricting its rights you know it. If the operator at station C neglects or fails to perform his duty, it is still possible to signal at station B, the meeting point of the danger. It is proven throughout the country by a very large number of cases that the failure of these operators in placing signals of danger for trains have resulted in our reading the next day of enormous property loss to the company and the loss of a great many valuable and innocent lives. But the operator is not wholly to blame, for, as a rule, he has a multitude of duties to perform aside from his train service. He is possibly the mayor and constable of the town with the important duties attaching to those offices, also an express agent, which adds another important duty. In an effort to perform all of this work, the railway interests are not safeguarded nor are those of the public."

Mr. Button explained what signal was displayed if an operator forgets to give an order. In case the train gets away from him he simply inserts a plug in the machine which corresponds with the number of the station and in a few seconds the signal at that station drops to danger and automatically informs the dispatcher within two seconds that the signal at that station has fallen to signal danger, giving him positive proof that what he wanted to do has been done. In case an operator does not answer his call promptly by reason of being asleep or at his home, the device rings an alarm bell at his particular station and also at the operator's home, as a command for him to come to the office. Thus his service is immediately obtained and the trains kept moving.

He also described how the system was relieved in case the operator leaves his key open and the circuit re-established. Mr. Button said he had been asked what they could do for the electric railways in their field. They tell them they can apply the signal device on telephone service so that any time communication can be had with stations or trains in a few seconds. Mr. Button related several instances where railroad officials had frankly told him that if they had had such a system of signaling in use, particular frightful disasters would not have occurred. Mr. Button said this is why they come before the interurban men to see whether or not they can be of service to the electric railway field. Mr. Button said they built the machines at their own expense and can install a number of them in one day. The rental charge is $1 a month at each station. He concluded his talk by inviting the members to his room in the hotel where he had installed his device. There he gave a most interesting demonstration of what his signal system will do. The interurban men were greatly pleased with the simplicity of the device, and generally admitted that it could be applied to an interurban system to great advantage.

AFTERNOON SESSION.

Upon calling the convention to order, President Nicholl read a telegram from F. J. Stout, general manager of the Lake Shore Electric Railway, regretting his inability to be present and incidentally announcing that he had appointed L. K. Burge general superintendent of the Lake Shore Electric Railway and all other properties controlled by that company.

The next paper was read by S. R. Dunbar, purchasing agent, Indiana Union Traction Company, Anderson, Ind., on "The Issuing of Supplies. How to Prevent Leaks."

THE ISSUING OF SUPPLIES. HOW TO PREVENT LEAKS

In presenting this subject, I shall try not to wander too far from the issue, and shall endeavor to guard the leaks closely. I have perhaps interpreted the title as being more comprehensive than was intended, but lack of the time which I should have liked to devote to it may explain that.

A railroad, more than any other concern, it seems to me, must trust a great deal of valuable property to the hands of its employees. It places as many safeguards as possible about the handling of its cash and its cars, but is everything done which could be done to insure a proper use, as well as a proper issuing of its material?

The cash is the heaviest problem, of course. What we do not get might pay for an accident or two, with a little material thrown in, but what fails to reach the treasury has to accomplish its disappearance before the eyes of at least a few people. When a car is put out on the road with its load of humanity or freight, a great deal of property and life is entrusted to the crew and the dispatcher. They cannot disappear with it, but they can cause great loss. Unlike either of the foregoing, material can disappear and no one know where.

The possibilities of loss do not stop with the issue of supplies from the storeroom by any means, and if the title of this paper does not limit me to consideration of leaks before and at issuance, I might suggest that one of the biggest problems is the care of material, tools and supplies after they leave the storeroom. The only ways to prevent leaks and waste after supplies are issued are continual vigilance on the part of the heads of departments and a policy of holding each employee strictly and individually responsible for all company property which may come into his hands.

Nowadays, the concern which does not know just what its product should and does cost will not live to bother its competitors long. That the cost may be known, some one must know just how much material and time are necessary to accomplish the work in hand. We know that a railroad, with many of its workers away from any possibility of strict supervision, is up against difficulties which are hard—some of them impossible—to overcome; but a system of reports can be devised which would prevent excessive waste or loss.

A lineman may be a tough proposition, but he is seldom responsible for the tearing down of a line, and may be required to report the material used to repair the break, and his work be checked by an inspector. So with an armature winder or any other employee.

Railroads generally supply most of the inhabitants in their territory with a complete set of tools before construction is over, but afterwards I believe that absolutely no tool should be issued until the old one has been turned in or additional tools are shown to be necessary.

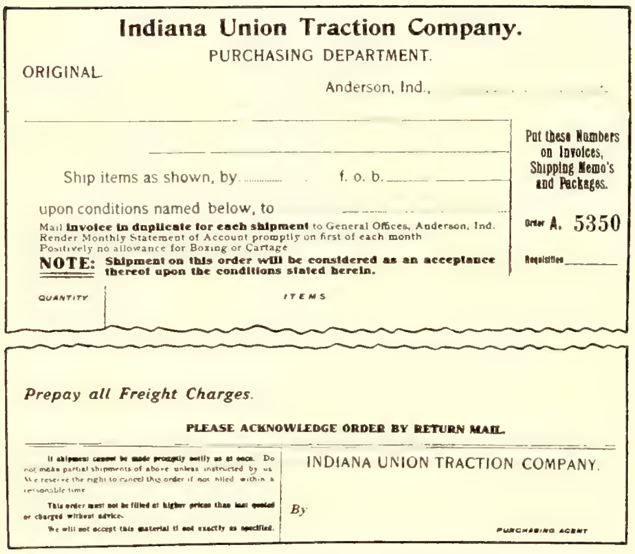
As has been implied, there are, in my opinion, fewer difficulties in the way of a proper issuing of supplies than there are in the way of a proper use and care of them. There is an impersonality about a railroad which has its effect upon all who are employed by it; what loyalty there is more often is felt toward the head of a department rather than toward the company itself. As the storeroom is concerned with all the departments, this "impersonality" has less effect, and, partly for that reason, the storeroom can be dealt with more strictly and exactly. The proper use and care of supplies will, I believe, always be more or less of an unsolved problem; but to my mind that is not the case with a storeroom. Leaks in the issuing of supplies can be prevented. The problem is solved by merely having a good system and sticking to that system. It is possible to do both, but, necessarily, as in all kinds of work, good tools (in this case a good system) should be in good hands. Good men are needed in the storeroom just as much as on any other part of the road. In fact, I would rather have enough good—that is, accurate and careful—men and a poor system than cheap help and a good system. That's No. 1 on "How to Prevent Leaks."

The storeroom serves two purposes, that is, the holding of material in stock for use as needed, and serving as a suspense account, so that charges are not made to the operating and other accounts until the material is actually used. Both are important, equally so as far as the storekeeper is concerned, although the auditor and the master mechanic may not agree as to which is the more important. I shall probably be unable to keep the stock and the accounting entirely separate, because what affects the one affects the

other; but that there are two objects to be served should, nevertheless, be borne in mind. And as the subject is partly "How to Prevent Leaks," I shall not try to describe the leaks, but possibilities of one or more leaks will be found lurking somewhere near each suggestion that follows.

The starting points—the very foundation of our system, and without which there can be no system at all, but everything left wide open for all kinds of leaks—should be a locked storeroom with big "Keep Out" signs over the inside gates, and well understood rules to the effect that nothing can be obtained from the storeroom without proper written authorization. The material and supplies in the storeroom represent cash to the company, are handled as cash in the accounting, and should be safeguarded the same as cash. No one would think of permitting Tom, Dick and Harry to have access to the cash drawer, or of issuing John Doe a voucher for money merely because he asked for it.

To go with a locked storeroom must be rules that only some one of the storeroom force can give or take out material. The storekeeper cannot be held responsible unless he can prevent supplies from being stolen, or from being improperly issued or taken out.



Indiana Union Traction Company.

PURCHASING DEPARTMENT.

ORIGINAL.

Anderson, Ind., ...

Ship items as shown, by .... f. o. b. ....

upon conditions named below, to ....

Mail **invoice in duplicate for each shipment** to General Offices, Anderson, Ind.
Render Monthly Statement of Account promptly on first of each month
Positively no allowance for Boxing or Cartage

NOTE: Shipment on this order will be considered as an acceptance thereof upon the conditions stated herein.

Put these Numbers on Invoices, Shipping Memo's and Packages.

Order A. 5350

Requisition ....

QUANTITY ITEMS

Prepay all Freight Charges.

PLEASE ACKNOWLEDGE ORDER BY RETURN MAIL.

If shipment cannot be made promptly notify us at once. Do not make partial shipments of above unless instructed by us. We reserve the right to cancel this order if not filled within a reasonable time.

This order must not be filled at higher prices than last quoted or charged without advice.

We will not accept this material if not exactly as specified.

INDIANA UNION TRACTION COMPANY.

By ....

PURCHASING AGENT

TRIPLICATE ORDER BLANK (ORIGINAL 8 INS. BY 10 INS.)

The written authorization to obtain supplies should be on a specified form, generally known as a requisition, numbered if possible. As the requisition serves as the basis for the charges to the different accounts, as well as the authority on which the supplies are issued, the auditor should be at least concerned in getting up the form and in the instructions to be given in regard to its use.

The requisition is the corner-stone of any storeroom system. After the material has been issued on it, it takes the place of the material, so far as the accounts go, and must be treated as carefully as a voucher for a cash payment would be. If lost, or if misappropriated by the guardian of some source of expense because his accounts have been running high, no charge can be properly made, and the storeroom will be "short." It is important, therefore, that requisitions not only be kept in a safe place, protected from fire if possible, until charges and stock records have been made from them, but that no one outside the storekeeper and his stock or charge clerks should have access to them. One lost, mislaid or misappropriated requisition does not mean much, perhaps, but a few of them for big charges would make a large shortage at the next inventory, which would have to be charged against profit and loss.

The storekeeper must, of course, issue material whenever a properly signed requisition is presented. He cannot have any discretion in the matter except as between proper and improper requisitions. He should, therefore, receive definite instructions as to what and whose requisitions to honor at the same time that heads of departments are instructed as to how requisitions should be made and signed. There are many possibilities for leaks, or an improper issuing of material, if requisitions are allowed to be made without being approved, or at least being seen, by the heads of the different departments. If you don't believe it, ask the storekeeper.

The requisition should contain columns in which to enter the prices of the articles named and the accounts to which charges are to be made, as well as space for date, quantity of the article on hand, quantity required, quantity delivered, description, and purpose for which intended.

A good system does not stop with the locked storeroom and the requisition. The more complete the system the fewer chances there are for leaks. The requirements of the auditing department and the necessities which exist for keeping an ample stock of all supplies on hand at all times, as well as the amount of money the management is willing to allow for running the storeroom, determine the details of the system to be maintained. One of the first details to be affected by the considerations referred to is the stock record. This should be kept, preferably, on cards, arranged in the manner usual to a card index, or in loose-leaf ledgers, the sheets being large enough and arranged to accommodate several items of the same class. (It might be well to say that I shall not attempt to describe or make recommendations on all the forms, whether mentioned here or not, which may be necessary to an adequate storeroom system, as I do not understand that to be the purpose of this paper; but I shall be glad to show samples and to answer questions concerning them, either as they are referred to or later.)

On the stock record should be shown, by dates and in as much detail as desired, the quantities issued and received, as they are issued and received and deductions and additions made from day to day, so that the amount of a given article on hand may be ascertained at a glance. I shall refer to this feature again.

Leaks from an incomplete or ill-kept stock record may not show up very big until an inventory is taken, or there is a fire, when someone is likely to inquire, "What's the matter with the storeroom?" In case of fire, a complete stock record, if intact from having been properly protected, would enable the company to show clearly to the insurance adjusters just what its loss had been. That is, it could show just what had been in the storeroom when the fire occurred, and, after deducting the value of the mess that is left, the difference, or the loss, could not be questioned. It would be difficult to say what the saving might be in such a case.

An incomplete stock record, as well as incompetent men on the floor, means leaks in other directions; that is, outside of the storeroom. I refer to "low stock." One side of the leaks from low stock is the expense of express, telephones and telegrams, and the time of the purchasing agent consumed in getting material in a hurry; the other side is the expense, trouble and inconvenience of waiting for

material, or of making something else do, or of running risks with the equipment. I venture to assert that if the condition of "low stock" could have been avoided on almost any road in Ohio or Indiana during, say, the past year, a good extra stock record clerk would have been a minor expense.

The expense of maintaining a storeroom is borne for the purpose of keeping material and supplies on hand at all times, and the end in view is, therefore, partially defeated if there are frequent, or even infrequent, cases of "low stock." So, I claim, a complete stock record is necessary, because it is unfair to presume that the floorman can always remember when to report that a certain item, out of perhaps several thousands, is running low. There may be several men waiting with requisitions to be filled, or there may be any one of several circumstances to distract his mind and cause his failure to notice that the supply of a certain article should be replenished. Then, again, he may think there is ample stock, whereas it may take weeks, or even months, to replenish.

The stock record clerk should have before him on each of his cards, or sheets, the minimum amount of stock it is safe to carry; that is, the point at which the supply should be replenished, which should be determined by the time it takes to get delivery and the relative importance of the material in question. Only in this way can items be ordered in ample time. No one's memory is trusted. In making his entries, the stock clerk can easily get into the habit of referring to his "minimum," and the importance of showing the amount on hand after each entry, that the minimum may be recognized when it is reached, can readily be seen.

To prevent, so far as possible, any item so important as "low stock" being overlooked, a printed form called, say, "Memorandum of Stock Required," of an individual shape, should be used. In this way such items will not escape attention as they might if miscellaneous slips of paper were used. These forms should be used both by the stock clerk and by the man issuing the material. Two chances of catching low stock, therefore, are at hand; that is, from the records and from the stock itself, and it will frequently happen that the stock clerk and the floorman will make out slips on the same items at the same time.

The complete stock record may be made to serve still another purpose, namely, that of the "perpetual inventory." The annual inventory, with its attendant expense and confusion, is a nightmare to all concerned. Errors will creep in during a year's transactions, so that beside the actual work of an inventory, which may have to be made by a force already overcrowded, a difference will probably be found to exist between the actual value of the stock on hand and the book value, which means affecting an adjustment unwelcome to some one or every one.

The "perpetual inventory," as I understand the term, is a stock record so exact that it coincides strictly with the actual quantities of material on hand each day, and is, in fact, a complete inventory. The perpetual inventory is strongly advocated by a large number of accountants, and an approach to it is in vogue in numbers of establishments. I would not recommend, however, the theoretically perfect perpetual inventory, as it is expensive, but a near approach to it is practicable, and a complete count will be necessary only once in several years. With this system frequent counts are made of the different items as new stock is ordered, and these counts compared with the records. Where a discrepancy is found to exist, an apportionment of the charge or credit can be made to the accounts affected, after possible causes for the errors have been investigated. To help locate the errors and serve as an additional check, some systems go so far as to provide a card, kept in a rack at each bin, on which the store man enters the quantity, date and requisition number each time material is removed. This really makes two stock records.

Where these frequent counts are made, more time is required from day to day, but leaks and errors are discovered and adjusted more readily, and the extra clerical expense is distributed over the entire year, instead of at the time of the annual inventory. Besides, possible thefts are more easily detected.

Intimately concerned with the stock record are the methods of checking in material, entering bills, and otherwise handling the storeroom accounts so as to prevent leaks. In this era of advancing prices it is particularly important that the price record should be kept always up to date, whatever system, or lack of system, is pursued. This includes the prompt entering of bills as they are passed. Otherwise, the charges may be distributed to the various accounts at improper prices, and the stores account be the loser or the gainer, as the case may be—an undesirable situation.

Material should be checked in when it is received, and not after the bill comes in. This applies to all departments, as well as to the storeroom. If there is no record from which to approve bills, then they have to be approved from some one's memory, or by guess; either way furnishes chances for error. To approve bills properly, the department for which the material is ordered, say the storeroom, should have knowledge in advance of the receipt of material, as to just what is to be expected and from whom it is to come, and blanks should be provided for recording exactly what comes in. The most serviceable form for this purpose is a triplicate of the order placed by the purchasing department. It serves as a notice of the placing of the order, and can be arranged for recording the dates and quantities of material received on the order. If the record and the bills do not agree, there is a fair claim against or in favor of the shipper. A permanent record of material received at the storeroom each day is advisable for various reasons, which I shall not take the time to go into here.

A distinct phase of the issuing of supplies, and one which touches closely both parts of the title to this paper, is the distribution of supplies from headquarters to the various points on the road at which they are required. There are more opportunities for loss here, it seems to me, than in any other one direction. There are, of course, practically only two means of distribution—the regular freight and passenger cars or the supply car. If there are any objections to the supply car, some one else can urge them probably better than I, so, as the subject is "How to Prevent Leaks," I say, take the deadhead stuff off the regular service, so far as possible, and put it on a supply car, unless the freight business is very light and the road be altogether too short—in mileage, I mean.

It might be shown by investigation that a supply car would not be so much of an expense as an actual saving. No matter how much care is taken, or how many rules there may be, it seems to be almost impossible to have deadhead material handled with as much attention as it should be. Supplies are lost and never found; there are unavoidable delays in delivery; the freights must take time out to make special side trips to the company's property;

and, frequently, cars are so crowded that a choice has to be made as to whether to leave paid freight or deadhead stuff. One is as bad as the other, or a good deal worse, to readjust the Irishman's remark. Company shipments should be billed out the same as any other freight. This takes time on the part of the freight department force, and time is valuable there, as well as at the storeroom, where the billing, tagging, boxing, etc., all have to be carefully attended to. The boxing, wrapping, etc., are necessary on account of transfers, rough handling and misappropriations. So much for a few of the objections to the regular service.

The supply car can be loaded at or in the storeroom, and much time be saved that department from that circumstance, as well as others. The regular trips of the car can be utilized by the mechanical, roadway and electrical departments for the delivery of all kinds of supplies and material belonging to each, and, many times, a special trip of some work car could be saved. Especially valuable would be the return trips of the supply car, bringing into headquarters shipments which now burden the freights or make necessary the use of a separate car. Valuable scrap, for instance, and from which there are many leaks, could be better taken care of and classified. Last, and most important, supplies would be promptly, properly and surely delivered.

Briefly, in closing, I would recommend for the issuing of supplies, properly and with as few leaks as possible, a locked storeroom, governed by strict rules as to the taking out of material; a well-considered system; enough good men to carry out the system completely; facilities for the men to handle their work without confusion; that is, an adequate storeroom, both as to size and arrangement; the distribution of supplies through the medium of a supply car, and the inculcation in the minds of every one on the road of a wholesome respect for the storeroom and for company property.

DISCUSSION

W. H. Forse, Jr., assistant treasurer Indiana Union Traction Company, said that the paper covered the subject so well that there was little left to be said. However, he would like to ask Mr. Dunbar how he checked his material. As he understood Mr. Dunbar's paper, a triplicate copy is given to the floor man. It is a practice of some not to give a triplicate copy to the floor man. If he does not have it he is more apt to count the material correctly. He had found that if the floor man is in a hurry he might just O. K. material instead of counting it.

Mr. Dunbar replied that there might be a difference of opinion, but believed it works better to have the information before the man. If you are going to prove his account you will have to have him count it twice. If he counts it and then goes to his order and finds an error, he will count it several times.

Mr. Spring asked Mr. Dunbar what rule he adopted for replenishing stock when it got low; if he had any idea of how much stock he wants and how he handles it. Mr. Dunbar replied that materials are likely to be changed, and there would be a loss. The manager should instruct the storekeeper as to the minimum and maximum supply on hand. Then the quantity ordered depends upon how much stock is necessary to be carried. You can have a six months' supply if necessary.

Mr. Norveil asked Mr. Dunbar how he handled the scrap pile. Mr. Dunbar replied that he did not know what was done with that. He said if there is too much scrap it should be stopped. Disputed stock in the storeroom is charged from month to month, and, of course, in that case the auditor should be consulted, the credit be distributed and the difference in the cost ascertained.

S. D. Hutchinson said he thought that the discussions would be more elaborate if the papers were printed and sent to the members ten days before the meeting. The association had got to the point where that ought to be carried out. It is difficult for members to grasp the subject and think of all the ideas they want to express. Such a plan would make the discussions more practical and beneficial. President Nicholl replied that the proposition had been previously considered by the association, and while it was thought to be a good idea, it was deemed too expensive. He said the members had thought, inasmuch as the meetings were held only every two months, there would likely be sufficient discussion.

REPORTS OF COMMITTEES

Under this head, W. H. Evans, of the Indianapolis Traction & Terminal Company, and chairman of the committee on standardization, made the following report:

REPORT OF THE STANDARDIZATION COMMITTEE

Your committee appointed to investigate the subject and recommend standards for adoption of this association, as applied to traction railroads, held meetings at Indianapolis on April 25, 26 and 27, and investigated the subject of standards, principally on the line of the recommendations which were made by our association in convention assembled at Fort Wayne, under date of Sept. 27, 1906, with particular reference to the following subjects: Brake-Shoes, Axles, Journals and Journal Boxes, Tread and Flange of Wheels, and Rails for Street and Interurban Railways.

After carefully considering the various subjects, your committee deems it advisable to make a partial report at this time, in order that this can come before the association for consideration at the meeting to be held at Indianapolis on May 23, 1907.

In the discussion of the advisability of standards, it was evident that it would not be possible to arrive at any happy medium between the various types and classes of material now in use by the different traction companies serving the purpose for which we desire to adopt standards, but rather it would be necessary arbitrarily to select a standard and determine the dimensions which we consider advisable for these different parts, as any slight variation in the dimensions would necessarily interfere with the interchangeability of the parts and prevent, to a large extent, the object to be accomplished by standardization; that is, the selection of material and parts which would be of the same pattern and dimensions and common to the different roads forming this association.

BRAKE-SHOES

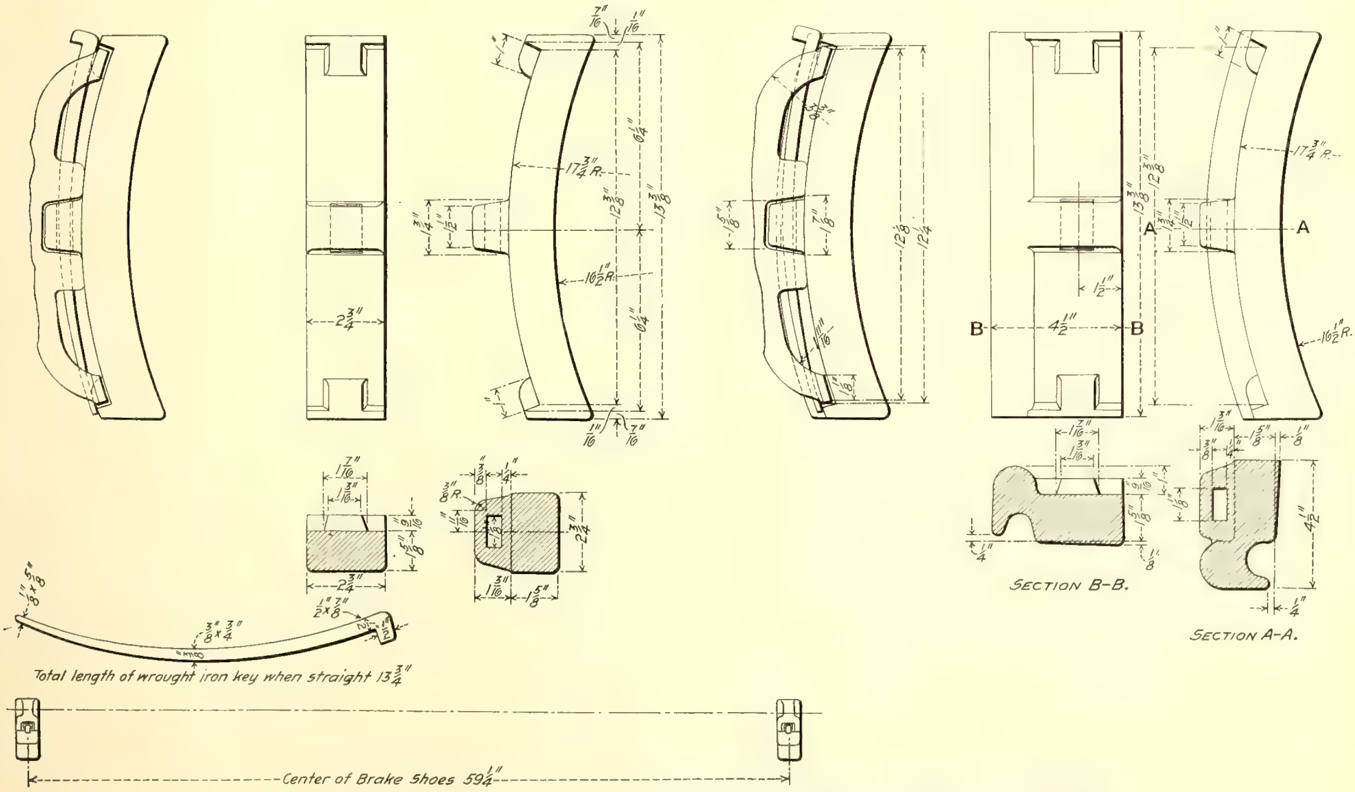
It was decided to recommend the use of a brake head and shoe similar to the one which is now standard on the steam railroads, but adapted to a wheel tread 3 ins. wide and consequently a shoe 2¾ ins. wide, as shown in the attached drawings. Your committee is decidedly in favor of the shoe without the flange where it is possible to use these shoes with trucks which permit the use of brake beams, as, in our opinion, much greater economy can be effected with the use of this type of shoe than with the flange shoe, and it is necessary to scrap a considerably smaller portion of the shoe. This shoe can also be reversed on the same wheel and requires but one pattern for all types of trucks,

and can also be used, should occasion require, on wheels with the steam railroad standard width of tread.

However, we consider it advisable to include in our recommendations a flange shoe which fits the brake head and can be used where desired in place of the shoe recommended.

Your committee makes no recommendations as to the attachment of brake head to the brake beam, as this portion of the head will necessarily take the form of the various types of beams to which it is to be attached. We would, however, recommend that with 3-in. tread wheels the center to center of brake heads on the same beam shall measure 59¼ ins.

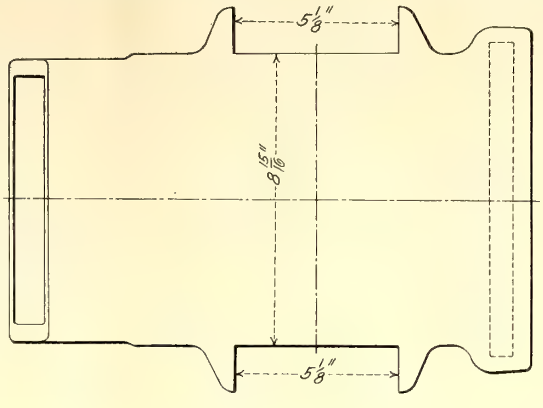
The attached drawings, covering the brake heads and brake shoes, are respectfully submitted.



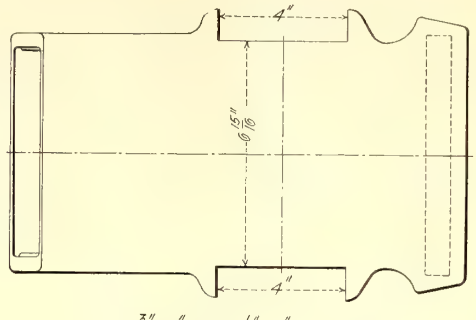
STANDARD BRAKE-HEAD AND SHOES, CENTRAL ELECTRIC RAILWAY ASSOCIATION

AXLES, JOURNALS AND JOURNAL BOXES

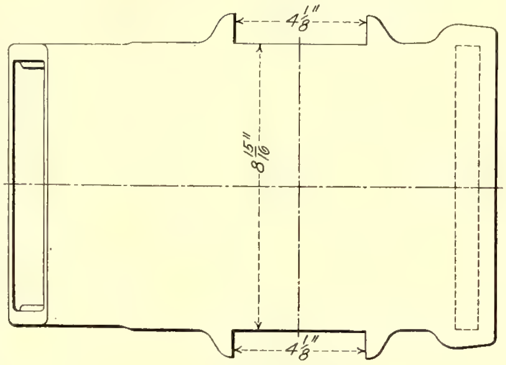
We would respectfully submit the attached drawings, covering axles for the various weight cars and different capacity motors, reducing the variety of axles to four sizes, as indicated by the axle journals, viz., 3¾ ins. x 7 ins., 4¼ ins. x 8 ins., 5 ins. x 9 ins. and 5½ ins. x 10 ins.



For 5½" x 10" Journal.



For 3¾" x 7" and 4¼" x 8" Journals.



For 5" x 9" Journal.

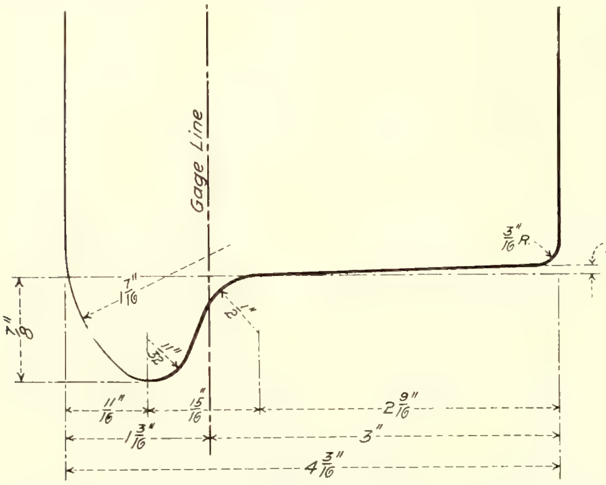
PEDESTAL DIMENSIONS FOR STANDARD JOURNALS, CENTRAL ELECTRIC RAILWAY ASSOCIATION

The various dimensions as given on these axles were the subject of considerable discussion by your committee, and while these dimensions very nearly approach those of axles already in service on the various types of motor trucks, it is the opinion of your committee that these dimensions can be faithfully followed to advantage in remodeling or rebuilding trucks already in service and to cover all future orders for equipment.

We would particularly recommend the advisability of reducing the journals to these standards, and also consider it very desirable to inaugurate a standard for gear fits and also for motor axle bearings, and while it may be necessary to vary from the dimensions, as recommended, for some particular style of motors or trucks, if these particular dimensions referred to above are adhered to, a decided benefit will be obtained.

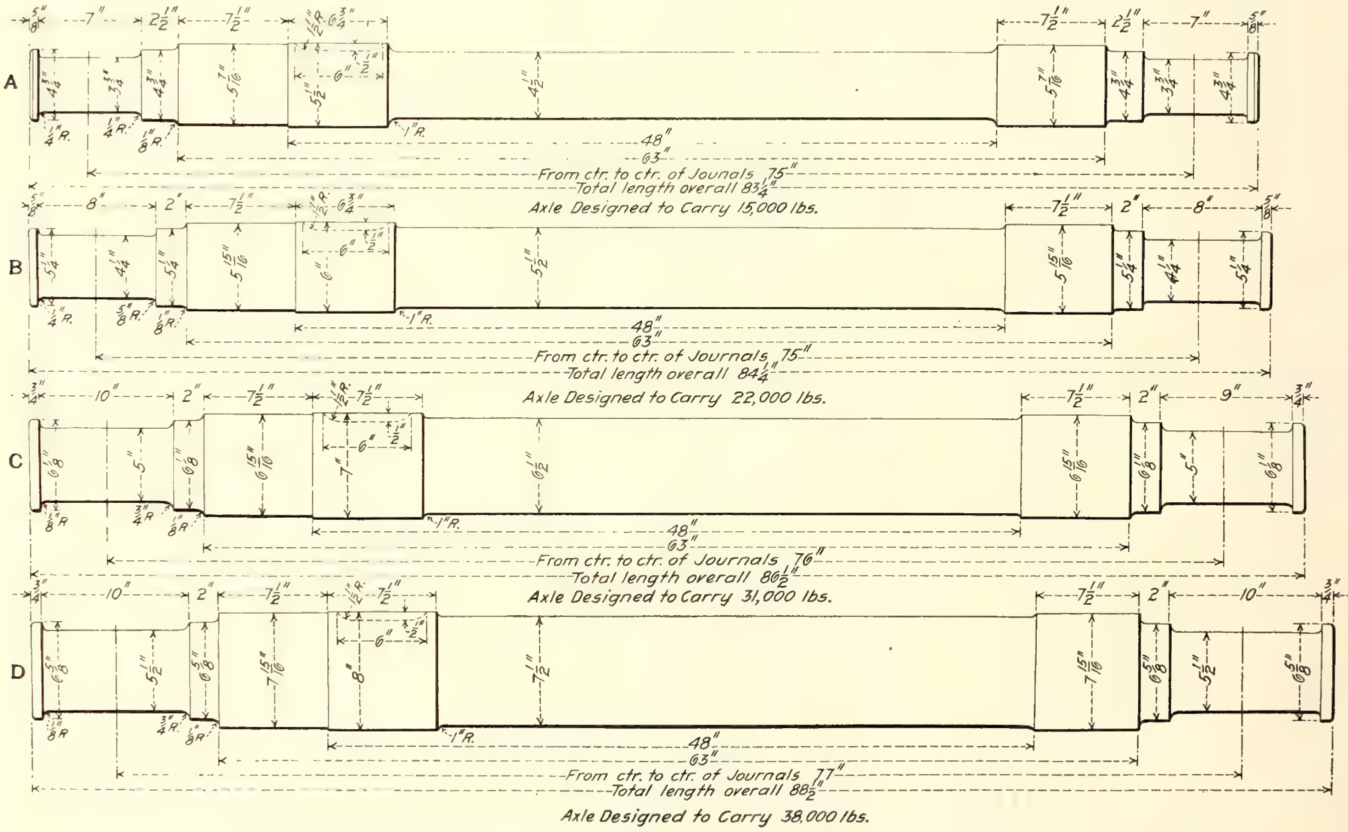
JOURNAL BOXES

In connection with the axles already recommended, we recommend the adoption of journal boxes which conform in detail to the dimensions commonly used with axles with journals of the dimensions recommended and which have



SECTION OF STANDARD TREAD AND FLANGE FOR CITY AND INTERURBAN WHEELS

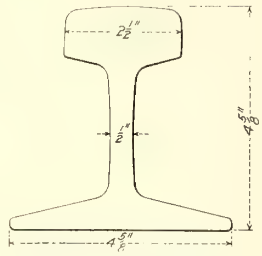
become standard on the various equipments on the steam roads. The dimensions of these various parts of journal boxes, journal bearings and bearing keys are generally familiar, and your committee has not considered it advisable at this time to prepare detail drawings, covering the dimensions of these parts. However, we desire to call particular attention to the dimensions of the boxes where they fit the pedestal jaws, as it is principally in this particular that the motor journal box differs from that commonly used in other trucks. We, therefore, submit the drawings attached, showing the dimensions where the journal boxes for the different axles fit the pedestal jaws. It will be noted that the dimensions of the boxes at the pedestal jaws are the same for the journal, 3¾ ins. x 7 ins., as for the 4¼ ins. x 8 ins., as it is found that this can very readily be accomplished, and it would, no doubt, be an advantage, as it frequently occurs that it is desirable to put in a 4¼-in. x 8-in. axle in place of one 3¾ ins. x 7 ins. These dimensions for the 5-in. x 9-in. and 5½-in. x 10-in. journal boxes are what have usually been the practice on trucks where these axles have already been used.



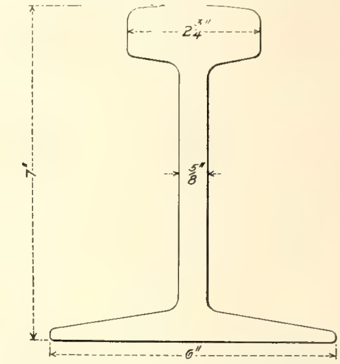
PROPOSED STANDARD MOTOR AXLES, CENTRAL ELECTRIC RAILWAY ASSOCIATION

TREAD AND FLANGE OF WHEELS

We would respectfully submit herewith a drawing of the tread and flange of wheels of dimensions which conform



SECTION OF 70-LB. RAIL FOR INTERURBANS



SECTION OF 7-IN., 91-LB. T-RAIL FOR CITY USE

to recommendations made at Fort Wayne on Sept. 27, 1906. In the opinion of the committee, this tread and flange can be used equally well on city and interurban tracks, and was selected after a careful investigation of the types of wheels used by many of the largest traction companies in the country.

RAILS FOR STREET AND INTERURBAN RAILWAY

We would recommend the adoption as standard of what is known as the T form section of rail, for both city and interurban work.

For city tracks we would recommend what is known as the 7-in. T-rail section, 91 lbs. to the yard, as shown in the attached drawings. This section of rail and others very similar to it have been used successfully on many of the large systems in the country, and, in our opinion, can well be adopted as standard.

For interurban tracks we would recommend the American Society Civil Engineer's standard section, 70 lbs. to the yard, as shown in the attached drawing. This rail is commonly used on interurban lines in the territory covered by our association, and, so far as we have any information, it has given very good satisfaction and appears to be of sufficient weight to amply take care of the interurban traction car requirements.

In submitting these recommendations, your committee would urge a full and free discussion by the members of the association, with the view of bringing out all points to be considered in the adoption of so important a matter as a standard for traction companies at this time, and in the end we feel that the recommendations here made will meet with your approval

Respectfully submitted,

W. H. EVANS, Chairman;
R. C. TAYLOR,
FRED HECKLER,
M. E. BAXTER,
W. A. GIBBS, Committee.

DISCUSSION

President Nicholl said the standardization committee had spent a good deal of time in consideration of this subject and formulating this report, and he thought considerable time should be taken in discussing whether or not it should be adopted.

Mr. Hutchinson asked the committee under what conditions they recommend the use of the groove shoe. Mr. Evans replied that they did not recommend the groove shoe at all.

Mr. Dunbar said as the subject was so important to the electric railway business, and was made after much consideration, it would be better to discuss the report at another meeting, and he made a motion accordingly.

Mr. Taylor, a member of the committee, said he would be glad to have the members examine the details of the report carefully and discuss it satisfactorily so the committee can get the matter in shape for presentation at the next national convention.

Fletcher Durbin suggested that inasmuch as they had no better talent than the committee having the subject under consideration, he thought it advisable to adopt the report as presented.

F. D. Carpenter said the matter was of great importance, and made a motion to have the report printed and distributed to each member of the association for study and future discussion. The committee had done most nobly and the thanks of the association were due the members for their arduous labor. The motion was adopted. The report of the committee on express contracts went over until the next meeting.

W. J. Woods and C. V. Adams, members of the Indiana Railroad Commission, were present and invited to address the meeting. Judge Woods said he was pleased to be present and thought it advisable for the interurban men and the members of the commission to become better acquainted. "Accidents on all railroads in this country are entirely too numerous. The public must be given more consideration." He said the interurbans, like the steam roads, should have a printed set of rules posted throughout their systems governing the operation of trains and the conduct of employees. The employees should be compelled to learn the rules and to strictly observe them. Judge Woods reminded the interurban men that their roads would, under the law, fall under the entire jurisdiction of the commission with reference to freight matters as soon as their freight business contributes 33 1/3 per cent of their income. He said, in his judgment, the interurban people made a mistake in opposing such jurisdiction. "No later than to-day," said he, "I was asked by an interurban man if the commission had power to compel one interurban line to enter into a freight traffic agreement with another or connecting interurban line, and I was compelled to answer in the negative."

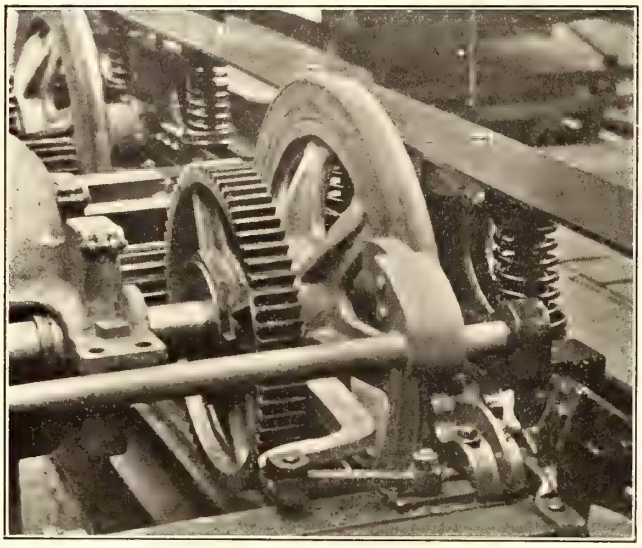
C. V. Adams was next introduced and explained the accident reports to be sent out in a few days. He said the commission proposed to establish a standard report for accidents along practically the same lines as those laid down by the Interstate Commerce Commission, which has rules that if an accident does not prevent the victim from working three days following the accident it need not be reported. In addition to accidents resulting in injuries to persons, all damages to the companies' property must be reported, but no account of damages to other property need be reported. The accident reports are not required of city lines, but only of interurban lines; but if an accident happens to an interurban train while operating over a city line, it must be reported.

STILLWELL PAPER IN BOOK FORM

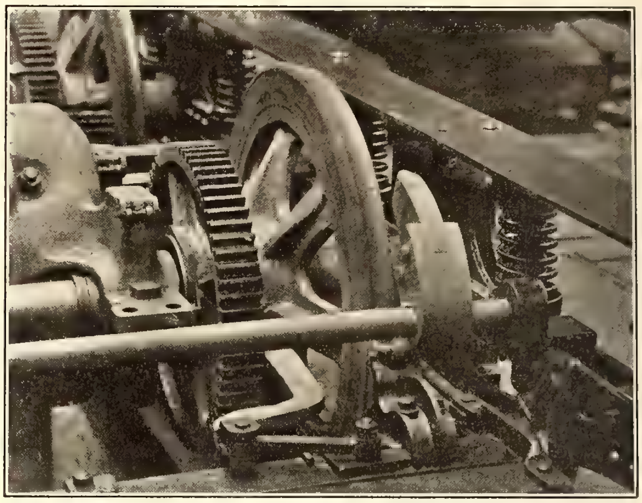
The American Institute of Electrical Engineers has just issued in book form and bound in cloth, the paper on the "Substitution of the Electric Motor for the Steam Locomotive," by L. B. Stillwell and H. S. Putnam, published in abstract in this paper for March 16, 1907, with the resulting discussion both oral and written. The latter includes a number of interesting statements. Mr. Townley, of the New Haven Railroad, believes that the institute would lay itself open to serious criticism if it undertook to establish a standard frequency for electrically-equipped steam roads, when there is no single electrified steam road in the country operated by single-phase current. He does not believe that present evidence would warrant the general adoption of 15-cycle single-phase motors in view of the general wide use of 25-cycle apparatus. R. D. Mershon also believes it well to go slow with standardizing frequency. H. M. Brinckerhoff quotes some figures on cost of operation on the Metropolitan West Side Elevated Railway, which, after ten years of operation, are from 25 to 30 per cent below corresponding costs of similar steam locomotive operation. A. H. Babcock, of the Southern Pacific Railroad, quotes some figures in favor of high-voltage direct-current operation. He says, however, that the fact that motors of this type have been specified by him for a large suburban service should not be taken as a declaration in their favor as a substitute for single-phase in all cases. W. S. Murray, of the New Haven Railroad, contributes some extensive tables on the cost of steam operation, dividing it into express passenger service, local express passenger service and freight service. These are based on New Haven operation. The price of the book is $1, and it will be sold at that price by the McGraw Publishing Company.

VARIABLE GAGE TRUCK USED IN BRADFORD, ENGLAND

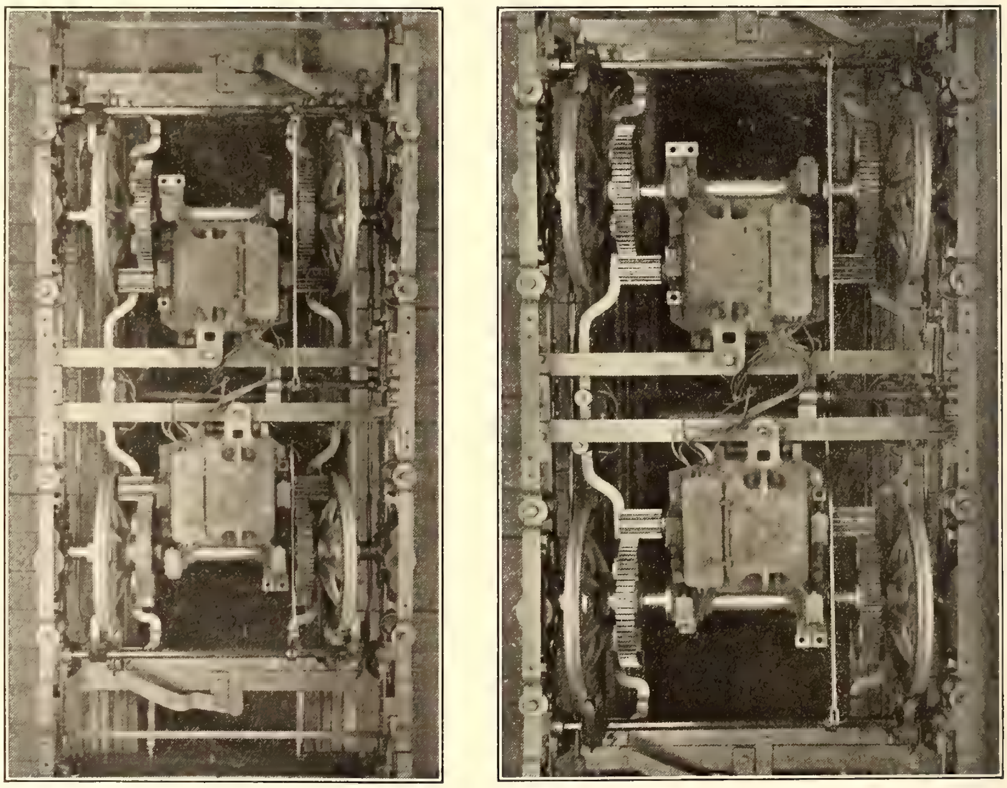
Although the tramway authorities of Bradford and Leeds, in Yorkshire, England, have long been desirous of running through cars over their adjoining systems, such connection appeared impracticable, as the gage of the Bradford tracks is only 4 ft., while Leeds uses the standard 4-ft. 8½ ins. It was first proposed to overcome this hindrance by laying a third rail, but as this would have meant an expenditure of nearly $100,000, it could not be seriously considered. As an alternative, C. J. Spencer, general manager, and J. W. Dawson, the assistant engineer, of the Bradford City Tramways, submitted to the joint tramways committee drawings of a car equipped with wheels adjusted to run on either gage. An experimental car was then built by the Thornbury Car Works, of the Bradford City Tramways. Since its installation this car has operated so successfully that it has been provisionally approved by the expert of the Board of Trade, the body which has very wide powers to regulate the operation of tramways and other public utilities.



VIEW ON WIDE GAGE WITH DISTANCE BLOCK IN RUNNING POSITION



DISTANCE BLOCK RAISED PREPARATORY TO CHANGING GAGE



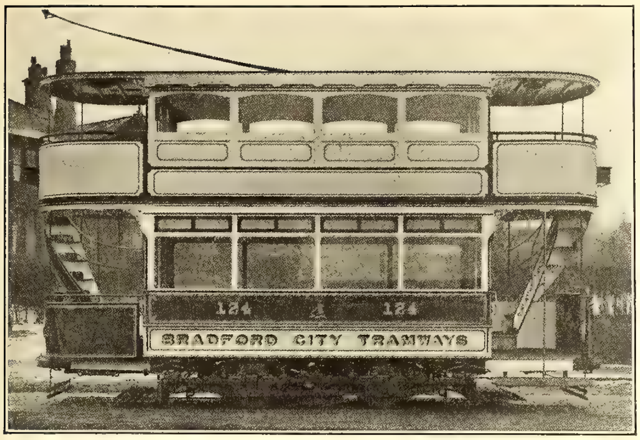
PLAN VIEWS OF TRUCK ON 4-FT. AND 4-FT. 8½-IN. GAGE, WITH GEAR CASES REMOVED TO SHOW EXTRA WIDE PINIONS

The general framing of this truck does not differ from the standard type, as the changes for different gages are made by the sliding of the car wheels to definite stops on the truck axles. The motor is carried in the ordinary manner, but has a broader pinion. The gear wheel and car wheel are mounted on a sleeve which can slide on the axle.

The gage-changing equipment consists essentially of an extra shaft behind each truck axle on which is carried a so-called distance block, to lock the wheel in the desired position. This shaft is turned by a lever mounted on the upper side frame of the truck, this causing the block to rise or fall from the side of the car wheels. Assuming that the vehicle is traveling on the 4-ft. gage, the axle sleeve with its wheel and gear is then at the innermost position with the gear engaging the motor pinion on its inner end; in this case the distance block is in contact with the outer face of the wheel. When the car reaches the point where the bridging rails taper outward to the wider rails, the block is lifted, and thus the entire gage-fixing mechanism slides along the axle through the motion imparted through the wheel flange and rail groove. On reaching the wider

gage the block is dropped to come in contact with the inner side of the wheel. When changing from the wide gage to the narrow one this process, of course, is reversed. The only part subject to rapid wear is the distance block, which, therefore, is made with a renewable tongue.

The important feature of braking is cared for by so



CAR EQUIPPED WITH GAGE-CHANGING MECHANISM

mounting the brake-shoes that they are free to slide along the brake operating bar and hence are moved along this bar by the portion of the brake block which engages with the wheel flange. The same result may be obtained by link connections to a bracket mounted around the axle sleeve whereby a longitudinal movement of the sleeve produces a corresponding movement of the brake shoes. Similarly, a track brake can be made to move in unison with the rest of the equipment.

STORAGE AIR STATION AUTOMATIC CONTROL

The accompanying diagram shows the connections of the devices used to automatically control the compressor motors in a storage air station, where compressed air is stored for charging cars equipped with storage air brakes. The three functions of such a control system are:

(1) The two compressor motors, of which only one unit is indicated in the diagram, must start and stop simultaneously between certain maximum and minimum air pressures, just as in the case of a car governor, except that the pressures handled are from 250 to 300 lbs. to the square inch.

(2) At starting, resistance is in circuit and the automatic must operate to reduce this resistance gradually to zero, just as a car controller does when properly handled.

(3) The automatic must operate to remove the air load just before the motors are started or stopped. If this feature is neglected, conditions are about the same as when operating a car with the brake applied.

In the diagram, A is a solenoid, with its plunger and contact plate g in the off position; if A is energized, g is pulled up into contact with g1 and g2, thereby closing the motor circuit. E, F and G are somewhat similar, but much smaller magnets for automatically cutting out the resistance. E and F carry special contacts, c and c′, the function of which will be seen later. Aluminium disk i is carried on plunger i′, terminating in a piston in dash pot D.P. containing oil. The dash pot regulates the rate at which i shall successively contact 1, 2, 3 and 4, and thereby controls the cutting out of resistance in the motor-circuit and the time of loading and unloading the compressor. X is the regulator, the contacts of which determine the pressures at which the automatic shall operate to start the motor and stop it. The blow-out coils of the main circuit magnet A are indicated at t-t′. M-M are magnets, the operation of which is effective in lifting the compressor valves in such a way that the compressor ceases to do work. L-L are three 32-cp lamps automatically cut into series with the magnets after they have operated, to decrease the amount of current that they take. This is possible because much less current is required to hold a plunger up than is required to pull it up from a distance. T is the source of trolley current.

In the diagram all devices are at the off position, the regulator-hand touches neither the starting nor stopping post, and the motor is at rest. Assuming the unit to start whenever the air pressure in the storage tank, hence in regulator X, may be 250 lbs. and stop when the pump has raised the pressure to 300 lbs. per square inch. The positions of the diagram may then be assumed to mean that the pressure has been stored to 300 lbs., that some of the air has been used, that the pressure is falling toward 250 lbs., and that, therefore, regulator hand h is moving toward starting post. In the diagram, then, all control circuits are open and the motor circuit is open.

The instant regulator hand h contacts the starting post on the left, trolley current takes path T-r-L-m″-m-m′-x-A-B-f′-v-h-starting post-f2-y-ground. The energizing of magnet A causes g to contact g1 and g2, thereby closing the motor circuit so that current can take path T-a-resistance-armature-field-g′-g-g″-ground and start the motor. Simultaneous operation of magnet B causes disc f to contact f′ and f″, to short-circuit the path leading through hand h, so that when the pressure increases and h leaves the starting post it will draw no arc. Also simultaneously with the operation of magnets A and B, current from junction x takes path x-q-D-f′-v-ground, thereby energizing magnet D and causing its plunger and disc i to move upward slowly on account of the resistance of the oil in the dash pot. The result of h touching the starting post, then, is to close

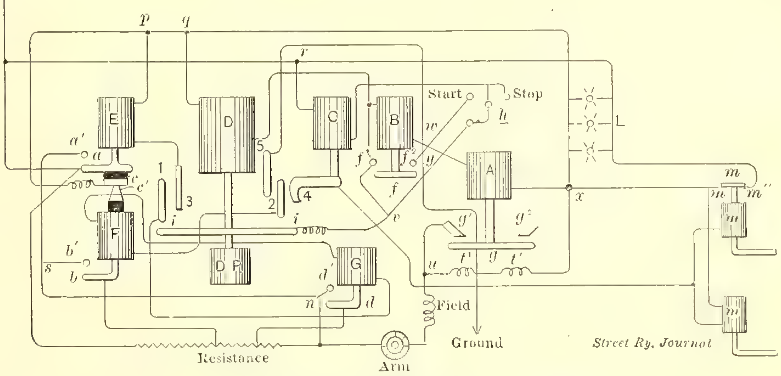


DIAGRAM OF AUTOMATIC ELECTRICAL CONTROL OF STORAGE AIR BRAKE SYSTEM

the motor circuit, short-circuit the regulator so that its contact hand cannot burn, and put in motion the automatic that is to cut out the main motor starting resistance. As soon as i in its upward motion contacts carbon rod 1, current from junction x takes path x-q-p-c-c′-G-1-i-v-f′-f-f″-y-ground, thereby operating magnet G, causing d to contact d′ to cut out one section of the motor starting resistance.

On further movement i contacts carbon rod 2, thereby causing current to take path-x-q-p-c-c'-F-2-i-v-f'-f-f''-y-ground and operate magnet F, which causes b to contact b', thereby cutting out a second section of the starting resistance in the motor circuit. Further upward movement causes i to contact 3; current from junction x then takes path x-q-p-E-3-i-v-f'-f-f''-y-ground and energize magnet E, so that a contacts a'' and at the same time contacts c and c' separate. The operation of E results in cutting out the last section of the starting resistance, the main motor current path becoming T a-a'-O-armature-field-g'-g-g''-ground. The separation of contacts c and c' opens the circuits of magnets F and G, so that they cease to take current, when such current becomes useless. All starting resistances having been cut out, the motor is now operating on full line voltage, but is doing no appreciable work, because the compressor is unloaded from the preceding shut-down. As soon as further upward travel causes i to contact 4, current takes path L-m''-m-m'-through unloading magnets M and M in parallel-4-i-v-f'-f-f''-y-ground. Both magnets operate to release their respective valves, so that the compressor can compress air. The operation of the upper magnet M also lifts disc m off contacts m'-m'', thereby removing the short-circuit across lamps L and cutting those lamps as a whole into series with the magnets now in operation; this effects a saving in current. The compressor is now storing air into the storage tanks, so that the pressure in those tanks and in regulator X slowly rises toward the maximum limit of 300 lbs. Simultaneously regulator hand h is slowly moving toward stopping post to the right. Assuming the regulator to be correctly adjusted, as soon as the pressure reaches 300 lbs. h will contact the stopping post. Magnet D has remained energized all the time, but could not pull i up any further, owing to the interference of hook-shaped contact 4. The contact of hand h with the stopping post causes a current to take path T-r-C-stopping post-y-f'-f-''-y-ground, thereby energizing magnet C, which then pulls up its plunger, rocks 4 out of inference with disk i, and allows it further upward movement. The instant 4 leaves contact with i the loading magnets M M lose their ground connection, become de-energized and assume their unloaded position where the compressor ceases to compress. A few seconds later i contacts carbon rod 5. Path w-5-i-v-f'' then acts as a short-circuit across the terminals of magnet B, thereby de-energizing it and causing disc f to drop, and with the result that all magnets are deprived of their ground connection, become de-energized and fall to the off positions. The dropping of f also insures that hand h will not drag an arc when the fall in pressure causes it to leave the stopping post.

DEVICE FOR RECORDING TRANSVERSE MOVEMENTS OF TRUCKS ON TRACK

J. Sutherland Warner contributes a suggestion to the Tramway & Light Railway Association, contained in its last Proceedings, for a device for registering the transverse movement of cars on the track. The nearer the body of the car follows a straight line the greater will be the comfort in riding and the lower the work expended in travel. Mr. Warner, therefore, suggests a small reservoir containing whitewash attached to the front and the rear of the car and connected with a spout so that a line of whitewash will be run on the track to show the variations from a straight line, followed by the front and rear ends of the car. By measuring the distances of this line from the center of the track a measurement of the oscillations will be secured. Mr. Warner believes that these variations are due more to the suspension of the trucks than to variations in track level.

EMPLOYEES' ENTERTAINMENT AT HOBOKEN

The Street Railway Employees' Social and Athletic Club, of the West Hoboken Division of the Public Service Corporation, gave its third annual entertainment on the afternoon and evening of May 25. It took the form of an amateur minstrel performance in which twenty-five members participated, with six "end men." Following this performance was a vaudeville entertainment with moving pictures.

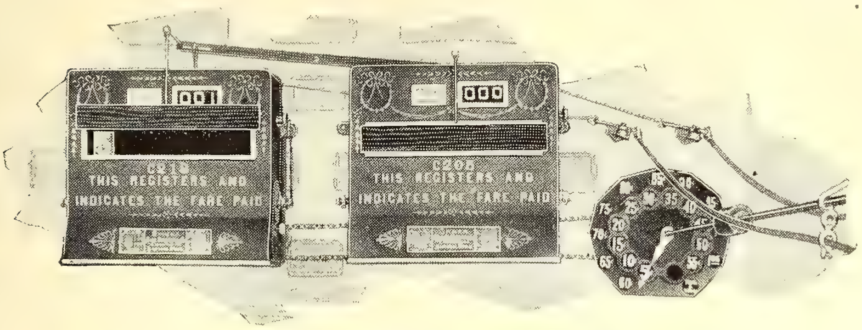
This organization is one of the most successful and prosperous of its kind in the neighborhood of New York, and has its headquarters in the West Hoboken car house. Here

WEST HOBOKEN CAR HOUSE

the company has provided an auditorium, aproximately 35 ft. x 110 ft., with stage, curtain, etc. In an adjoining room are two pool tables. A smoker, dance or some other entertainment is given once a month in the winter time, and a more ambitious performance once a year. The success of the club has been largely due to the active efforts of George H. Duck, division superintendent, and president of the club last year. The president this year is Charles A. Bauman, assistant division superintendent. Newton W. Bolen is honorary president of the club.

TWO REGISTERS OPERATED BY A ROD AND TWO CORDS

A new invention by the Ohmer Fare Register Company, of Dayton, Ohio, consists of an arrangement for operating two registers in either a city or interurban car by the use of one rod and two cords in such manner as to expose the denomination of fare registered in one machine and at the same time cover, by means of a winker, or small curtain so



FARE RUNG ON LOW-FARE REGISTER

attached to the operating mechanism as to move automatically whenever a fare is recorded, the tablet aperture on the face of the other register. The amount recorded is shown on the face of the machine in operation, on the double dial, placed on either side of the registers, or between them; on corresponding double dials throughout the car, and on the back platform when desired. The aperture on the face of the other register, through which a tablet is visible when it is operated, is hidden from view by one of the curtains of the winker, the corresponding curtain being automatically raised to show the last fare registered in the operated machine.

In the accompanying illustrations, one of the machines is mounted for recording smaller fares and the other one for registering larger denominations. The mountings of the inner dials correspond to those within the register con-

FARE RUNG ON LARGE-DENOMINATION REGISTER

taining the smaller mountings, and the denominations on the outer dials are similar to those within the second machine. This arrangement tends to render the work of the conductor as easy and simple as though he were operating one machine. It also simplifies the duties of the auditing department.

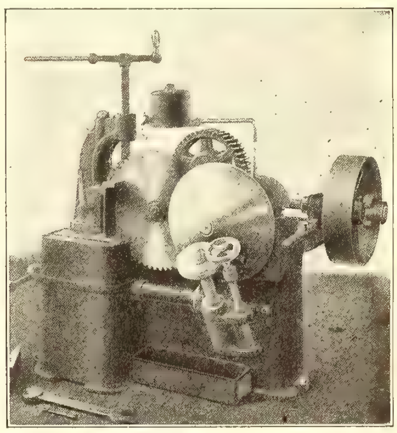
A sheet from Register No. C-218, for example, will show the record of fares collected from 5 cents up to 55 cents, and a sheet from Register No. C-205 from 55 cents to $1.05, and also tickets. It will also show the identification key number, or numbers, of the conductor, or conductors, who operated the machines, the numbers of the registers and other data.

The new apparatus is constructed along the lines that have become standard Ohmer practice, and all that is new in the device is protected by additional patents. It can be attached to two registers of any size or capacity; for example, where two fare registers, or counting machines, with permanent fare indications, are used in a car—one for counting cash, the other tickets or transfers—the winker can be attached and will reveal the denomination of the last fare registered, and at the same time will cover the tablet or figures on the face of the other register.

It is possible under the new method to register separately and print detail records of twenty-two different classes of fares on two No. 4 type machines. In all operations the last fare registered is the only one exposed to view, and is the only one indicated by the pointers on the several dials.

A NEW TYPE OF METAL SAW

A new type of metal saw has been designed by the Quincy, Manchester, Sargent Company, of New York and Chicago, to meet the demand for a somewhat smaller machine than the company has manufactured in the past, and though the new saw embodies the strength and wearing qualities of the company's regular machines, it is available for many small shops that would not be warranted in purchasing a larger and more expensive machine. The blade, as on the Bryant type of machine, is driven from the periphery, but instead of a sprocket drive, hardened steel rollers are used, which are ground and journaled in removable steel bushings held securely in the double driving



SAW USED FOR CUTTING RAIL

gear. By this method of drive a much larger diameter of the blade is available for cutting than can be obtained from a blade of the same size arbor driven, where about one-third of the diameter of the blade is necessarily occupied by the driving collars. It also has an advantage of economy in repairs. The machine has a capacity for cutting rounds up to 6 ins. in diameter and I-beams in a vertical position up to 10 ins. at any angle up to 45 degs. The feed is of the variable friction type, adjustable with the machine in motion. It is said to be powerful and continuous in its action throughout its entire range and superior to a ratchet feed. When desired the machine can be arranged for direct connected motor drive.

LONG-SCALE SWITCHBOARD INSTRUMENTS

Recognizing the need for switchboard instruments well suited for use with generators of large capacity and where readings must be made at a considerable distance from the switchboard, the American Instrument Company has recently designed a long-scale instrument of the type shown in the acompanying illustrations. These instruments are provided with scales approximately 14 ins. long, or twice the length of the usual large size round pattern instrument. This gives ample room for large divisions and large figures which, together with the unique method of marking the scales (shown in Fig. 1), make them extremely clear and legible.

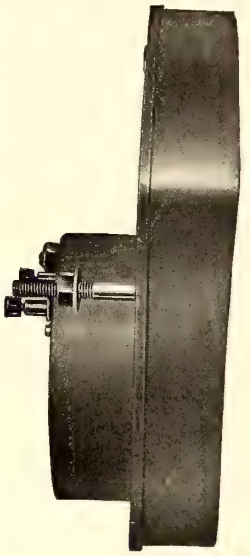
Perhaps the most unique feature of these instruments is the method of mounting them on the switchboard. When an instrument with a long-scale, as described above, is mounted entirely on the front of the board, it projects a considerable distance and is more or less in the way, while if the same instrument is mounted flush it requires cutting a large irregular shaped hole, which weakens the panel very materially. The way this new instrument is constructed entirely obviates both of these difficulties. It projects less than 2 ins. from the front of the board, and yet requires a circular hole only 6⅝ ins. in diameter to be cut in it. Thus they are easy to mount, the panel is not unduly weakened, and all the advantages of the flush type instruments are offered. Very satisfactory illumination may be obtained by a lamp and bracket mounted over the instrument.

Fig. 2 shows the unique construction of the case to allow this unusual method of mounting. The instrument proper is mounted in a circular box which projects through the board while the shallow portion of the case contains the scale and lies flat against the front of the switchboard.

LONG-SCALE SWITCHBOARD VOLTMETER

The internal construction of these new Type 3 instruments is said to conform strictly to the usual excellence of this company's round pattern and portable instruments. The magnets are aged and magnetized according to the latest and most approved methods. The mechanical construction of the moving coil, its mounting, etc., are extremely simple and rugged, so that they are well adapted for the hard service, which is bound to come to any switchboard instrument.

Ammeters of this type are arranged to operate in connection with the standard interchangeable switchboard shunts regularly used with round pattern switchboard instruments. These shunts are adjusted to give a uniform drop of exactly 50 milli-volts on full load. The instrument, together with its leads, also is adjusted to have exactly one ohm resistance and to give full deflection on 50 milli-volts. Thus any shunt of any capacity can be used with any instrument and pair of leads, and correct results will be obtained. This feature is of great advantage, as it allows the use of any number of shunts of any capacity on one indicating instrument, the only requirement being that a suitable two-pole switch of negligible resistance be inserted in the leads between the instrument and shunts. Should an instrument be disabled through accident, it can be returned to the factory for repairs and properly adjusted without disturbing the shunt at all, and while it is out of commission another "American" ammeter, whether of the same or different type, may be used and correct readings obtained when the proper multiplier is used to make the scale values agree with the shunt capacity.



LONG-SCALE SWITCHBOARD VOLTMETER (SIDE VIEW)

These long-scale voltmeters have a uniform resistance of exactly 100 ohms per volt, so that a 150-volt instrument has just 15,000 ohms total resistance and a 300-volt instrument exactly 20,000 ohms resistance, and so on. This uniformity makes it possible to use multipliers interchangeably should they be required, and also adapts the instrument for measuring insulation resistance and grounds most satisfactorily.

Where generators of large capacity are used there will naturally be large currents flowing in the bus-bars, which will set up magnetic influences affecting the readings of the ordinary instrument. This company's long-scale instruments, as well as its other switchboard round pattern instruments, however, are provided with soft-drawn sheet-iron cases, which provide a most efficient magnetic shield for the internal parts. As these cases are drawn into shape, the material must be of uniform softness throughout. In consequence of this there is practically no danger of their becoming permanently magnetized, as happens when cast iron is used. In addition to the shielding quality of these cases they are so designed that where parts come together there is ample bearing service to prevent effectively the entrance of dust.

The factory of the American Instrument Company is in Newark, N. J., but the general sales office is in Philadelphia, where James G. Biddle, president as well as sales agent of the company, makes his headquarters.

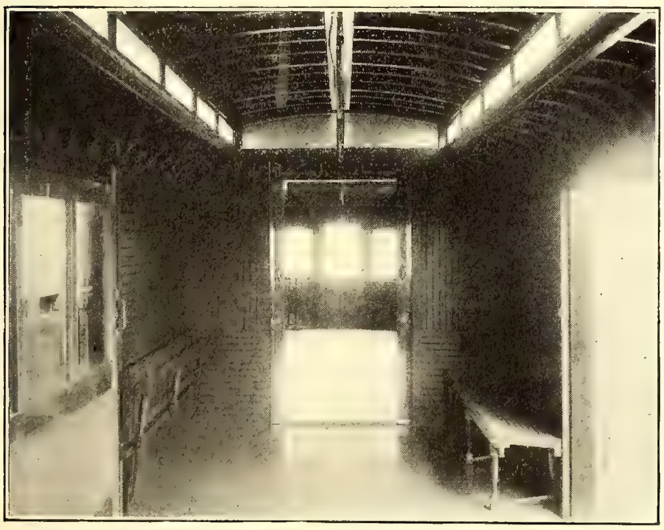
The strike situation in San Francisco is improving daily. More cars are in operation now than noted last week, and additional rolling stock is from time to time being placed in service. Acts of violence are infrequent. According to the representatives of the company in the East, the situation is well in hand.

INTERESTING BAGGAGE CAR FOR CENTRAL CALIFORNIA TRACTION COMPANY

An interesting baggage car for interurban service has been furnished to the Central California Traction Company by the American Car Company. The car is divided into two equal compartments, mainly to assist in classifying the various kinds of freight. Each compartment has the regulation doors at the sides, and the partition between

EXTERIOR OF CALIFORNIA BAGGAGE CAR

compartments contains double folding doors. Side benches are arranged along the walls and can be folded up when not in use. The doors at the ends of the car are placed in the center because it is proposed to operate the car with the four 40-ft. interurban passenger cars supplied to the company by the same manufacturers. The trucks are equipped for third-rail operation, as the interurban cars on the system will be operated outside the city limits with 1200 volts d. c.



INTERIOR OF CALIFORNIA BAGGAGE CAR, SHOWING ARRANGEMENT OF COMPARTMENTS

taken from a protected under-running third rail. The principal dimensions of the baggage car are as follows: Length over all, 45 ft. 10 ins.; over body, 45 ft.; width over sill plates, 8 ft. 10 ins..; height from underneath sill to top of deck, 9 ft. 2 ins.

Construction work on the system of the Central California Traction Company commenced last summer in Stockton, and the city system, consisting of 11 miles of single track, is already in operation. The first interurban division, from Stockton to Lodi, has just been placed in operation. When completed, the entire system will be 235 miles in length.

STATISTICS OF ELECTRICAL DEVELOPMENT

According to Bulletin 73 of the U. S. Bureau of the Census, which is a report on the manufacture, according to the census of 1905, of electrical machinery, apparatus and supplies, there were, in 1905, 784 establishments engaged primarily in the manufacture of electrical machinery, apparatus and supplies. Their capital was $174,066,026; the average number of wage-earners employed, 60,466, and their wages, $31,841,521; the cost of materials used, $66,836,926, and the value of products, $140,809,369. The percentages of gain since 1900 are as follows: In establishments, 34.9 per cent; in capital, 108.1 per cent; in number of wage-earners, 43.9 per cent; in amount of wages paid, 54.7 per cent; in cost of materials, 35.1 per cent, and in value of products, 52.3 per cent. In addition to the products reported by these establishments, there was an output of electrical machinery and supplies, valued at $18,742,033, from 128 establishments engaged primarily in other lines of manufacture.

The distribution of electrical manufacturing throughout the States has remained the same in all essential respects at the two censuses. New York, Illinois, Ohio, Pennsylvania, Massachusetts, Connecticut, Indiana and New Jersey reported 631 of the 784 establishments making electrical apparatus at the census of 1905, and products valued at $126,-807,804, or 90.1 per cent of the total for the country. In value of products, New York led, followed by Pennsylvania, Illinois, Massachusetts, New Jersey and Ohio in the order named. Their combined products constituted five-sixths (84.5 per cent) of the total value of products.

The increase in total capital was greatest in Pennsylvania, where capital increased from $20,967,587 to $58,393,011, or 178.5 per cent, although the value of products advanced only from $19,112,665 to $26,257,569, or 37.4 per cent. The capital and value of products of the other leading States were as follows: New York, capital $30,643,167, and products, $35,348,276; Illinois, capital, $21,644,783, and products, $16,700,027; Massachusetts, capital, $12,735,427, and products, $15,882,216; New Jersey, capital, $18,457,821, and products, $13,803,476; and Ohio, capital, $10,408,184, and products, $11,019,235.

A LIGHT-WEIGHT TROLLEY BASE

A trolley base, which is said to embody a number of distinctive features, is manufactured by the Milloy Electric Company, of Bucyrus, Ohio, by which it is now being placed on the market. It is built of charcoal malleable iron and weighs only 120 lbs. A consideration that governed in its design was the amount of space it was to occupy, and in this respect it has been kept in size down to a minimum. Its height is only 5 ins., with a bearing surface in keeping, which is said to insure good contact and to preclude the possibility of arcing. The base centers itself between two sets of taper roller bearings arranged so as to prevent oil from percolating through to the roof of the car and doing almost irreparable damage. With the Milloy base the tension is said always to be uniform. The advantages of this feature are readily apparent in the elimination of arcing at the wheel where the wire is especially high and of excessive pressure where the wire is low. Another feature claimed for the device is that the lateral swing which it has makes it possible for the wheel to follow curves without jumping the wire. As the cable connection is not exposed and no tape is required to insulate it, it is said to be impossible for water and dirt to injure the connection.

LONDON LETTER

(*From Our Regular Correspondent.*)

Louis Brennan, who is well known in connection with torpedoes, has just created somewhat of a sensation by a paper which he read before the Royal Society and the exhibition of a model of what he terms his "Gyroscopic Mono-Rail." Reference to this system is made in another column, but the presentation of his paper seems to have called for a little more than the usual press notice in England, as it is undoubtedly a system of extreme novelty and one which has aroused wide interest. Briefly, it consists of a car, operated by any motive power, which travels on a steel rope, or the top of any kind of steel structure, which may be erected over mountains, valleys, tops of houses, and, in fact, anywhere. The car appears to balance itself, as it were, on single wheels on this tight rope by means of swiftly revolving gyroscope. Mr. Brennan effectively employed the gyroscope for speeding torpedoes accurately in the direction in which they have been launched, and the same principle has been applied in his mono-rail system. The results are certainly extremely astonishing, for as long as the gyroscopes continue to revolve it would seem to be an impossibility to upset one of these cars from off the structure on which it may be running.

Last month this letter contained a note to the effect that a conference of tramway managers was decided to ask the Postmaster General to receive a deputation from them that they might make representation against the proposal which the post office was making to insert a new clause in the new tramway bills. These bills would enable the authorities of the post office department to attach telegraph wires to the poles or standards erected in the public routes for the tramways authorized by these bills. Such a deputation has now been received by the Postmaster General, and though the proceedings were private, it is understood that fifty municipalities were represented. They are said to have made strong representations that they considered such far-reaching proposals should not have been presented to them so late in the session, and that it would have been much better if a public bill had been brought in on the subject instead of a private bill dealing with certain localities. It was pointed out that the Board of Trade had made regulations for guarding against accidents by means of guard wires, and that the tramway authorities were generally of opinion that these guard wires only added to the danger instead of diminishing it. They were not so anxious to avoid such expense, but their true desire was to protect the public, and if the post office were to attach more wires it would simply increase the danger. No decision was reached, but the Postmaster General stated that his department would carefully consider the points and probably arrange for a further conference, when some arrangement would doubtless be made. It is not so long ago since Liverpool had a fatal accident by means of a telephone wire falling on the trolley wire and coming in contact with occupants of the top of a tramway car. It would appear that further erection of wires on the routes of tramways would be simply a step backward, and it is to be hoped that the results of the deputation will be such that the post office will abandon its proposed clause. A conference has since taken place at the General Post Office, London, between Sir Robert Hunter, solicitor; Major O'Meara, chief engineer, on behalf of the post office, and representatives of the Municipal Tramways conference, at which it was agreed that the post office would do its utmost to minimize the dangers arising from the adoption of such a system, and that the Postmaster General would accept responsibility for damage done as the result of placing telegraph and telephone wires on tramway standards.

London is a city of tubes, and among the many that are being opened from time to time the original electric tube of London is apt sometimes to be forgotten. This tube, the City and South London, is again to the front, however, by reason of the opening of its new extension from the Angel via King's Cross and St. Pancras to Euston, which took place a few days ago. This extension forms really the ultimate object of this railway and gives a very much needed connection from the whole city district to the large main-line railways situated in Euston Road. The ceremony was performed by H. Percy Harris, chairman of the London County Council, a special train conveying a large party of gentlemen over the new portion of the line from the Bank Station. The first stop was made at the Angel, which station itself was only opened a few years ago, when Mr. Harris switched on the current fitted in the carriage in which he traveled. At King's Cross another stop was made to inspect the platforms and on reaching Euston the company was entertained at luncheon by the railway company in the hall of the station. Among those present were C. B. Stuart Wortley, M. P., chairman of the company, Sir Benjamin Baker, consulting engineer, and many other influential gentlemen connected with railway enterprise. Mr. Harris, in proposing the toast of prosperity to the company, stated that the London County Council was deeply interested in the promotion of traffic facilities in the metropolis, and that the public would doubtless recognize the benefit bestowed by all promoters of transportation, whether on the surface or in tubes. He also mentioned that the City & South London Railway Company had carried since it commenced business two hundred million passengers without any serious accident. Sir Benjamin Baker, in replying to the toast of the engineers, contractors and officers, mentioned that the largest iron tunnel in the world had been placed at the Euston end of the new extension.

With regard to the London County Council electricity bill, which it will be remembered is a bill for providing the whole of the London area with cheap electric power by means of construction of large power houses, nothing has yet been actually decided, although the bill has now been up in Parliament. It was thought that when the Council was changed at the last election the Moderates might be inclined to drop the bill entirely. Such, however, appears not to be the case, as it was decided to proceed with the bill with clauses inserted giving the Council permission to make arrangements with private companies for operation, as the Council appears to be of opinion that it would not be wise to operate such plants itself. This indicates that the Council is working more in unison with one of the other bills in parliament, the administrative county and London bill, which is a bill working for powers to make agreements with the Council. At the meeting, therefore, of the London County Council, the motion was duly carried through, though strongly opposed by the Progressives, that the bill should be submitted for second reading in the House of Commons with a view to securing an arrangement under which private enterprise undertakes, subject to the control of the Council, the business of the supply of electrical energy, and on the understanding that such alterations as may be required in the bill to effect this object and to deal with any other matters of importance which may arise on the bill will be reported to the Council for its approval as soon as possible. The bill has now come up for second reading and on the first occasion it was practically talked out, or, technically speaking, adjourned till another day. McKinnin Wood, the Progressive leader, though defeated in the County Council vote, made an able speech in defense of the bill, making it quite clear that he had no love for the leasing proposal. Lloyd George was strongly in favor of the bill going to a committee, but in the meantime the discussion has been postponed.

Liverpool now has a proper home for its tramways and electric supply departments, as these have just moved into a new permanent building in Hatton Garden. For some time the staff of the tramways department has been divided between the head office in Sir Thomas Street and an office in Hatton Garden, while the electric supply staff has found quarters in Highfield Street. As has been apparent for a long time proper quarters for both departments were necessary, and a new building which has occupied about two years in completion is the result. It has a frontage to Hatton Garden of 184 ft., and the total area of the site on which it stands is 1982 square yards. It is a handsome six-story structure of Hall Dale stone and red Ruabon brick and has cost £48,650.

The work of the electrification of London's tramways is still proceeding satisfactorily, and the highways committee of the London County Council has recently reported that the electrification of the tramways in City Road, from the terminus at Finsbury Pavement as far as Old Street; in Old Street, from Great Eastern Street to Kingsland Road, and along High Street, Shoreditch, Whitechapel, High Street and Leman Street, with junction lines, comprising the remainder of the first section of the Council's northern tramways to be electrified, has been completed, with the exception of certain works at Whitechapel. The Board of Trade inspection of the new tram lines from the Clock Tower, Lewisham, to Lee Green has also taken place, and this service is now in daily operation. The speed limit is 16 miles an hour, no special restrictions being made at any point. The tramways bill of the London County Council has also been

before a select committee of the House of Commons. Counsel for the London County Council at that time made the statement that there were 127 miles of tramways in London, the London County Council owning 118 miles, and that in 1911 they would own the balance. Sixty miles of the tramways are now worked electrically, and 20 miles will be converted for electric traction this year.

The question was recently put to the Prime Minister in the House of Commons whether the Government would appoint a traffic board with powers to regulate and supervise the various transportation services of the metropolis, as recommended by the Royal Commission. Sir H. Campbell Bannerman replied that the subject was engaging the attention of the Government, but that he could hold out no hope of legislation during the present session. Allen Baker, who has been connected with the London tramways for so many years, on being interviewed, stated that he considered the solution of the problem consisted in the extension of the Council's tramways. Mr. Baker is evidently in favor of the construction of more shallow subways similar to the one now under Kingsway, and believes that in time the tramways will extend as far as the Bank in the heart of the city, but that these tramways will be operated in shallow subways. As to the motor-bus "bogey," Mr. Baker does not seem to have the slightest fear of it and makes the broad statement that none of the motor-bus companies is paying, operating now along the very best routes, and that if the London County Council could only get tramway facilities on the same routes the 'bus companies would be in a worse plight than ever.

The Parliamentary bills' committee of the Glasgow Corporation recommend that the Corporation should petition against the order of the Paisley District Tramway Company. Under the order power is sought to construct a new tramway from Barrhead to Thornliebank, and to run over the tramways to be constructed by the Corporation from the present terminus at Pollokshaws (west) to Rouken Glen Park via Thornliebank. The Renfrew County Council has also decided to oppose the order.

It is quite possible that some arrangement will be arrived at between the British Electric Traction Company and the Birmingham Corporation for the disposal by the former to the city authorities of the remaining lines in the city, which comprise the cable route. If such an offer is made, it is expected that the Corporation will look upon it with favor should the terms proposed be at all reasonable, and if the transference takes place the cable route will be electrified at once.

Progress has been made with the negotiations that are proceeding between the tramway committees of Manchester and Salford for the running of an inter-change system of tramcars over the routes of both Corporations. The committees of the two Corporations will be asked to support the running of interchange through cars for a period of some months over one important route, through the borough and across the city, with a view to a practical demonstration of the utility of the scheme before it is more widely adopted.

A sub-committee of the tramways committee of the York City Council visited Lincoln recently, and, by the courtesy of the officials, inspected the Griffiths-Bedell system of electric tramways, established there about eighteen months ago. Wolverhampton was also visited by the same committee which inspected the Lorain surface contact system of tramways. The York sub-committee is inclined to favor the installation of a surface contact system at York, in which city at present the horse tram system is in use.

The first contract for tramway permanent way for Japan which has been placed in this country has just been secured by Edgar Allen & Company, of Sheffield. Hitherto orders of this kind for Japan have been placed with American firms. The contract provides for the supply and construction of the whole of the special track work, lay-outs, cross-overs, etc., required for the tramways to be constructed in Osaka.

At the annual meeting of the Elland District Council James Clarkson (clerk) reported that he had had an interview with the manager of the National Electric Construction Company with respect to the proposal to join Halifax and Huddersfield by tramway via Elland. He was asked to inform the Council that the company is prepared to carry the scheme through. The promoters have already spent about £10,000 upon the scheme, and it is not likely that they will drop it. Every line which the company promised has been completed.

The formation of the new cable tramway lines of the Edinburgh Corporation in Gilmore Place and Broughton is at once to be proceeded with. A meeting of the tramway committee of the Corporation was held recently, at which a report by Sir Alexander Kennedy, the Corporation's consulting engineer, on the work authorized by the Town Council was submitted. The report dealt chiefly with details in the carrying out of the work. It is understood that there is no question of providing further power. The power stations at Tollcross and Henderson Row can furnish ample additional power for the new sections. The Town Clerk was instructed to advertise for estimates for carrying out the construction of the new lines.

The tramway facilities between Croydon, Penge and the Crystal Palace are about to be greatly improved as a result of an agreement just arrived at between the Croydon Corporation and the South Metropolitan Tramways Company. At the present time all cars stop on the Croydon and Penge boundary at Shelby Road, and, though they may hold through tickets, passengers are compelled to change. This has led to so much complaining that the Croydon tramways committee felt compelled to seek a solution. The new arrangement provides for the interworking of cars, so that the public may travel between Croydon, Penge and the Crystal Palace without changing.

At a meeting of the Belfast tramways committee, Sir Robert Anderson presiding, the sub-committee appointed to consider the desirability of purchasing the Cavehill and Whitewell tramway system recommended the purchase of the entire tramway for the sum of £60,000. The recommendation was adopted subject to confirmation by the Council. The line runs from the terminus of the Belfast tramways at Fort William Park to a favorite suburb 6 miles distant.

The report of the past year's working of the Blackburn Corporation Tramways shows that for the first time since the undertaking was acquired by the Town Council in 1899 a net profit has been made, the amount being £511.

A deputation representing the blind people of Bradford recently waited upon the tramway committee of the Bradford Corporation and asked that passes should be granted to the blind, enabling them to travel on the city tramways without charge when going to their work or returning therefrom. The committee decided that they could not grant the whole of the request, but they agreed to issue instructions that blind people should be permitted, on production of a certificate, to travel at any time on the tramcars at half the ordinary fares.

George Craddock & Company, Wakefield, have received an order from the Glasgow & District Subway Company for a specially made tramway cable to work their line. This rope is 36,300 ft. long, 1½ ins. in diameter, and weighs approximately 57 to 60 tons. This is the heaviest rope in one piece that is working any cable tramway system in the world.

Cars are now running on the New Malden to Raynes Park section of the new tramway line laid down by the London United Tramway Company. The section, which is about 2½ miles in length, was finished about a year ago, but it has not hitherto been brought into use on account of the non-completion of the Wimbledon section, which is a continuation of it. An extension of the line from South Wimbledon to Tooting, where a junction will be effected with the London County Council tramways, is also well advanced and it is expected will be opened at an early date. South London residents will then be able to proceed by tramway to Hampton Court and other places in the Thames Valley.

After repeated experimental runs with the tramcar fitted with the new adjustable axle arrangement, illustrated elsewhere in these columns, for traveling upon both wide and narrow gages, a month's trial of a through service on the tramways between Leeds and Bradford has been commenced. At Stanningley, where through passengers have previously had to alight and change cars, they keep their seats, and by the simple movement of a lever the conductor alters the gearing so that the wheels readily accommodated themselves to the broader gage of the Leeds system. On the Leeds section there are several rather sharp curves, but these are successfully negotiated and the whole journey is accomplished with perfect smoothness. In Bradford the new car is by this time a tolerably familiar object in the streets, but in City Square and at the Corn Exchange, Leeds, it is sufficient of a novelty to arouse considerable curiosity. The special car is kept on throughout the day and is scheduled to complete a journey every 65 minutes. The question as to the permanent adoption of the invention and the extension of its application to a regular service of cars has not yet been decided upon by the two authorities, but it is understood that terms have provisionally been discussed. The through fare, as in case of the divided journey, is sixpence—a reduction of threepence upon the amount charged on the railway.

THE IMPETUS GIVEN ELECTRIC RAILWAY BUILDING IN PENNSYLVANIA BY THE PASSAGE OF FAVORABLE LEGISLATION

With the enactment of favorable legislation by the late sitting of the State Assembly, of Pennsylvania, electric railway interests throughout the State are becoming quite active, and a genuine boom in sections of the State now without trolley facilities is looked for during the balance of 1907 and in 1908. In the vicinity of Harrisburg particularly is this activity noticeable, largely owing to the close proximity of the McCall's ferry power plant now in course of construction. The company constructing this plant has already acquired the Lancaster County Railway & Light system, radiating in all directions from Lancaster and is said to be backing the project to build a double track, fast express system between Harrisburg and York, a distance of 27 miles. Governor Stuart has approved the application of the capitalists back of the company for authority to extend the chartered route of the Lewisbury & Strinestown Street Railway Company, which extension will begin near New Market, York County, pass through New Cumberland, where it will cross the Susquehanna River on a double-track steel bridge, to be built for wagon and foot travel, as well as electric railway travel, and have its terminus in South Harrisburg, covering certain streets in Steelton and South Harrisburg not now occupied by the tracks of the Central Pennsylvania Traction Company. The tracks of the Northern Central Railroad at New Cumberland and the Pennsylvania and Philadelphia & Reading Railroads in this city are to be crossed by overhead bridges. The line in this city will run from Cedar Street to Thirteenth and up Thirteenth to Sycamore, down Sycamore to Tenth, on Tenth to Paxton, thence on Paxton to Thirteenth and down Thirteenth to Sycamore, making a loop.

David Pepper, Jr., of 1233 Land Title Building, Philadelphia, is the president of the company which was chartered to build a line in the upper part of York County in 1905. J. DeW. Duncan, of Philadelphia, is the secretary. E. R. Sponsler, of Harrisburg, also is interested in the company. It is expected to make arrangements to carry out the project of extension and bridge building this year. Application will have to be made to the City Councils for rights on city streets and to New Cumberland for rights there. Mr. Sponsler is quoted as stating about the project: "This is the closing up of the link of the line which will connect York and Harrisburg. This company will connect below New Market with the York Traction Company and we will at once take steps to secure municipal rights. The surveys have been completed and the plans are for a fast line. The system will be built upon modern ideas and make quick trips."

Mr. Sponsler said that the steps to secure franchises for Harrisburg and New Cumberland would speedily be taken. It is not thought that the New York capitalists operating the McCall's ferry electric plant will stop with acquisition of this line and the Lancaster County system, but will eventually secure the systems in York.. The Central Pennsylvania Traction Company also figures largely in the early completion of a through system between Harrisburg and Philadelphia.

Among the charters issued at the State department last week were the following:

Philadelphia, Valley Forge & Suburban Railroad Company, to construct a line 6 miles long from the terminus of the Philadelphia Elevated Railway, at Darby, to a point toward the historic camping ground. L. Knowles Perot, of Bala, is president. This charter completes the last incorporation necessary for the companies of the Valley Forge system of trolley lines projected from the western terminus of the Philadelphia Elevated road to Valley Forge and Phoenixville. This system, financed by L. Knowles Perot, of Bala, and others, and included in a holding corporation, the Public Service Investment Company, has been surveyed all the way, but building operations have not yet been begun. The Philadelphia, Valley Forge & Suburban is capitalized at $60,000. Mr. Perot is president, and the other incorporators are: A. D. Whiting, David Rombold, Jr., and Edward W. Johnson, Philadelphia; James A. Bunting, Secane; Morris H. Wetherill, Haverford, and Robert C. Selden, Norristown.

A number of other charters had already been obtained for the system, which includes the Valley Forge, the Colonial Springs & Phoenixville, the Cynwyd, Fairview & Ardmore, the Fairview & Merion Square and the Merion Square & Barren Hill Railroads, and the Audubon, Lower Merion, Bala & Wynnefield Railways. Among the towns from which the system expects to draw traffic are Spring City, Royersford, Phoenixville, Port Kennedy, Wayne, St. David's, Radnor, Bridgeport, Norristown, Conshohocken, Spring Mill, Barren Hill, Bryn Mawr, Haverford, Ardmore, Cynwyd and Bala.

Waynesburg & Monongahela Street Railway Company, capital $84,000, to build a 14-mile line from the junction of the Waynesburg & Rogersville Railroad in Franklin Township, Greene County, with the Waynesburg & Washington Railroad, thence over the Waynesburg & Rogersville Railroad through West Waynesburg, Waynesburg, East Waynesburg, Morrisville, Jefferson, Clarksville, to Millsboro, Washington County. The line follows the bank of Ten-Mile Creek for some distance. The directors are: Jesse L. Ross, president; E. L. Denny, W. P. Ely, G. M. Scott, W. A. Titus, all of Waynesburg. Other incorporators are: H. C. Scott, L. M. Waddell, Harry Taylor, H. K. Coffrath, C. M. Scott, J. G. Rinehart, S. P. Bossert, John Lantz, and Thomas S. Crago. Other local companies which will soon receive charters are the Palmyra & Campbellstown Street Railway Company, from Campbellstown to Palmyra, and the Bismark & Lebanon Street Railway Company to build between Lebanon, Bismark and Mt. Ætna. George C. Unger, of Lebanon, has been awarded the contract for the overhead work on the new Palmyra-Campbellstown line.

It is stated that the building of the York-Hanover electric line, which is to be a part of the great Central and Southern Pennsylvania net-work of electric railways, will approximate $500,000. There will be nearly twenty large and small bridges. One of them, near Hanover, will cost in the neighborhood of $30,000, it is said. A large force of men is at work on the line, there being a camp of nearly 200 men in the vicinity of Spring Grove. The work of strengthening the Market Street bridge in York to accommodate the heavy cars to be used is in progress. This road is expected to be in operation by Dec. 1. A contract for the car equipment of this line will be awarded in a few days. Extra large cars are to be used on the line. Ten new cars are to be added to the present equipment of the York County Traction Company, of which five have arrived from the Wilmington works of the American Car & Foundry Company.

About 1500 men are now engaged on the building of the McCall's ferry power plant, which will be completed next year it is expected.

PROSECUTING THE DISHONEST EMPLOYEE

Peculations by conductors here and there have always been a source of considerable annoyance, especially as there seemed to be no way of dealing with the offender that meted out the proper punishment and carried a moral lesson showing clearly to the other men how dishonesty must work seriously to their detriment, not only in the company with which they are associated, but in the closely related way of increasing their difficulty in securing employment elsewhere through the inability of their last employer, as a result of their own actions, properly to recommend them. Isolated instances are on record where proceedings have been carried to court in prosecuting dishonest employees, and one such on the East St. Louis & Interurban Railway has recently come to notice and again brings up the whole subject, not only because of the methods employed by the company, but because of the effect this case is expected to have on the organization as a whole. Discharging dishonest men as soon as they are apprehended seems not to have just the right effect. This, the company in question, soon discovered. It was, therefore, decided to secure evidence against a suspect and arrest him while on duty. This was done after the man had finished his second trip for the day. He immediately asked to have his case tried as soon as possible. As a result of the court proceedings the man pleaded guilty and was fined $1 and costs and sentenced to jail for one day. The specific charge against this man was the embezzlement of $1.60. Although the sentence was a short one it establishes a precedent and is expected to have a permanent effect, especially as the company has publicly stated that hereafter all employees who are discovered to be dishonest will be prosecuted.

SYNOPSIS OF LAWS PASSED BY THE ASSEMBLY OF IOWA AFFECTING STREET AND INTERURBAN RAILWAYS

The thirty-second General Assembly of Iowa, which adjourned in April, passed a number of acts affecting interurban and street railways that are of considerable interest. The following is a brief synopsis of the important acts:

House file No. 281, which amends the present law and provides that companies shall, upon request, construct a cattle-guard on each side of private crossing, with necessary fences. The old law only required construction of cattle guard on one side of causeway.

House file No. 421, which repeals section 2026 of the code relating to street railways over highways and enacts a substitute therefor. The old act section applied to street railways alone. The new act affects interurban, as well as street railways, and provides that they may construct their lines upon any highway 100 ft. in width outside the limits of the city or town, provided they repair the road as soon as the line is constructed. In case the road is only 60 ft. in width, then the supervisors may grant the right for the use thereof by interurban or street railway company for a distance of 2 miles only, beyond the limits of a city or town. In either case, written consent from two-thirds of the property owners along the road must be obtained before the line can be constructed.

Senate file No. 240, which amends code section 2051, relating to conditional sale or lease of rolling stock and equipment of steam railroads by adding thereto a provision for the conditional sale or lease of power house, electric or other equipment of street or interurban railways, or of electric light and power companies, or of steam heating companies, such equipment including engines, boilers, generators, switch-boards, transformers, motors and other machinery and appliances.

House file No. 63, which repeals section 2057 and enacts a substitute therefor. This act provides that the company must construct and keep in repair a suitable fence of barb wire and posts, or woven wire, or both combined, or posts and boards, or any other fence which the fence viewers shall determine to be equivalent thereto, on each side of the track, so constructed with cattle guards at all public road crossings as to prevent cattle, horses, sheep, swine and other live stock from getting on the tracks.

House file No. 220, which provides for the classification of railroads into three classes, class "A," those with gross earnings in excess of $4,000 per mile; class "B," those with gross earnings at $3,000 per mile, but not over $4,000, and class "C," those with gross earnings under $3,000 per mile. The passenger rates on all class "A" roads shall not exceed 2 cents per mile; those on all class "B" roads shall not exceed 2½ cents per mile, and on all class "C" roads 3 cents per mile. Children twelve years of age or under one-half the regular rates above mentioned. The law also provides a minimum rate of 10 cents for all distances under 5 miles.

House file No. 65, which provides that it shall be unlawful for any railway to require or permit any employee engaged in movement of rolling stock, engine or train, to remain on duty for more than 16 consecutive hours, or to permit any such employee to perform further service without 10 hours of rest. Exceptions are made where work performed is in protection of life and property; in cases of accident, wrecks, etc., crews in charge of train loaded exclusively with live stock or perishable freight are to be allowed to take same to nearest division point on said railroad; also crews delayed by wrecks or accidents. The penalty is a fine of not less than $100 and not over $500 for each offense. The Railroad Commissioners are authorized to investigate and hear complaints.

House file No. 479, which provides that all street or interurban railway companies shall furnish terminal facilities, including power, to other interurban companies desiring entrance into such cities or towns as they operate in for a reasonable compensation. If no agreement can be reached as to compensation, then the matter is to be referred to the Railroad Commissioners, who are authorized to fix the rate. In case either company is not satisfied with the rate fixed by the Railroad Commissioners, then the right remains of appeal to the District Court, which appoints a commissioner to investigate and report.

House file No. 290, which provides that every railway company shall, on written notice from the owner of any land along the right of way, cut, burn or destroy once each year, in the month of July, all cockle burrs, burdock weeds, quack grass and thistles on the right of way adjacent to said land.

Senate file 11, which repeals section 2112 of the code and enacts a substitute therefor, defining the powers and duties of the Railroad Commissioners relative to examination and inspection of railroads, ordering repair of roadbed, fixing number of trains to be run, ordering location and construction of depots, etc., applies to interurban as well as steam roads.

Senate file 235, which gives the supervision over any and all wires for transmitting electric current or any other wire crossing under or over any track of a railroad in Iowa. All such wires must be at least 22 ft. above the top of the rails. The commissioners are empowered to examine wires already strung and order changes made where necessary. The object of the act is the protection of the employees of railroad and interurban and street railways.

House file No. 318, which provides that railway officials must report all accidents which result in personal injury or loss of life to the Railroad Commissioners. The commissioners are authorized to make investigation if they deem it necessary, and make report to the Governor. Such report is not to be used as evidence against the company.

House file No. 282, which repeals sections 2153 and 2155 of the code and enacts substitutes therefor. This act requires railroads, including interurbans, to transport freight within the State over connecting lines for a reasonable joint rate, and is intended to prohibit the present practice of the Iowa roads of charging separate local rates over each line. The act empowers the Board of Railroad Commissioners to make schedules of joint rates, which they may alter from time to time as they deem necessary.

Senate file 305, which amends section 2116 of code, which provides that it shall be the duty of railroads to furnish cars and transport freight as soon as possible, by adding thereto a provision, that in any suit or action brought against a company to enforce the rights arising under the provisions of said section, the burden of proving that the company has complied with its provisions, shall be upon the company.

Senate file No. 205, which provides that any railroad company, either steam or interurban, owning its own right of way in any city or town, shall be subject to all special assessments for sidewalk and street improvements for all such improvements constructed along said right of way.

ACTING ON THE BROOKLYN SUBWAY

Elsewhere in this issue mention is made of the meeting of the New York Rapid Transit Commission last week, at which the subject of the Brooklyn tunnel was discussed. On Tuesday, May 28, the committee on plans of the commission met and discussed the resolution offered by Controller Metz regarding the Brooklyn extension. The resolution, briefly, was that the city should proceed to advertise for bidders for the construction alone of that portion of the tri-borough route running through Brooklyn. The route is from Chrystie Street, Manhattan, over the new Manhattan Bridge and through the extension of Flatbush Avenue and Fourth Avenue to Coney Island, with a spur to Fort Hamilton. In consultation with Chief Engineer Rice, the committee ascertained that the estimated cost of the road, $30,000,000, could be materially cut down by the elimination of some of the tracks in certain sections where it is thought two tracks will be sufficient to carry the traffic. After discussing the whole question at length, the committee, which is composed of Commissioners Starin, Smith and Metz, decided to report the resolution out without recommendation. This will put it up to the board to discuss the matter and take action. Should the matter go through on Friday, as expected, the preparation of the form of contract will take about two weeks. A hearing on the form of contract must, under the law, be advertised for two weeks. By quick work the board can finally approve the form of contract and obtain the concurrence of the Board of Estimate a few days before the public utilities bill becomes operative. All the new commission will then have to do will be to advertise for bidders, as it is required under the terms of the bill, to take up the work of the present commission without review.

AFFAIRS IN CHICAGO

President Rawson, of the North and West Side Street Railway Companies, has announced that sufficient stock had been deposited with the Union Trust Company to insure the adoption of the plan of reorganization of the company and the acceptance of the ordinance. As soon as it was learned how much stock had been deposited, General Manager Roach and Receiver Sampsell, of the company, left for New York, to consult with Attorneys G. W. Wickersham, representing the North and West companies, and L. C. Krauthoff, working for the Union Traction, who have been busy for a long time fixing up the plan of reorganization of all the properties. Mr. Roach is to talk about the physical condition of the lines and the needed money to put them in shape, and Mr. Sampsell about the steps which will have to be taken to get them out of the hands of the United States Court and back into the possession of the stockholders. The first thing expected to be done in New York is the capitalization of the Chicago Railways Company at a figure which will enable it to take over all the properties of the North and West Chicago and the Union Traction Companies. The stock of this company will be prorated among the stockholders of the existing companies.

In a letter sent Wednesday, May 22, to Division 260 of the Street Railway Employees' Union, comprising employees of the Chicago City Railway Company, President T. E. Mitten, of the company, renewed the offer of the company to advance wages 2 cents an hour, but refused to grant concessions in the matter of working conditions.

Paving or repaving of about 15 miles of streets will be undertaken by the Chicago City Railway Company and the Chicago Union Traction Company immediately, as part of the conditions of the traction settlement ordinances. The Board of Supervising Engineers have decided that quick work must be done in this direction, as some of the streets have been torn up awaiting settlement of the traction question. The companies will be required to pave strips 8 ft. wide on single-track streets and 16 ft. wide where there are double-track lines.

RAPID TRANSIT AFFAIRS IN NEW YORK

The Rapid Transit Commission, at its meeting last week, awarded the contract for the construction of a section of the subway loop on Center Street between Canal and Broome Streets. The contract went to the Cranford Company, which was the lowest bidder, for $2,210,000.

A letter from F. B. Behr accepting the conditions imposed by the Commission and asking it to lay out a route for a monorail system to Coney Island from South Ferry was referred to counsel and the chief engineer.

William S. Hurley, the new member of the Commission, introduced a resolution to build a subway in Fourth Avenue, Brooklyn, from the Manhattan Bridge to Coney Island and Fort Hamilton. He said the subway could be built at once and would not cost more than $20,000,000. Chief Engineer Rice estimated, however, that the four-track road as proposed would cost $30,425,000, and after considerable discussion the matter was referred to a sub-committee. It is not believed definite action can be taken on this matter before the Commission's term of office expires on July 1.

THE NEW HAVEN'S POLICY

In connection with the plans reported of the purposes of the New York, New Haven & Hartford Railroad to merge its various properties it is pointed out that since President Mellen became the head of the New Haven, some four years ago, there have been between forty and fifty consolidations of various kinds in the system, including steam lines and electric railways in Connecticut and Massachusetts. To these will be added at the end of the present month the merger into the parent steam company of its holding company, the Consolidated Railway Company. The next step will be the progressive merging of the intricate system of corporations holding the street railways of Rhode Island, these ultimately being taken into the parent corporation, so it is said.

This consolidation policy of President Mellen as applied to Connecticut corporations indicates the final plan during his presidency of consolidation into one central and highly organized management of all properties under the New York, New Haven & Hartford Company's control, successively merging steam roads outlying in Rhode Island and Southern Massachusetts, including the Old Colony system, parts of which are the Boston & Providence and the Providence-Worcester Roads, and then the consolidation of the Boston & Maine system. The latter has a large part of its properties under lease, and payment of rentals constitutes a very large part of the fixed charges of the Boston & Maine system.

A final feature in the situation is the vesting in a Connecticut corporation of practically the entire railroad system and a large part of the street railways of New England, which will mean a considerably larger representation in the New Haven corporation of the local interests of five other New England States.

THE SITUATION IN CLEVELAND

Attorneys for the low-fare companies at Cleveland have decided not to accept the decision of Judge Phillips in the Isom injunction case barring them off Central Avenue, and will appeal the case to the Circuit Court. If the decision of the lower court is sustained by the higher tribunals, and the power of attorney clause in a majority of the consents is not ruled out, then the Cleveland Electric has absolute control on those two streets for the next six years. Under the decision, the City Council acted without authority in granting the Low Fare Railway Company a franchise in April.

The arguments in the injunction case to prevent the Low Fare Railway Company from operating on Euclid and Superior Avenues has been on hearing in Judge Chapman's court. The arguments were completed Friday, and a decision is expected some time this week.

A few days ago the Low Fare Railway Company made an offer to the city to furnish the material and put in the tracks on East Ninth Street, where the Cleveland Electric has taken up its tracks, with the understanding that the property shall belong to the city when it is completed. The city accepted this offer so far as the material is concerned, but put city employees to work building the track. The officials were served with notice that there is now an injunction against both the Low Fare Company and the city, preventing the construction of tracks in that street.

The Circuit Court has refused to give an immediate hearing on the Isom injunction case, which was appealed by the Low Fare Railway Company from Judge Phillips' court, and the statement was made that this court would hear no street railway litigation whatever. The litigants were advised to have their cases ready for as many final decrees as possible after June 10, when judges from other courts would be in Cleveland to hear them. This action was taken by the court so that there may be no grounds whatever for criticism, whatever the decisions may be.

The City Council laid over for one week the Hirstius ordinance granting the Cleveland Electric five-year franchises on Central Avenue and Quincy Street, in order that the company may file the consents of property owners. Whether the company will file consents or not remains to be seen. It is possible that it will contend for a longer franchise, to be valid if the courts finally decide that the franchises of the Low Fare Company are invalid, and to be void if the decisions favor the new companies.

RECKONING WITHOUT TAKING THE ELECTRIC RAILWAYS INTO CONSIDERATION

President Baer, of the Reading Railroad, announced during the recent session of the Pennsylvania Legislature that if the 2-cent fare bill was passed it would be followed by an increase in commutation rates. The bill was passed, and the Reading Company on May 23 announced that when the spring schedule went into effect on Sunday, May 28, there would be an increase in rates on lines out of Philadelphia averaging from 10 to 35 per cent. In a circular issued over the signature of Edson J. Weeks, general passenger agent, the company refers to the raise in rates as a "readjustment" only in order that there might be a "uniform system" adopted. In this notice is contained the very gracious statement that "to meet competition by trolley lines the Reading Railway in 1895 reduced the fares to a number of points in the Philadelphia district, such as Wayne Junction, Germantown and Chestnut Hill."

It is reported from Philadelphia that the patrons of the Read-

ing Company did not submit as willingly as Mr. Baer had anticipated, but that they nearly all had recourse to the trolley lines and stoutly proclaim that the Reading cannot hope again to have their patronage until it returns to the old schedule. An account in one of the daily papers of the effect of the new Reading rate says:

"All lines of the Philadelphia Rapid Transit Company traversing the northern section of the city and traversed by the Reading Railway were crowded with railroad commuters, who are using the traction lines as a boycott against the advance in the Reading suburban rates, put in effect on Saturday last. One Germantown car had 175 fares rung up on one suburban trip whereas twenty-five was always a good car full. The crowds have been so great on the traction lines which parallel the Reading during the last two days that it has been necessary to bring out closed cars put away for the summer."

ADDITIONS TO ST. LOUIS CAR COMPANY'S PLANT

The St. Louis Car Company has recently made several additions to its main plant in St. Louis, which will increase its capacity considerably. An erecting shop just completed, measures 225 ft. x 250 ft. This shop is located east of the transfer table runway and south of the machine shop. The dry-kiln capacity has been increased by the erection of a kiln measuring 342 ft. x 52 ft. In addition to the new erecting shop and the dry-kiln there has also been constructed a 63 ft. x 282 ft. extension to the storeroom.

AMERICAN MUSEUM OF SAFETY DEVICES

At a meeting a few days ago at the Player's Club in New York of the advisory committee of the American Museum of Safety Devices and Industrial Hygiene, announcement was made that the museum will open in the autumn in the Thirty-Ninth Street Building, which will also be occupied by the McGraw Publishing Company. A full line of safety devices will be shown. Dr. William H. Tolman, director of the museum, also announced that in response to the museum's appeal for funds, a check for $5,000 from an anonymous donor, living outside of New York, has been received.

PROGRESS ON THE NEWTON & NORTH WESTERN

H. H. Polk, president of the Interurban Railway Company, of Des Moines, has announced that his company has completed arrangements for the use of the tracks of the Newton & Northwestern Railway Company between Colfax and Newton, by which his company will be able to operate its cars into Newton. The Newton & Northwestern Company will electrify its line between Colfax and Newton just as soon as it can transfer the men who are now engaged in putting in wires, etc., on the Fort Dodge, Des Moines & Southern line. It is stated that the work will be completed by Aug. 1, and that the interurban will be able to operate its Colfax cars into Newton by that time. The Interurban Company planned several extensions this year, among them one to Carlisle and an extension of its Woodward branch to Boone, but has abandoned all plans for such work until the franchise cases against the Des Moines City Railway and the Interurban Railway Company have been settled in the courts. The Federal court sustained the contentions of the companies as to a perpetual franchise, but the cases have been appealed, and will no doubt be carried through State and United States courts to the court of last retort. These cases have embarrassed the companies somewhat, and the officials have announced that no extensions will be constructed until these cases are finally settled.

PROPOSED CHANGES IN THE PORTCHESTER ROUTE

Engineer Nichols, of the Board of Estimate and Apportionate, has presented to Chief Engineer Lewis, of the board, a report on the application of the New York & Port Chester Railroad Company to make changes in its route in Bronx Borough. Both the Port Chester company and the Westchester company received, some few years ago, when they were rivals, franchises in Bronx Borough. The Westchester company did some construction on its route, but little has been done on the Port Chester route. Both companies have now come under the control of the same interests.

The change requested by the Port Chester company is for part of the route already granted the Westchester company, the question of the terms for the franchise is now before the Board of Estimate and Apportionate.

RIVERBANK SUBWAY DEVELOPMENT IN BOSTON

The Boston Transit Commission has transmitted to the Legislature of Massachusetts a report answering a request of the committee on metropolitan affairs for information concerning the need of an east and west subway as compared with the need of the subway for surface cars east of Washington Street, provided for by the acts of 1902. The Commission quotes at length from the report on the transit situation which it submitted to the Legislature in 1906, pointing out that the needs of the present and immediate future require further considerable increase in facilities for traffic towards the west of the city, postulating an increase of population in the western suburbs within the 10-mile radius of the State House from 300,000 in 1905 to 384,000 by 1915. It appears probable to the Commission that the traffic on the street car lines in Boston will increase 60 per cent nominally in ten years, and will double in from fifteen to twenty years.

The Commission is of the opinion that under existing conditions the route defined by the present bill before the Legislature for a subway between Park Street Station beneath the Charles River Embankment to a point near the Back Bay Fens would be a desirable route for the accommodation of the present and future traffic from the west. It does not express an opinion as to the most desirable route, however, to be carried through the Back Bay, preferring to leave that matter to the Legislature. In view of the early completion of the Washington Street tunnel, with station accommodations for eight-car trains, the provision of additional facilities for traffic to the west is more urgently required than the construction of another subway running parallel to the Washington and Tremont Street underground routes.

LONG ISLAND RAILROAD REPORT

The annual report to the stockholders of the Long Island Railroad Company just issued, refers to the electrical equipment of the company, which now operates over about 100 miles of single track. The report says: "Its workings during the year have been very successful and the service has been reliable and efficient in every respect; and while it has not yet been economical, owing to the fact that your power is not fully employed, it has materially increased your passenger traffic."

Referring to extensions, the report says: "Plans are being prepared for the electrification of your lines from Long Island City to Port Washington and to Whitestone Landing, and as soon as the tunnels under the East River are completed, your lines will be electrified to Jamaica and to Woodhaven Junction, via the Glendale Cut-off, a connection between the main line of your company, the Montauk division and the Rockaway Beach division. Plans are also being made for an enlarged terminal at Jamaica where the change from steam to electric locomotives will be made. In the report for 1905, attention was called to the organization of the Long Island Consolidated Electrical Companies. That company has completed the acquisition of a one-half interest in the New York & Long Island Traction Company and in the Long Island Electric Railway Company, and has also purchased during the year the Babylon Railroad, a small line in the village of Babylon. The company has also planned the construction of a cross-island line from Huntington to Babylon via Farmingdale and Amityville, and the necessary franchises for this extension have been secured. It is proposed to obtain the funds for this purpose through the sale of the electrical companies' bonds, guaranteed by your company."

The cost of electric motive power plants and equipment is carried on the balance sheet at $3,034,913, which is a decrease of $1,122,362, as compared with Dec. 31, 1905.

EVANSVILLE STRIKE IS SETTLED

The strike of the employees of the Evansville & Southern Indiana Traction Company was settled Saturday, May 25, and the men returned to work on Sunday. By the terms of the settlement the men get platform time and an 11-hour day in place of 12-hour day, and get 16, 17 and 18 cents, according to length of service, instead of 15, 16, 17 and 18 cents. They have the right to appeal grievances either individually or by committee to the general manager or President Charles Murdock. Old men get preference of runs.

THE PHILADELPHIA & WESTERN OPENED

The Philadelphia & Western Railroad's new third-rail line from the Union Station, Sixty-Ninth and Market Streets, Philadelphia, to Strafford, in the Chester Valley, was formally opened Wednesday, May 22. The run to Strafford was made in 40 minutes, although the schedule time is 29 minutes. Officials of the railroad asserted this difference in time would be soon corrected and that within a few days the advertised time table would be in effect. Cars are being operated on a half-hour schedule, the last car leaving Union Station, where it connects with the elevated road, at 1 o'clock. It is promised that the line will soon be operated on a 15-minute schedule. Present Philadelphia & Western Railroad stations are located at Beechwood Park, Ardmore Junction, Ardmore, Haverford, Bryn Mawr, Rosemont, Garrett Hill, Villanova, Radnor, Ithan, St. David's, Wayne and Strafford.

AFFAIRS OF THE HAVANA COMPANY

The report from Havana that Frank Steinhart, former American Consul at Havana, has been selected as general manager of the Havana Electric Railway Company to succeed George F. Greenwood, resigned, could not be confirmed at the office of the company in New York, it being stated by Mr. Ashley, the secretary and treasurer of the company, that nothing was available at this time for publication concerning the affairs of the company. Mr. Ashley did admit, however, that Mr. F. W. Hild, who sailed for Havana a few days ago, had, as noted elsewhere in this issue, been appointed assistant general manager and chief engineer of the company. It will be remembered that at a meeting of the Havana Company in New York early in March, of which mention was made in the STREET RAILWAY JOURNAL for March 16, a new board of directors and officers were elected as follows: Warren Bicknell, of Cleveland; David T. Davis and Robert Mather, of the Rock Island interests; Walter G. Oakman, of the Guarantee Trust Company; James Rattray, San Miguel; Henry Runken, Carlos Zaldo and Frank Steinhart, of Havana; Warren Bicknell, president; David T. Davis, vice-president, and Mr. Ashley, secretary and treasurer.

NEW HAVEN'S NOTICE OF STOCK INCREASE

The New York, New Haven & Hartford Railroad Company has notified the New York Stock Exchange that the company's capital stock has been increased from $100,000,000 to $130,000,000. Directors of the road on Jan. 12 authorized this increase in capital and voted to offer, in July, the right to stockholders to subscribe at $150 a share for additional stock to the extent of one share for every four shares of their respective holdings. Action was taken later to give the holders of the $30,000,000 convertible debentures, issued Jan. 1, 1906, the right to subscribe to the new stock to the amount of 25 per cent of their holdings. Charles S. Mellen, president of the company, afterward made the announcement that the new stock offering, which is to amount to about $30,000,000, will be made in July, on the basis of $150 a share. But intimations have been given of late that in all probability the stock issue would be postponed indefinitely on account of market conditions. The notification to the Stock Exchange of the increase is to take formal steps to provide for the exchange of Consolidated Railway debenture certificates. The total amount of stock previously authorized to be listed was $99,069,000. At 150 the $30,000,000 new stock would realize for the New Haven $45,000,000. It is an interesting coincidence that the present market value of the $28,265,570 of the Boston & Maine stock, which is ruling at about 162, is only a trifle more than $45,000,000.

PROVIDING FOR IMPROVEMENT TO MOHAWK VALLEY COMPANY'S LINES

The directors of the Mohawk Valley Company, which holds, in the interest of the New York Central & Hudson River Railroad Company and the Andrews-Stanley syndicate of Cleveland, the majority of the stock of several electric railway companies in New York State, have passed a resolution authorizing the company to advance a large amount of money to various subsidiary lines for improvements which have been planned for some time. The Mohawk Valley Company, it is announced, has sufficient funds on hand to enable it to continue these improvements. It is not announced what the improvements in contemplation are.

THE STRIKE AT BIRMINGHAM

Cars are in regular operation at Birmingham, and the strike of the employees of the Birmingham Railway, Light & Power Company is reported to be petering out. Only a small proportion of the men went out, and desertions are reported from them. There is little disorder.

NEW RAILROAD COMMISSIONERS FOR PENNSYLVANIA

Under the provisions of the Dunsmore bill, passed by the Pennsylvania Legislature prior to adjournment, the Governor is empowered to appoint three members of the "Pennsylvania State Railroad Commission" before the first Monday in January, 1908, who shall serve for three, four and five years, respectively. After first appointments members of the commission are to be learned in the law. Each Commissioner will receive a salary of $8,000 per year. The secretary of the commission is to receive $4,000, the attorney $4,000, and the marshal $2,500. The bill creating the commission appropriates $150,000 for this purpose. The headquarters of the commission will be in Harrisburg.

As a result of the firm stand taken by Governor Stuart the bill as finally passed contains many of the sections of the original measure.

While in conference committee the bill was amended to include telephone and telegraph companies among the corporations over which the commission shall have supervision. These were not mentioned in the original bill.

THE EASTERN OHIO TRYING TO DISPOSE OF ITS PROPERTY

The Eastern Ohio Traction Company is endeavoring to make some arrangement with the second mortgage bondholders of the Chagrin Falls line for disposing of the property as a reasonable price. The idea of the management is to divide the property into three sections as follows and sell them separately: The original Cleveland & Eastern, between Cleveland and Chardon by way of Gates' Mills; Cleveland & Chagrin Falls, and between Chagrin Falls and Garrettsville. The Northern Ohio Traction & Light Company would probably purchase all the properties if the right figure were placed on them, but the Cleveland-Chagrin Falls line is more desirable to this company than the Chardon line, because of the possibility of completing it through to a point where it would connect with the Mahoning & Shenango Valley lines. This company would, however, want to purchase the property from Chagrin Falls to Garrettsville at a price little in advance of junk, as the tracks would have to be taken up and built over a new route to make a direct line to the connection desired with the Youngstown lines. It is thought that the original Cleveland & Eastern might be operated with profit by the Eastern Ohio Traction Company, if the other two sections were sold, or if it should not be sold to the Northern Ohio it might eventually become a part of some other system or the local lines here.

ELECTRIFICATION AT THE BERN CONGRESS

The International Railway Association, which meets every five years, and which held its last convention in 1905, at Washington, D. C., will have its next meeting at Bern, Switzerland, in 1910. The program has just been issued. Among other topics to be considered is that of electric traction, to which three speakers have been appointed as follows: For America, George Gibbs, chief engineer of electric traction Long Island Railroad, New York City; for Germany, Dr. Gleichmann, chief inspector of motive power Royal State Railways of Bavaria, Munich; for other countries, Dr. Wyssling, professor at the State Polytechnic Institute of Zurich, and secretary of the Swiss Institute of Electrical Engineers, Zurich.

NEW YORK ELECTRICAL SOCIETY VISITS NEW YORK CENTRAL POWER HOUSE

On Saturday, May 25, the New York Electrical Society visited the power plant of the New York Central Railroad at Port Morris, on the Long Island Sound. About 300 members participated in this interesting trip. Before inspection of the plant, President Condict conducted a brief meeting at which E. B. Katte, chief engineer of electric traction, made a pithy address as to its leading features, and Secretary Guy presented nearly fifty names of candidates for membership. About 2 hours were then devoted to a thorough study of the plant, all details of which were open to view, and in regard to which a handy brochure full of data was distributed. The power house and switch house, which have already been described in these pages, are the latest work in the generating art, and comprise four 5000-kw General Electric turbo units.

MAYOR OF NEW YORK VETOES PUBLIC SERVICE BILL

Mayor McClellan, of New York, on Tuesday, May 28, vetoed the public utilities bill. In a long statement issued when he announced his action, the Mayor asserted as his principal ground for vetoing the bill that it was wholly against the home rule principle, and for that reason, in his view, was unsatisfactory to the city. Mayor McClellan said in part:

I see no force in the argument that because the general purpose of this act is good, I should overlook its manifest defects and approve it in its present form.

As I understand the law, this measure has been sent to me, not for an expression of my opinion as to its basic features, but because in several of its provisions it affects the powers of the city government. In other words, I am called upon to say whether or not, from the city's point of view, the bill is satisfactory in its present form. To this question there can be but one answer. It is not. If I were to decide otherwise and to accept this bill as it stands, it would imply an admission on my part that the principle of self-government for the city was no longer worth striving for.

I regret that I cannot agree with those who have urged that this measure extends, rather than curtails, the present powers of the local authorities. It is true, I admit, that in the past the Legislature has constantly failed to grant the city's demands for larger powers of supervision and control in respect to these matters than it possesses at present, but in my judgment this does not constitute any reason why the city should consent to a bill which empowers the Governor to appoint a local commission, and then compels the city to pay a large portion of its expenses.

The power conferred by this act is unprecedented, and, under normal conditions, many of those who are advocating the measure would be among its strongest critics.

For the first time in the history of our State there are to be created two administrative bodies vested with power heretofore exclusively exercised by the Legislature, of regulating rates and fares of steam railroad, street and elevated railroad, gas, electric light and power companies. The combined capitalization of these companies is $3,322,537,916. The gross earnings from operation last year were approximately $533,000,000, the number of employees upward of 300,000, and the number of security holders not less than 100,000.

The commissioners are to be appointed by the Governor, and, as they may be removed by him or his successors, they will become the direct representatives and agents of each succeeding Governor. There is no provision that the commissions shall be bi-partisan or non-partisan, and all members may be of the same political party. What may be, will be. And if this bill becomes a law we shall, in the near future, see these commissions composed entirely of political partisans, with great consequent injury to the State and the properties affected.

If the theory of bi-partisanship or non-partisanship ever rested upon a sound foundation, what possible excuse can there be for withholding the principle from such administrative commissions as are established by this bill?

It is no answer that the present Governor will not prostitute his office by the selection of men capable of such acts. It is no answer that he will appoint three Democrats on the commission for the overwhelming Democratic First District, and that two Democrats will be named on the commission for the Second District. The Governor's tenure of office is short, and it will not be long before we will have a Governor who will not hesitate to use this power.

With the general principles of this bill I am in accord, but I will never give my approval to a meause that places in the hands of a single political party such tremendous and limitless power.

GEORGE B. McCLELLAN, Mayor.

NEW PUBLICATIONS

Generellas Projekt der Zugspitz-bahn. By W. A. Müller, C. E. Dresden, 1907. 54 pages and 12 plates. Price, 8 marks.

This is an analysis of the engineering problems and cost of construction of a proposed mountain railway in the Bavarian Alps, not far from Ober-Ammergau. The line ascends to an elevation of 2800 meters, or about 9000 ft., and is 15,450 km, or about 9.65 miles in length. The author considers various types of road and finally recommends a trolley line for the first 7.4 miles of track and a cable incline for the remainder of the distance. The time required for the trip is ninety minutes, and the entire cost, including several tunnels, is estimated at $1,050,000. The book is accompanied by drawings of the proposed line and is a good example of the clearness with which an engineering proposal should be prepared.

The "Engineering and Electric Traction Pocketbook." By Philip Dawson. Fourth edition, 1906. New York City: John Wiley & Sons. 16 mo, xx + 1054 pages, profusely illustrated. Price, leather, $5.00.

The best practical evidence of the favor with which a book is considered by the clientele for which it is prepared is the number of editions which the publishers issue. It is satisfactory to know that from this standpoint Dawson's Pocketbook is successful because it deserves to be from the matter which it contains. The technical contents of the present edition has been thoroughly revised, although the bibliography which accompanies it needs some emendations. Some old matter has been expunged and some new matter has been added, such as the chapter on single-phase systems. Other data, on the new British standard grooved rails, the thermit joint and turbines show the book has been brought up to date.

STREET RAILWAY PATENTS

[This department is conducted by Rosenbaum & Stockbridge, patent attorneys, 140 Nassau Street, New York.]

UNITED STATES PATENTS ISSUED MAY 14, 1907

853,209. Railway Rail; John N. Akarman, Newark, N. J. App. filed June 1, 1906. A girder rail made in two parts, the top portion of the upper girder forming the head of a railway rail, and the lower section forming the base of the rail.

853,210. Slack Adjuster; Charles O. Anderson, Omaha, Neb. App. filed June 11, 1906. Relates to automatically adjustable means for connecting the brake-shoe actuating mechanism at opposite ends of a truck.

853,221. Rail-Joint; William M. Brown, Johnstown, Pa. App. filed Aug. 6, 1906. The rails are provided with longitudinal ribs and fish-plates bear against the top of the base flange of the rail and the bottom of the longitudinal rib, and the bottom of the head of the rail and the top of the longitudinal rib.

853,223. Switch Tongue Operating and Retaining Device; Nicholas Burns, Johnstown, Pa. App. filed Dec. 21, 1906. A spring under tension at one end of two levers and a pair of toggle levers connecting the other ends of the levers with a rod from the tongue so that the switch will be held in either of its positions.

853,245. Walk-Over Car Seat; Peter M. Kling, Elizabeth, N. J. App. filed March 23, 1904. Details of construction of a reversible car seat.

853 270. Derailing Switch; Henry C. Stiff, Johnstown, Pa. App. filed Aug. 6, 1906. Comprises a continuous rail, a second rail having a parallel and an angular portion with relation to the first rail, and a movable switch point connected to a mechanically operated rod to hold the switch open, in combina-

tion with a switch lever and a slotted link connection between the rod and switch lever.

853,322. Trolley Harp; Edward D. Rockwell, Bristol, Conn. App. filed May 7, 1906. The harp is yieldingly mounted on the pole.

853,403. Electric Block System for Railways; Walter R. Fuller, Atlanta, Ga. App. filed Jan. 19, 1907. A circuit wire is fixed to the web of the track rails and is engaged by a depending shoe from the locomotive.

853,453. Trolley Retriever; Madison F. Hodge, Leavenworth, Kan. App. filed Dec. 18, 1905. Details of a spring drum and ratchet device for controlling the trolley cord.

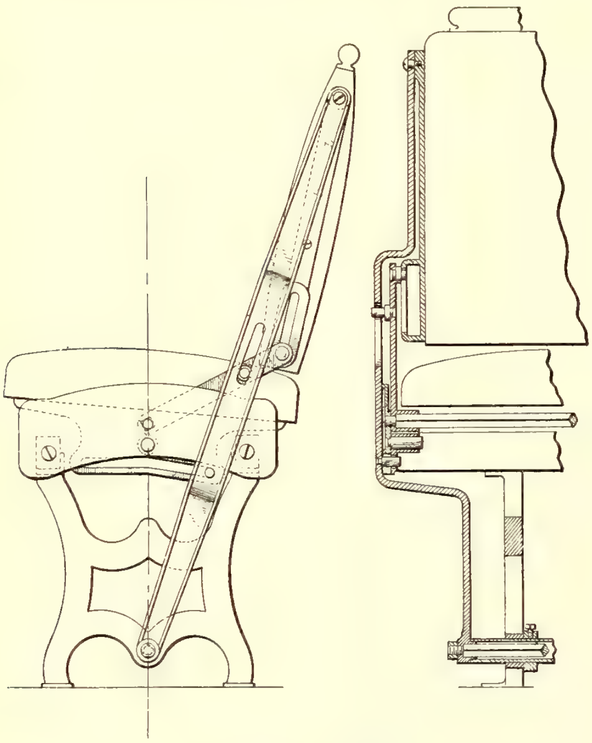
853,522. Cable Reel Apparatus for Mining Locomotives; Harry W. Shaver, Pocahontas, Va. App. filed June 7, 1906. Relates to that type of mining railways in which the flexible conductor is automatically paid out as the locomotive travels away from the fixed supply conductor, or is wound upon a reel as the locomotive travels back to the supply conductor. Provides means by which a torque is exerted on the reel in either direction of travel of the locomotive.

853,593. Railway Tie; James G. Parkerson, Jr., Lafayette, La. App. filed March 13, 1907. A metallic base having means for holding a block of wood at each end to which the rail is spiked.

853,618. Circuit-Closing Device; Rollin A. Baldwin, New Haven, Conn. App. filed July 19, 1906. A circuit-closing device for trolleys, adapted to complete a circuit through a magnet or other device when a trolley car passes a given point. Has two long, flexible strips which engage the side of the wheel in passing, whereby a good electrical circuit is made without any tendency to displace the wheel from the wire.

853,741. Metallic Tie and Rail Fastener; La Verne Simpson and Jacob Stein, Pittsburg, Pa. App. filed Feb. 11, 1907. Rail-engaging lugs are cut from the body of the tie and suitably bent.

853,886. Safety Device for Railways; Otto F. Kloetzer and William A. Borders, Washington, Ind. App. filed Nov. 9, 1906.



PATENT NO. 853,245

Comprises track rails divided into blocks, sectional conductor rails divided into blocks and connected to the track rails of adjacent blocks, and means carried by the train for delivering a current of electricity to the conductor rails and receiving a current from the track rails.

853,838. Current Collector; Samuel B. Stewart, Jr., Schenectady, N. Y. App. filed Aug. 1, 1906. An overhead trolley collector or shoe which is impelled upward vertically by a spring-impelled lazy-tongs device.

853,898. Amusement Device; Robert F. Rice, Bridgeport, Conn. App. filed Oct. 24, 1905. A circular track inclosed in a building, the inner side of which consists of a screen on which moving pictures may be reproduced.

PERSONAL MENTION

MR. WARREN S. HALL, general manager of the Lehigh Valley Transit Company, of Allentown, Pa., has been elected vice-president of the company.

MR. EDWARD W. MOORE, of the Everett-Moore syndicate, has been appointed president of the Cleveland, Painesville & Eastern Railway Company, of Cleveland, to succeed Mr. Charles Wason, resigned.

MR. R. T. LAFFIN, who went to Manila in 1903 as general manager of the Manila Electric Railway & Light Company, expects to return to this country in the fall. Mr. Laffin formerly was general manager of the Worcester Consolidated Railway Company, of Worcester, Mass.

MR. HUGH COOK has been appointed chief engineer and superintendent of construction of the lines being built on Long Island by the Stanley syndicate of Cleveland. Mr. Cook was formerly assistant engineer of the Youngstown & Ohio River Railroad, of Youngstown, Ohio.

MR. E. V. MALING, who has held the position of superintendent with the Shelburne Falls & Colrain Street Railway Company for the past two years, has resigned, his resignation to take effect June 10, and Mr. F. L. Reed, treasurer of the company, has been elected manager to succeed him.

MR. REESE DAVIS, formerly roadmaster of the Connecticut Railway & Lighting Company's lines at Bridgeport, and for the past three years roadmaster of the Mexico City Electric Tramway Company's lines in Mexico City, has been appointed roadmaster of the Consolidated Railway Company's lines in Hartford and its suburbs.

MR. C. F. BRYANT, whose resignation as auditor of the Connecticut Railway & Lighting Company was mentioned in the May 4 issue, has become connected with the general auditor's department of the Utica & Mohawk Valley Railway Company, and will make his headquarters at the New York office of that company, 527 Fifth Avenue. During the last few months Mr. Bryant has been engaged on special work for the American Street and Interurban Railway Association.

MR. FREDERICK W. HILD has been appointed assistant general manager and chief engineer of the Havana Electric Railway Company, of Havana, Cuba. Mr. Hild formerly was construction engineer for the General Electric Company, in charge of the installation of machinery on the Aurora, Elgin & Chicago Railway Company, and more recently has been chief engineer of the Southwestern Wisconsin Railway, with headquarters at Dubuque, Ia. Mr. Hild was married May 22 at Dunkirk, Ohio, to Miss Georgia Marion Halstead, of that city. Mr. and Mrs. Hild will be at home at Havana to their friends after June 15.

MR. CHARLES H. COPLEY has been appointed superintendent of the local division of the Consolidated Railway Company, at Norwalk, Conn., succeeding Mr. Everett F. Kyle, who is now located with the Sterling Salt Company, of New York. For six years Mr. Copley was manager, passenger agent and chief electrician of the Bellow's Falls & Saxton's River Street Railway, of Bellows Falls, Vt., and when appointed to Norwalk was employed on the construction by the Consolidated Railway Company of a new road between Rockville and Stafford Springs, Conn.

MR. W. N. STEVENS, mechanical engineer of the Southern properties which come under the control of Ford, Bacon & Davis, has just resigned his position with that firm to take effect June 1. Mr. Stevens has for the last twelve years been engaged in the design and construction of power houses, car houses, shops and other matters in connection with the development of railway and lighting properties. A considerable part of this time he was with the Manhattan and Interborough interests in New York, in both of which companies he occupied the position of chief assistant mechanical engineer. Mr. Stevens has not announced his plans for the future.

SEVERAL IMPORTANT CHANGES have been made in the Eastern personnel of the Electric Service Supply Company. Mr. Willis V. Sweeten, formerly of the Elmer P. Morris Com-

pany, of New York City, will travel through New York State for the Electric Service Supplies Company, and have headquarters at its New York City office. Mr. F. C. Peck, formerly real estate agent for the Delaware & Hudson Railroad Company, will cover the Philadelphia trade. Mr. T. F. McKenna, who for some years has been traveling for Machado & Roller, of New York City, will travel in Pennsylvania for the Electric Service Supplies Company, making his headquarters at the Mayer & Englund department in Philadelphia.

MR. GEO. F. CHAPMAN, vice president and general manager of the United Railways Company, of San Francisco, died in that city Thursday, May 23, after a short illness. Mr. Chapman had been connected with the United Railways since May, 1902, when he accepted the position of general manager of the company. Subsequently he was elected vice-president of the company, in addition to general manager. Before becoming connected with the United Company Mr. Chapman was general superintendent of the North Jersey Street Railway Company, of Newark, with which he was connected for twelve years. For eight years he was superintendent of the Union division of the company, and for the last four years of his connection with the company he was general superintendent, in charge of the entire system operating in Newark, Elizabeth, Jersey City and the Oranges. Mr. Chapman, who was an Englishman by birth, entered street railroading at Boston on the Charles River Street Railway under Mr. John N. Akarman, shortly after coming to this country in 1883. He had long taken an active interest in the affairs of the American Street and Interurban Railway Association, and was one of the committee that reported to the association on municipal ownership at the last convention. Mr. Chapman was about forty-seven years old.

GEO. F. CHAPMAN

MR. JOHN N. AKARMAN, who recently resigned from the position of general superintendent of the South Jersey division of the Public Service Corporation of New Jersey, is one of the oldest operating men in the business, having been a superintendent or manager of street railway properties for twenty-five years. Born March 4, 1854, he was educated in the public schools of Brooklyn and graduated in 1871, after taking a supplementary course in civil engineering and surveying. He then entered the office of Mr. George H. Day, city surveyor of Brooklyn, where he remained two years, leaving Mr. Day's service to engage with Mr. Henry Wilson, an engineer of Boston, Mass. In the latter part of 1873 Mr. Akarman began his railroad career by entering the service of the South Boston Railroad Company, and in 1877, leaving the employ of that company, he became one of the subordinate officials of the Middlesex Railroad Company, running between Boston and Charlestown, Mass. Six years' service, filling various positions with this company, qualified him to accept the position of superintendent of the Charles River Street Railway Company. Four years later, when this company was consolidated with the Cambridge Railroad, Mr. Akarman became general superintendent of the roads in Worcester, Mass., owned by the Seeleys. He then built the Biddeford & Saco Railroad, running from Biddeford to Old Orchard Beach, Me. Selling out his interest there within a year, he obtained an option on the roads in Newark and Elizabeth, N. J., and sold them to a syndicate of Philadelphia capitalists and became general superintendent. In 1892 he obtained an option from the Seeleys on their Worcester property, and sold this road to the same syndicate. Taking charge of this property as general manager, under his direction it was equipped electrically in seven months, and subsequently successfully operated until sold in 1901 for more than double what it cost. Mr. Akarman then returned to New Jersey, becoming general manager of the Elizabeth, Plainfield & Central Jersey Railway Company, and when this road was absorbed by the Public Service Corporation he became part of that organization, filling the positions of traffic superintendent, general passenger agent and general superintendent of the South Jersey division.

J. N. AKARMAN

MR. W. H. COLLINS, master mechanic of the Fonda, Johnstown & Gloversville Railroad, who, as noted in the STREET RAILWAY JOURNAL for May 25, has been appointed general superintendent of the company to succeed Mr. J. N. Shannahan, resigned, entered railway service in 1881 as timekeeper on the extension of the Delaware, Lackawanna & Western Railroad between Binghamton and Buffalo. From 1883 to 1888 Mr. Collins was successively in the employ of the Geneva, Ithaca & Sayre, Elmira, Cortland & Northern, Southern Central, and West Shore Railroads, as agent and operator. Jan. 1, 1888, he entered the motive power department of the West Shore Railroad, at the Frankfort shops, and served in various capacities until June 1, 1891, when he was sent to Buffalo as assistant to the master mechanic of the Western division where he remained until Jan. 1, 1898, when he entered the serivce of the Fonda, Johnstown & Gloversville Railroad in the same capacity. His appointment as master mechanic of the company dated from Jan. 1, 1903.

MR. L. C. BRADLEY has resigned as superintendent of the Scioto Valley Traction Company, at Columbus, Ohio, to become associated with J. G. White & Company, of New York. Mr. Bradley was formerly superintendent of the Seattle & Tacoma Interurban Railway, and came to the Scioto Valley three years ago. He is an engineer of wide experience and is especially well informed on third-rail operation, the Scioto Valley being one of the foremost roads of the kind in the country. In the new field Mr. Bradley will have a wide latitude for his ability, as White & Company have a number of properties under construction which will be under his supervision. By reason of the resignation of Mr. Bradley there will be a number of changes in the personnel of the Scioto Company. Mr. W. V. S. Robb, of the resignation of Mr. Bradley there will be a number of changes in the personnel of the company. Mr. W. V. S. Robb, formerly chief clerk to the superintendent, has been appointed purchasing agent and chief clerk to the general manager. Mr. Calvin Skinner, a steam railroad man of long experience, who was master mechanic of the Chicago & Alton before his appointment as master mechanic of the Scioto company, has been appointed superintendent in charge of the transportation, mechanical and roadway departments. Mr. G. A. Stiles, formerly day foreman in the mechanical department, has been promoted to be general shop foreman. Mr. J. O. Bradfield, formerly freight agent, has been appointed general freight agent. In addition to these changes the directors of the company organized by electing Mr. F. A. Davis, president and general manager; W. S. Courtright, vice-president, and E. R. Sharp, secretary and treasurer. In accepting the resignation of Mr. Bradley the following resolution was passed:

Whereas, Mr. L. C. Bradley, who has been the superintendent of this company since it began operation, has tendered his resignation to accept a position with J. G. White & Company,

Be it Resolved by the board of directors of this company, that the resignation of Mr. Bradley be accepted with regret, and that in accepting said resignation, this board takes the opportunity to express its appreciation of the careful, faithful and efficient service which Mr. Bradley has rendered to the company with notable ability and capacity.

Be it further Resolved that we extend to Mr. Bradley our best wishes for his future success, and commend him to his new employers as a capable and efficient operator of electric railways.

At the close of the directors' meeting, Mr. Davis, on behalf of the officers and employees of the company, presented Mr. Bradley with a Patek Phillips watch. In accepting the watch Mr. Bradley expressed his regret at leaving the company and spoke of the pleasant relations which had existed between the company, its officers and himself.

TABLE OF OPERATING STATISTICS

Notice.—These statistics will be carefully revised from month to month, upon information received from the companies direct, or from official sources. The table should be used in connection with our Financial Supplement, "American Street Railway Investments," which contains the annual operating reports to the ends of the various financial years. Similar statistics in regard to roads not reporting are solicited by the editors. * Including taxes. † Deficit. ‡ Including Rapid Railway system, Sandwich, Windsor & Amherstburg Railway, and Detroit, Monroe & Toledo Short Line Railway.

COMPANY.	Period.	Total Gross Earnings.	Operating Expenses.	Net Earnings.	Deductions From Income.	Net Income, Amount Available for Dividends.
AKRON, O.	1 m., Apr., '07	132,844	82,889	49,955	42,402	7,553
Northern Ohio Tr. &	1 " " '06	117,367	78,200	39,167	39,947	†780
Light Co.	4 " " '07	508,727	318,396	190,331	166,431	23,899
	4 " " '06	451,975	302,573	149,402	159,788	†10,386
ALBANY, N. Y.	3 m., Mar., '07	494,285	292,621	201,664	87,481	114,183
United Traction Co.	3 " " '06	415,431	250,317	165,114	86,581	78,533
	9 " " '07	1,500,020	893,352	606,668	262,444	344,224
	9 " " '06	1,314,156	847,755	466,401	259,743	206,658
BINGHAMTON, N. Y.	1 m., Apr., '07	20,240	13,377	6,844	8,128	†1,284
Binghamton Railway	1 " " '06	22,012	12,461	9,550	7,363	2,188
Co.	10 " " '07	248,989	137,249	111,740	78,596	33,145
	10 " " '06	236,951	124,312	112,638	72,936	39,703
CHAMPAIGN, ILL.	1 m., Apr., '07	277,724	*160,101	117,624	......	......
Illinois Traction Co.	1 " " '06	225,083	*142,282	82,801	......	......
	4 " " '07	1,105,324	*630,019	475,305	......	......
	4 " " '06	893,385	*510,988	382,396	......	......
CHARLESTON, S. C.	1 m., Apr., '07	55,324	35,091	20,233	13,517	6,716
Charleston Consolidated Ry., Gas &	1 " " '06	50,155	31,518	18,637	12,967	5,670
Elec. Co.	2 " " '07	111,460	72,221	39,239	27,033	12,205
	2 " " '06	101,996	63,351	38,645	25,933	12,711
CHICAGO, ILL.	1 m., Apr., '07	101,198	58,594	42,605	27,588	15,017
Aurora Elgin & Chicago Ry. Co.	1 " " '06	89,981	51,749	38,232	24,939	13,293
	10 " " '07	1,079,633	590,054	489,579	264,897	224,681
	10 " " '06	960,133	529,619	430,514	244,140	186,374
Chicago & Milwaukee	1 m., Apr., '07	68,711	31,829	36,882	......	......
Elec. R.R. Co.	1 " " '06	57,015	24,131	32,884	......	......
	4 " " '07	248,234	127,269	120,966	......	......
	4 " " '06	177,505	90,093	87,411	......	......
CLEVELAND, O.	1 m., Apr., '07	19,470	*11,349	8,121	7,213	908
Cleveland, Painesville	1 " " '06	18,202	*12,118	6,084	6,789	†705
& Eastern R.R. Co.	4 " " '07	71,543	*41,489	30,053	28,851	1,203
	4 " " '06	63,440	*39,703	23,737	26,989	†3,251
Cleveland, Southwestern & Columbus	1 m., Apr., '07	58,089	36,978	21,111	......	......
Ry. Co.	1 " " '06	47,394	29,339	18,055	......	......
	4 " " '07	203,729	126,098	77,630	......	......
	4 " " '06	176,000	111,181	64,820	......	......
DALLAS, TEX.	1 m., Mar., '07	89,493	*69,013	20,480	16,858	3,622
Dallas Elec. Corp'n.	1 " " '06	80,384	*56,148	24,237	15,431	8,806
	12 " " '07	1,050,119	*744,723	305,396	190,457	114,940
	12 " " '06	970,985	*601,115	369,871	182,399	187,472
DETROIT, MICH.	1 m., Apr., '07	511,445	321,992	189,453	115,460	73,993
‡Detroit United Ry.	1 " " '06	470,434	280,154	190,280	105,654	84,626
Co.	4 " " '07	1,962,796	1,263,535	699,261	448,138	251,123
	4 " " '06	1,716,883	1,040,238	676,645	393,968	282,677
DULUTH, MINN.	1 m., Mar., '07	64,356	31,292	33,064	17,617	15,447
Duluth St. Ry. Co.	1 " " '06	58,402	33,904	24,498	17,496	7,002
	3 " " '07	176,697	97,798	78,899	52,721	26,178
	3 " " '06	163,174	97,348	65,826	52,482	13,344
EAST LIVERPOOL, O.						
East Liverpool Tr. &	1 m., Apr., '07	28,745	16,642	12,102	11,554	549
Lt. Co.	18 " " '07	497,754	283,397	214.357	171,219	43,138
EAST ST. LOUIS, ILL.	1 m., Apr., '07	161,203	*93,801	67,402	......	......
East St. Louis & Suburban Co.	1 " " '06	148,230	77,519	70,711	......	......
	10 " " '07	635,762	353,663	282,099	......	......
	10 " " '06	573,955	296,846	277,109	......	......
FT. WAYNE, IND.	1 m., Mar., '07	92,500	*58,844	33,656	......	......
Ft. Wayne & Wabash	1 " " '06	79,991	51,472	28,519	......	......
Valley Tr. Co.	3 " " '07	267,018	165,909	101,109	......	......
	3 " " '06	232,088	143,733	88,355	......	......
FT. WORTH, TEX.	1 m., Mar., '07	91,756	*52,551	39,205	10,313	28,893
Northern Texas Tr.	1 " " '06	64,738	*39,826	24,911	9,942	14,970
Co.	12 " " '07	920,298	*580,020	340,278	120,508	219,771
	12 " " '06	694,654	*419,063	275,591	120,429	155,162
GALVESTON, TEX.	1 m., Mar., '07	27,066	*16,909	10,157	4,167	5,990
Galveston Elec. Co.	1 " " '06	19,308	*14,844	4,464	4,167	298
	12 " " '07	334,228	*197,815	136,413	50,000	86,413
	12 " " '06	272,561	*174,523	98,038	48,333	49,705
GLENS FALLS, N. Y.	3 m., Mar., '07	109,682	103,602	6,080	50,029	†43,949
Hudson Valley Ry. Co.	3 " " '06	99,362	73,453	25,909	64,178	†38,269
	9 " " '07	471,551	312,207	159,344	151,849	7,495
	9 " " '06	431,101	237,690	193,411	196,160	†2,749

COMPANY.	Period.	Total Gross Earnings.	Operating Expenses.	Net Earnings.	Deductions From Income.	Net Income, Amount Available for Dividends.
HOUGHTON, MICH.	1 m., Mar., '07	20,415	*13,315	7,100	3,971	3,129
Houghton County St.	1 " " '06	15,251	*11,751	3,500	3,937	†437
Ry. Co.	12 " " '07	237,051	*150,677	86,373	47,123	39,250
	12 " " '06	182,550	*158,865	23,685	44,981	†21,296
HOUSTON, TEX.	1 m., Mar., '07	55,226	*35,601	19,625	8,260	11,365
Houston Electric Co.	1 " " '06	44,328	*30,503	13,824	7,692	6,133
	12 " " '07	615,275	*391,169	224,106	93,801	130,305
	12 " " '06	539,661	*331,941	205,720	103,568	102,153
KANSAS CITY, MO.	1 m., Mar., '07	478,464	258,894	219,571	152,052	67,518
Kansas City Ry. & Lt.	1 " " '06	407,631	219,231	188,400	135,907	52,493
Co.	10 " " '07	4,753,616	2,385,948	2,367,668	1,464,064	903,604
	10 " " '06	4,265,751	2,123,153	2,142,598	1,365,062	777,535
LEXINGTON, KY.	1 m., Mar., '07	41,739	25,476	16,262	......	......
Lexington & Interurban Rys. Co.	1 " " '06	31,542	24,769	6,773	......	......
	3 " " '07	116,719	78,002	38,717	......	......
	3 " " '06	97,559	72,502	25,057	......	......
MILWAUKEE, WIS.	1 m., Apr., '07	305,743	152,506	153,237	95,474	57,763
Milwaukee Elec. Ry.	1 " " '06	273,534	134,435	139,099	88,364	50,735
& Lt. Co.	4 " " '07	1,208,332	621,817	586,515	375,741	210,774
	4 " " '06	1,086,368	540,383	545,985	347,692	198,293
Milwaukee Lt. Ht. &	1 m., Apr., '07	52,211	24,151	28,060	30,424	†2,363
Tr. Co.	1 " " '06	46,682	19,208	27,475	24,306	3,168
	4 " " '07	208,695	102,606	106,089	120,570	†14,481
	4 " " '06	177,323	76,517	100,806	92,500	8,306
MONTREAL, CAN.	1 m., Apr., '07	274,635	166,422	108,213	45,318	62,896
Montreal St. Ry. Co.	1 " " '06	235,615	136,663	98,953	41,114	57,839
	7 " " '07	1,873,684	1,240,079	633,605	284,196	349,409
	7 " " '06	1,641,938	1,065,294	576,643	219,739	356,905
NEW ORLEANS, LA.	1 m., Mar., '07	518,721	260,205	258,517	172,470	86,046
New Orleans Ry. & Lt.	1 " " '06	486,245	267,875	218,370	157,367	61,003
Co.	3 " " '07	1,595,713	767,295	828,419	489,718	338,701
	3 " " '06	1,491,332	765,759	725,572	447,348	278,224
NEW YORK, N. Y.	3 m., Mar., '07	4,062,165	2,600,564	1,461,601	2,863,010	†1,401,409
New York City Ry. Co.	3 " " '06	4,261,815	2,398,458	1,863,357	2,789,724	†926,367
	9 " " '07	13,771,636	7,346,059	6,425,577	8,600,449	†2,174,872
	9 " " '06	13,878,672	7,162,178	6,716,494	8,404,774	†1,688,280
NORFOLK, VA.	1 m., Mar., '07	163,135	106,030	57,106	......	......
Norfolk & Portsmouth	1 " " '06	123,173	81,035	42,138	......	......
Tr. Co.	3 " " '07	447,204	293,971	153,233	......	......
	3 " " '06	366,966	237,405	129,561	......	......
PHILADELPHIA, PA.	1 m., Apr., '07	223,124	......	......	......	......
American Rys. Co.	1 " " '06	203,882	......	......	......	......
	10 " " '07	2,344,790	......	......	......	......
	10 " " '06	2,137,533	......	......	......	......
PLYMOUTH, MASS.	1 m., Mar., '07	6,830	*5,827	1,002	1,820	†818
Brockton & Plymouth	1 " " '06	5,825	*5,526	299	1,863	†1,564
St. Ry. Co.	12 " " '07	113,323	*71,541	41,781	21,731	20,051
	12 " " '06	103,419	*71,808	31,611	21,313	10,298
ROCHESTER, N. Y.	3 m., Mar., '07	570,398	358,486	211,912	106,003	105,909
Rochester Ry. Co.	3 " " '06	490,510	289,573	200,937	93,746	107,191
ST. LOUIS, MO.	1 m., Apr., '07	884,923	*583,039	301,884	230,893	70,991
United Railways Co.	1 " " '06	852,593	*532,306	320,287	231,704	88,583
of St. Louis	4 " " '07	3,379,085	*2,305,634	1,073,451	924,627	148,824
	4 " " '06	3,138,885	*2,008,044	1,130,841	927,226	203,615
SAVANNAH, GA.	1 m., Mar., '07	47,167	*31,098	16,069	11,775	4,294
Savannah Electric Co.	1 " " '06	47,300	*30,840	16,460	10,904	5,556
	12 " " '07	605,031	*377,029	228,002	136,545	91,457
	12 " " '06	603,590	*363,245	240,345	128,745	111,599
SYRACUSE, N. Y.	1 m., Apr., '07	98,109	55,004	43,105	25,471	17,634
Syracuse R. T. Co.	1 " " '06	86,864	49,285	37,579	22,907	14,672
	4 " " '07	387,910	217,257	170,653	100,376	70,277
	4 " " '06	340,497	193,590	146,907	89,144	57,763
TOLEDO, O.	1 m., Apr., '07	164,473	*99,031	65,442	46,982	18,460
Toledo Rys. & Lt. Co.	1 " " '06	156,396	*83,623	72,773	42,213	30,560
	4 " " '07	660,890	*384,754	276,136	181,714	94,422
	4 " " '06	616,543	*326,639	289,904	169,208	120,696
UTICA, N. Y.	3 m., Mar., '07	231,591	148,581	83,010	77,079	5,931
Utica & Mohawk Valley Ry. Co.	3 " " '06	199,844	123,901	75,943	44,964	30,979
	9 " " '07	770,177	467,060	303,117	168,416	134,701
	9 " " '06	662,770	378,651	284,119	134,727	149,392

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Of this issue of the Street Railway Journal 10,000 *copies are printed. Total circulation for* 1907 *to date,* 190,050 *copies, an average of* 8263 *copies per week.*

"Surprise Tests" in Train Operation

In train operation an excellent plan for maintaining the efficiency of the service is the occasional use of "surprise" tests to discover whether or not trainmen and others are obeying the rules regarding train operation and signals. According to press reports during the year 1906, on one steam road 1,625 such tests were made, and the records show there was not a single failure to obey the signals, and in only sixteen cases were the rules not absolutely followed. The strict observance of rules is probably in a measure due to the fact that when the tests were inaugurated on this road several years ago ten engineers were discharged from the service and several others were dealt with severely.

In some instances the managements of electric railway companies seem to presume that rules with regard to dispatching and train operation will be lived up to without any attention on the part of the management. Presumption, however, is never as good as knowledge. "Spotters" are detailed to watch conductors, and it might be to the advantage of every company to inaugurate a system of spotting or of "surprise tests" to assure care and obedience on the part of the trainmen. The system need not be secret to the extent that the men know nothing of it. On the contrary, it might be better to let them understand that such spotters are on the road, and that these tests are likely to occur at any time. The fact that there is chance of being caught at any time would do much to keep them on their guard, and the more open the company is about it, the less the men will feel that advantage is being taken of them.

Electrified Steam Road Practice

The articles published a year or more ago in this paper, and generally in the technical press, describing the power stations, locomotives and cars which the New York Central has adopted in its electric zone, attracted wide attention, but in many respects the details of operation of a large electrified trunk line, like that possessed by this company are of more interest than its methods of construction and of more practical value to the operator. This is particularly true in regard to its repair shop practice, because of the experience of the company's engineers along these lines, and its financial ability to carry out plans of the largest magnitude.

Our article on this subject shows that the company is planning to concentrate the greater part of its maintenance work at its Harmon shops, although an inspection shed will be also maintained at North White Plains and the existing West Albany shops will be called upon to take care of any work involving a large amount of reconstruction. A study of the plans also reveals the liberal scale upon which all the departments have been laid out. In this respect the company has had an advantage over most city electric systems, where the high cost of real estate handicaps the engineer-architect in the design of a plant of this kind. The possibility at Harmon of duplicating the plant along its present lines on land already owned by the company may prove of great advantage in preserving the orderly arrangement of the departments as the capacity of the shops is increased. The same liberal treatment of all details is found not only in the space accorded each department but

in the thorough manner in which the entire building—but especially the pits—are heated and lighted, and in the precautions adopted for fire protection, a matter which has only recently been considered of paramount importance.

Another feature in harmony with those already described and also worthy of special comment is the practice of the company in providing duplicate apparatus in the form of trucks, rheostats, etc., for rapid installation on the cars. While this involves considerable additional investment, it is the policy of the company that it is better and cheaper in the long run to maintain this extra equipment rather than to keep a car out of service during the time that would be necessary to repair it.

In the handling of equipment in its machine shop the company has adopted the telpher system rather than the practice of installing one or more heavy cranes. The telpher extends across the end of the inspection shed of the car house and of the machine shop, and then continues down through the center of the latter. I-beam switches reach to every machine tool from which heavy parts may have to be handled. This allows the use of a dozen or so telpher carriages in different parts of the shops and avoids the necessity of the heavy beam construction requisite with the traveling crane.

Another example of New York Central electric railway practice is described in the account of the electrified section of the West Shore Railroad between Utica and Syracuse, which constitutes the leading article in this issue. We believe that it was Mr. Wilgus who first advanced the suggestion—this was in 1903, in his testimony before the Royal Commission on London Traffic—that trunk line and trolley line service could be combined so that city cars could pick up passengers at any point on the city streets, carry them to the trunk line and there convey them without change of cars over electrified tracks in multiple-unit or single cars to their destination. This plan has also received the able advocacy of President Mellen of the New Haven road, and will be exemplified on a considerable scale on the new electrified West Shore Railroad. The problems leading up to the equipment of this line and the selection of the electric system adopted are discussed at considerable length in the article referred to and the equipment finally selected is described in detail. The existing conditions favored the adoption of the under-running third-rail system, although a number of modifications were made from the practice followed in the New York zone, and the cars, of course, are entirely different. The official opening of this system this month will be an important mile-stone in the history of electric traction.

The installation is of interest not only to the railroad manager but to the transmission engineer as well, owing to the use of 60,000-volt potential. The advance in this branch of electrical engineering has been more rapid perhaps than in any other. It was less than ten years ago that the use of 11,000 volts on the Buffalo-Niagara Falls transmission line was considered a great achievement under Eastern climatic conditions. From this to 60,000 volts has been an enormous stride, but the practical success of the lines in use and the improved methods of handling this potential, developed on both the Hudson River Electric Power Company's lines and the Niagara power transmission to Syracuse, indicate that modern electrical engineering has made the economical distribution of power half way across New York State a possibility, and that the construction of other lines of this voltage will not now be long delayed.

Electric Locomotive Economy

Two main sources of economy characterize the electric locomotive as compared with its steam-driven rival: The saving in power consumption and the reduction of maintenance expenses which may be positively expected with good handling. The benefits of a higher tractive effort in proportion to the weight of the machine, more rapid acceleration, a wider opportunity for coasting, and operation at from 80 to 90 per cent efficiency at all loads and conditions of weather, with no consumption of current when standing idle, all accrue toward better and more economical service. If test figures mean anything, when obtained by duplicating commercial runs, it is fair to expect that the maintenance cost of the electric locomotive per mile operated will seldom exceed one-third that of the steam machine, and may in favorable cases reach but one-sixth the upkeep of the latter.

A third source of long run economy in the electric locomotive is quite often overlooked in the broader considerations of service improvement which have guided transportation engineers in the electrification of steam railroads. It has been well appreciated that the electric locomotive is a simpler machine than its competitor of the boiler, fire box, valve gearing, cylinder and driving mechanism, but certain fundamental characteristics which insure a highly efficient working unit throughout the entire life and development of the motor-driven outfit have not as yet become fully recognized.

It is only within the past seventeen years that steam locomotive experts have come to appreciate in a scientific way the general conditions of efficiency in their engines as modified by changes in detail design. The influence of boiler tube length upon the rate of fuel consumption on the grates, the effect of varying draft intensities upon the coal pile in the tender, the best steam pressures for simple and compound cylinders, the effect of steam quality upon performance and efficiency, influence of superheating and results of varied valve adjustments—these and other points have only begun to be studied in relation to the types of locomotives now being delivered to the railroads from the shops of the makers. Splendid work has been done in the locomotive testing laboratories in the way of answering questions of the foregoing character when directed upon single machines, but a vast amount of experiment remains to be carried through before the determination of the best design for a given set of operating conditions can be promptly made.

With the electric locomotive the problem of economy appears simpler, and although opinion differs as to the relative advantages of direct and alternating current for heavy railroad service, the conditions of operation in the locomotive itself are in no sense as variable as in the steam machine. Questions of quality do not concern the electric current in the sense that steam is superheated or dry saturated; quality of fuel and water do not impose restrictions upon the service at special places on the line; valve adjustments and draft problems are not present, and, in short, the details of design which mean so much in the efficient operation of the steam locomotive are paralleled scarcely at all in corre-

sponding features of the electric locomotive. Given a motor with a predetermined efficiency curve and sufficient capacity to handle the specified traffic without an excessive temperature rise in the windings, economical operation follows as a matter of course if due regard is paid to coasting. In other words, the arrangement of the conductors in the slots, the number of commutator segments selected, the use of the compensating pole, the dimensions of the brushes, cross section of the lead wires, dimensions of the magnetic circuit and similar points of vital interest to the designing engineer in the factory, make very little difference in the operating results as respects efficiency and maintenance, for a motor of given output and service capacity. The line potential must be well supported by the power plant for economical service, and in this respect a fair comparison is possible with the effect of low steam pressure in the older type of locomotive, but in the main there is a wider range of detail to be settled in the design of the steam locomotive for economical operation and the securing of a given efficiency in fuel consumption is less certain than in the case of the electric motor outfit.

The latter starts its career in fast and heavy railway service with a high efficiency and a substantial certainty that this efficiency will be continually realized in practice. It is a machine to be counted on, and questions of driving wheel diameter, type of control, wheel base, mounting and ventilation are not likely to modify the present efficiency for the worse. The actual decreased cost of power is an incidental reason in the main arguments in favor of electrification, but in terms of dollars and cents it is by no means insignificant. The independence of the electric locomotive in the conditions limiting the steam machine is certain to be the cause of greatly reduced expenses as electrified service increases.

Steel Passenger Cars

It does not take much perspicacity to see that the steel car, both for passenger and freight service, has come and has come to stay, at least for certain classes of service. The development of the steel car has taken some time and much hard work, but the wonder is that it has been so long delayed. Years ago when metal carlines first put in an appearance there were a few advocates of an all-steel car who were persistent, but they were ahead of their time. That the American steel car has, as yet, settled down to a fixed or typical method of construction is doubtful because there are too many ways to be tried before any final standard can be adopted, and the cases where steel cars have been put into service in any large numbers are still too few and of too recent date to make it possible to put one's finger on any one design and say this is the best.

Undoubtedly electric traction, especially in connection with underground roads, has had a potent influence in the introduction and design of these cars, although the practice of the Pennsylvania and Southern railroads, not to mention some others which have tried steel passenger cars, shows that their use is not confined to subterranean or subaqueous transportation.

Within the short period during which builders have been experimenting with this type of car a large number of designs have been brought out, and, while for tunnel work the question of non-inflammability has been the controlling one, the avowed purpose of the designer has also been to make a stronger and a stiffer car than if built of wood for a corresponding service. In the majority of cases this end has been attained.

In the cars of the Pennsylvania and Hudson companies, the strength of the car and its fireproof qualities have been brought prominently to the front. In fact, with the Pennsylvania car, the possibility of the structure being brought into a rough and tumble scuffle with the titanic forces resulting from collisions and derailments, has evidently been given great weight, and the car is calculated to be of sufficient strength to roll down an embankment without, as we say in specifications, showing any crack or flaw. With the Hudson car, the strength has not been carried to the same limits, as the trains are lighter and the speeds lower, but great vertical stiffness has been obtained by means of deep plates over the windows that are thus made to serve as stiffeners for the top chord of the side frame truss, as well as gussets for the side posts.

In both of these cars it will be found that the girders and plates are riveted together with a solidity that bespeaks well in advance for their durability in service. One of the troubles of the earlier designs was that they were put up with an air of apologetic timidity. It was as though they were unwelcome visitors who wished to ingratiate themselves because of the lightness and airiness of the structure. This was a mistake, and it is probable that a number of designs that have not been successful would have been so had heavier materials been used and the same general scheme of construction been retained. The fact that this was done in the case of pressed steel gondola cars, by which ample strength was provided for any contingency, probably explains the wide popularity of that form of construction. It is interesting to note, also, that in both the Hudson and Pennsylvania designs it has been possible to secure an exceedingly shallow floor construction with a strength far above that ordinarily used with wood. With the whole of the side framing built into the form of a vertical truss, the lower member, being in tension, need not be so heavy as where it alone sustains the whole of the load, and has the upper framing simply built on top of it. Coming now to the floor framing, we find that in the Pennsylvania car a center sill of the box type has been used that is quite capable of sustaining all end thrusts, while the upper works are so substantially fastened that there is no danger of their being wiped away or telescoped by an adjacent car mounting the platform. This use of a center sill to carry the weight of the car body has frequently been suggested, but it is extremely interesting to see the way in which it has been worked out, particularly for a car designed to carry motors on the axles.

We have swung away from the notion that it is necessary to imitate the wood in the construction of a steel car, and with such notable examples as these two coming to the support of those already in service it is well within bounds to expect a still more rapid increase in the adoption of this form of construction, where conditions make it desirable, than has obtained in the past.

WEST SHORE ELECTRIFICATION BETWEEN UTICA AND SYRACUSE

The electrical equipment of the West Shore Railroad which is now complete between Utica and Syracuse differs radically in purpose from that undertaken on the Long Island, West Jersey & Seashore, New York Central or New Haven roads. The work has been vigorously carried on during the past year, and the official opening of the line with electrical operation will occur June 15. To understand the reasons for the adoption of the methods followed in this important undertaking, a review of the railway situation in Central New York State is necessary.

TYPICAL CONSTRUCTION ON TANGENTS, LOOKING EAST ALONG A THREE-TRACK SECTION

Up to within two years ago the electric and steam transportation lines from Albany to Buffalo belonged to separate interests. The steam lines carried all the through passengers and freight and the electrics were extending their interurban branches, making vigorous efforts to parallel the steam lines to secure local and semi-express business. Through the ownership of the West Shore Railroad by the New York Central & Hudson River Railroad Company, the latter owned practically six steam railroad tracks between Albany at the east end of the State and Buffalo at the extreme westerly end. Of these two roads, the New York Central main line conducted, of course, the greater part of the business. Its four tracks, well ballasted and kept in excellent condition for high-speed service, and its frequent trains, made it the dominating transportation factor in Central New York. The West Shore Railroad, with its two tracks, was given over largely to freight, although two or three through trains were run each way daily between New York and Buffalo, and this passenger service was supplemented by a few local trains and coaches attached to milk trains. The two roads, however, served practically the same territory. For the greater part of the distance across the State they are not more than 12 miles apart and in many places are in close proximity.

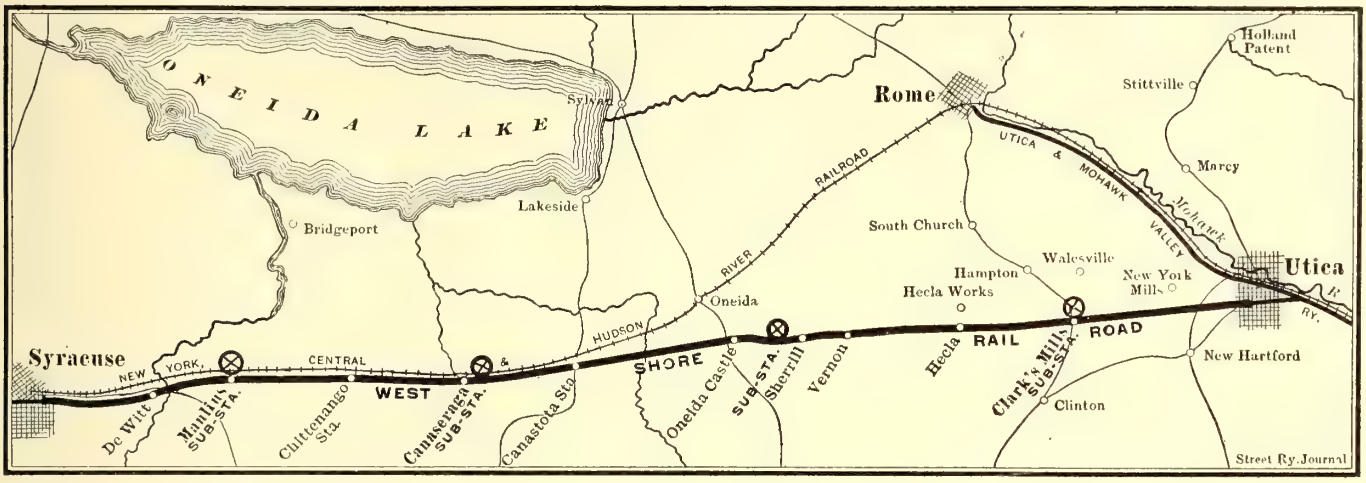
The first high-speed interurban electric railway in New York State was that connecting Buffalo and Niagara Falls, built in 1897-98. The success of this road in attracting passengers from the parallel steam railroad between Buffalo and Niagara Falls naturally attracted the attention of electric railway builders to the possibilities of interurban electric construction in the rich central district of New York State. Electric roads reaching out 20, 30 and 40 miles were projected and built from Schenectady, Utica, Syracuse, Rochester and other cities. At first they reached in a north or south direction, but were soon built to parallel the New York Central tracks. Extensions and purchases gradually threw several of the more important of these lines, as well as the two large city systems of Utica and Syracuse, into the hands of the Andrews-Stanley syndicate, of Cleveland,

Ohio. Active efforts then began to close the electric railway gaps between Buffalo and Albany.

At this juncture, the New York Central Railroad, recognizing the evils of competition, as well as the tremendous benefit which each interest could be to the other if they were united, started upon its policy of the absorption of the principal electric lines in Central New York. The properties of the Andrews-Stanley syndicate, consisting of the Utica & Mohawk Valley Railway, connecting Little Falls, Utica, Rome and Clinton, and the Syracuse Rapid Transit Company were first taken over. The value of the experience of Mr. Andrews and his associates was recognized by the New York Central interest in the selection of Mr. Andrews to take charge of this work. Subsequently control was secured by the New York Central of the Rochester Railway & Light Company and the Rochester & Eastern Rapid Railway, and, in conjunction with the Delaware & Hudson Railroad Company, of the systems in the cities of Schenectady and Albany.

Having now a free hand to develop every means of transportation is this rich and populous district, Mr. Andrews and his associates turned their attention to the task of uniting the several isolated electric systems in the territory in their charge. A consideration of the situation led to the belief that the greatest pressing need for direct connection was between Utica and Syracuse. In fact, before the consolidation of interests an electric interurban line had been projected between the two cities by the owners of the electric lines, and considerable grading had been done in pursuance of this plan.

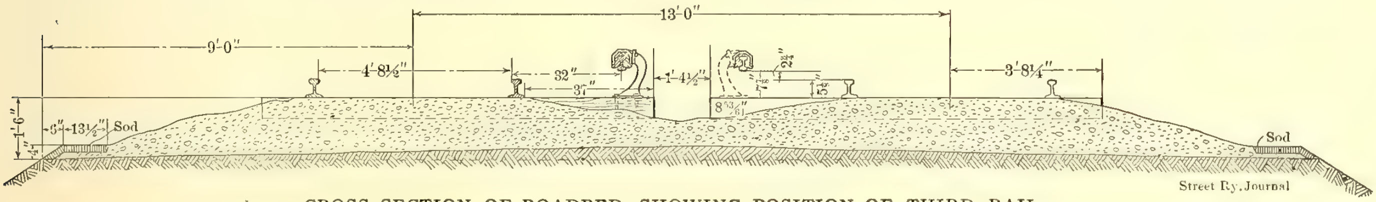
A glance at the accompanying map will best show the situation presented here. The main tracks of the New York Central Railroad depart from the direct line between Utica and Syracuse and sweep by a long curve to the north through Rome. The West Shore retains the general easterly and westerly direction by a route 7 miles shorter than that of the New York Central and extending through a well-populated and rich territory. Among the towns traversed are Oneida, 9000 population; Vernon, 3000 population, and Canastota, 5000 population. The distance between the two cities is a little over 44 miles, but under the West Shore schedule extremely scanty passenger transportation facilities were provided. With the exception of two trains with sleepers passing over the line at night and of practically no use to the contiguous or terminal population in Utica and Syracuse, there were only two trains each way a day. Here, then, was the logical place to apply electricity.



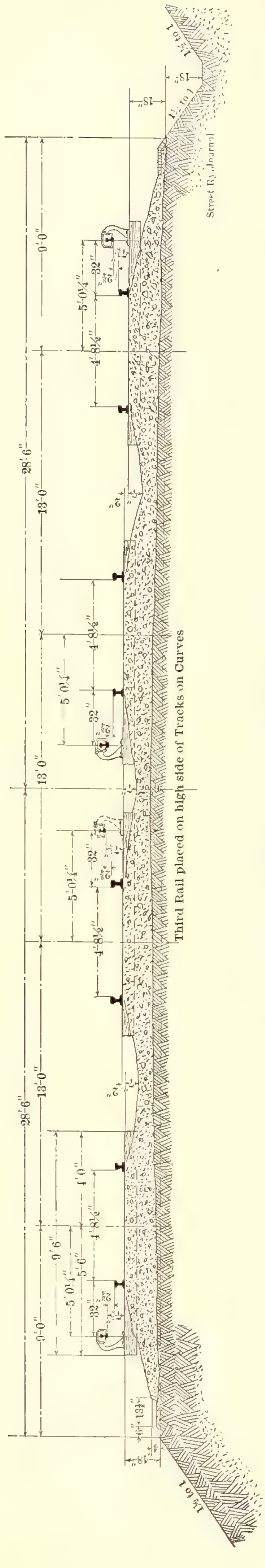
MAP OF TERRITORY BETWEEN UTICA AND SYRACUSE, SHOWING WEST SHORE AND NEW YORK CENTRAL TRACKS

The Oneida Railway, a corporation operating a trolley system in the city of Oneida, is the corporation to which the task of electrically connecting the two cities was entrusted. The next step was the mutual adoption of an agreement between the Oneida Railway Company and the New York Central Company under which the former agreed to lease the tracks of the West Shore Railroad between Utica and Syracuse, equip them for electrical operation and conduct the passenger business between these two points. The New York Central, on its part, consented to abandon the West Shore local trains on these tracks, but reserved the right to continue its through steam trains and to haul freight over the section by steam locomotives. The section of the West Shore included in this agreement runs from the westerly city line of the city limits of Utica to the easterly limits of the city of Syracuse, and at that time consisted of a double track. This track has been increased by the addition of 14 more miles in the form of third and fourth tracks, to accommodate the three classes of service which it is proposed to run. At the same time, the track was relaid throughout with 80-lb. A. S. C. E. rails. Altogether, of the 43.940 miles of route, 30.515 are laid with two tracks, 8.843 miles with three tracks, and 4.582 with four tracks, making a total mileage of 105.887.

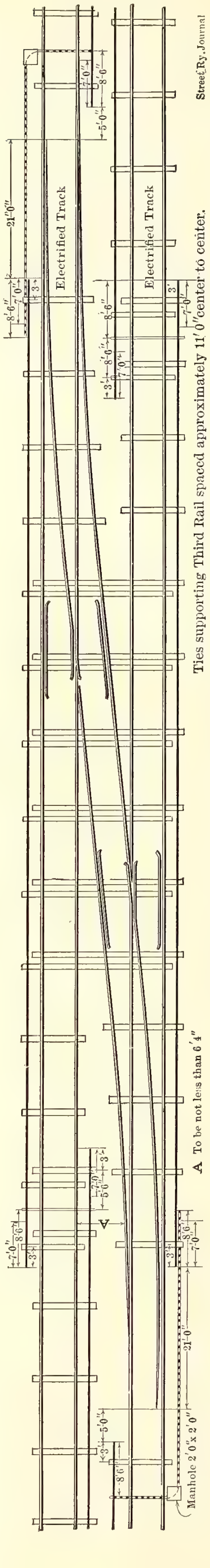
It is proposed to give three classes of service over the West Shore tracks between Syracuse and Utica. First, there will be the fast limited electric cars or trains which will run hourly between the two cities and will make two stops only, completing the run in one hour and twenty-eight min-



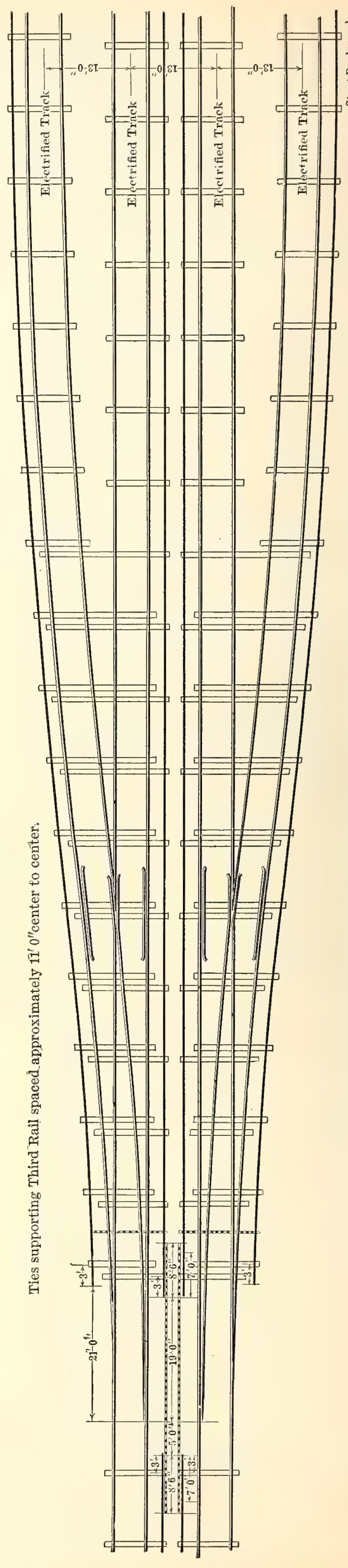
CROSS SECTION OF ROADBED, SHOWING POSITION OF THIRD RAIL



CROSS SECTION OF FOUR-TRACK ROADBED



CROSS-OVER, WITH THIRD RAILS BETWEEN CONNECTED TRACKS



TYPICAL TURNOUT FROM ELECTRIFIED TWO TRACKS TO ELECTRIFIED FOUR TRACKS

utes. Twenty-eight minutes of this time will be taken on the local system at each end and one hour for the run between the two cities. Second, there will be the local trains or cars which are scheduled to make 24 miles per hour, and which will complete the run in one hour and fifty-eight minutes. This service will be run hourly and the cars will make frequent stops, at every highway if necessary. Third, there will be the steam service. To provide for passing the fast-moving units around the slower trains, a third track has been laid between Clark's Mills and Vernon, a distance of 8½ miles. This middle track has crossover connections with both outside tracks and will be used jointly by both east-bound and west-bound traffic, to expedite the movement of all trains. It will be under the control of switchmen located in interlocking switch towers to insure safety and dispatch in the handling of train movements under all conditions. In addition, between Oneida and Canastota, a distance of about 5½ miles, a fourth track has been laid, as there are water stations and freight yards in this section and it is necessary to provide four tracks to pass the electric units around the freight trains that may be held up in the yards or at watering stations. The outside tracks will be used for the local trains.

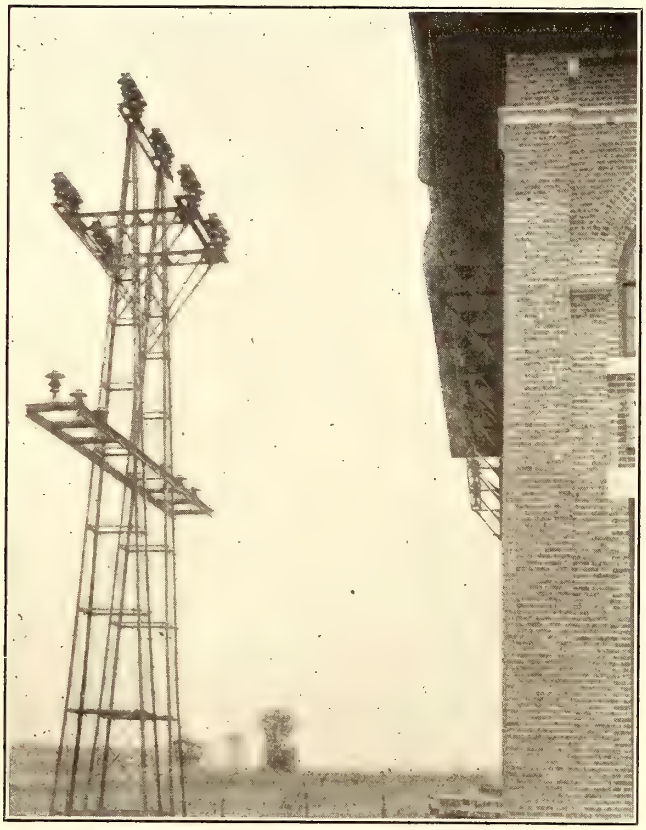

TYPICAL THIRD-RAIL CONSTRUCTION ON THREE-TRACK SECTIONS AT CURVES

SELECTION OF THE ELECTRIC SYSTEM

With a 600-volt trolley system at each end of the line, it became a serious question to the management of the Oneida Railway Company whether to adopt for the interurban sections the single-phase system with bridge or pole catenary overhead construction or direct current with overhead or third-rail distribution. The decision between direct and alternating current had to be made two years ago, and while the initial cost was an important consideration, it did not necessarily control the situation. It is interesting to note, however, that the combined cost of overhead bridges and motor equipment with the single-phase system just about balanced the cost of rotary-converter sub-station and motor equipment with 600-volt direct current. This was as far as the estimates were carried, so far as these two systems were concerned. Under these circumstances, the fact that the single-phase system at that time (June, 1905) was comparatively new and untried, and that the electrification was being done over leased tracks, confirmed the engineers of the company in their decision to adopt direct current.

Direct current having been selected, the question then lay between the overhead catenary construction and the third rail. The former had been used by the Oneida Railway Company for equipping a 3-mile section of the West Shore Railroad near Herkimer, as described in the STREET RAILWAY JOURNAL for Dec. 16, 1905. The estimates showed, however, that as between these two systems the third rail was considerably cheaper. Moreover, the character of the investment required was entirely different. With the overhead catenary construction the amount of copper necessary for feeders and trolley wire would have been in the neighborhood of 1,250,000 lbs. With the third-rail system, the greater part of the investment would be in steel rail, which could be more easily utilized elsewhere if necessary. Again, at the time that a selection had to be made between

third-rail and overhead construction, that is, in February, 1906, copper had recently risen greatly in price, and this fact and the difficulty of getting deliveries on feed wire were important factors in making a decision. Other considerations were the possibility of using electric locomotives on the section in question when the third rail would be more desirable and the less interference of the third rail with the steam trains. It was also found that if a third rail was installed the saving made in first cost over the overhead system would be sufficient at the end of five years to take the third rail up and put in an overhead system;



DOUBLE HIGH-TENSION TOWER AT REAR OF SUB-STATION, SHOWING METHOD OF TAPING OFF AND ENTERING BUILDING

also that if the use of the third rail was continued the saving at the end of ten years would be sufficient to cover the investment, so that then the single-phase system could be installed, if it should be considered desirable, without involving any "scrap loss" on the old equipment. The electrical features of the new line will now be considered.

POWER TRANSMISSION LINES

Power for the operation of the line is purchased from the Hudson River Electric Power Company, which owns the hydraulic power plants at Spiers Falls and Mechanicsville. This company is now extending its transmission line from its water-power plants to Utica, and expects soon to be able to deliver electric power to those points at 60,000 volts.

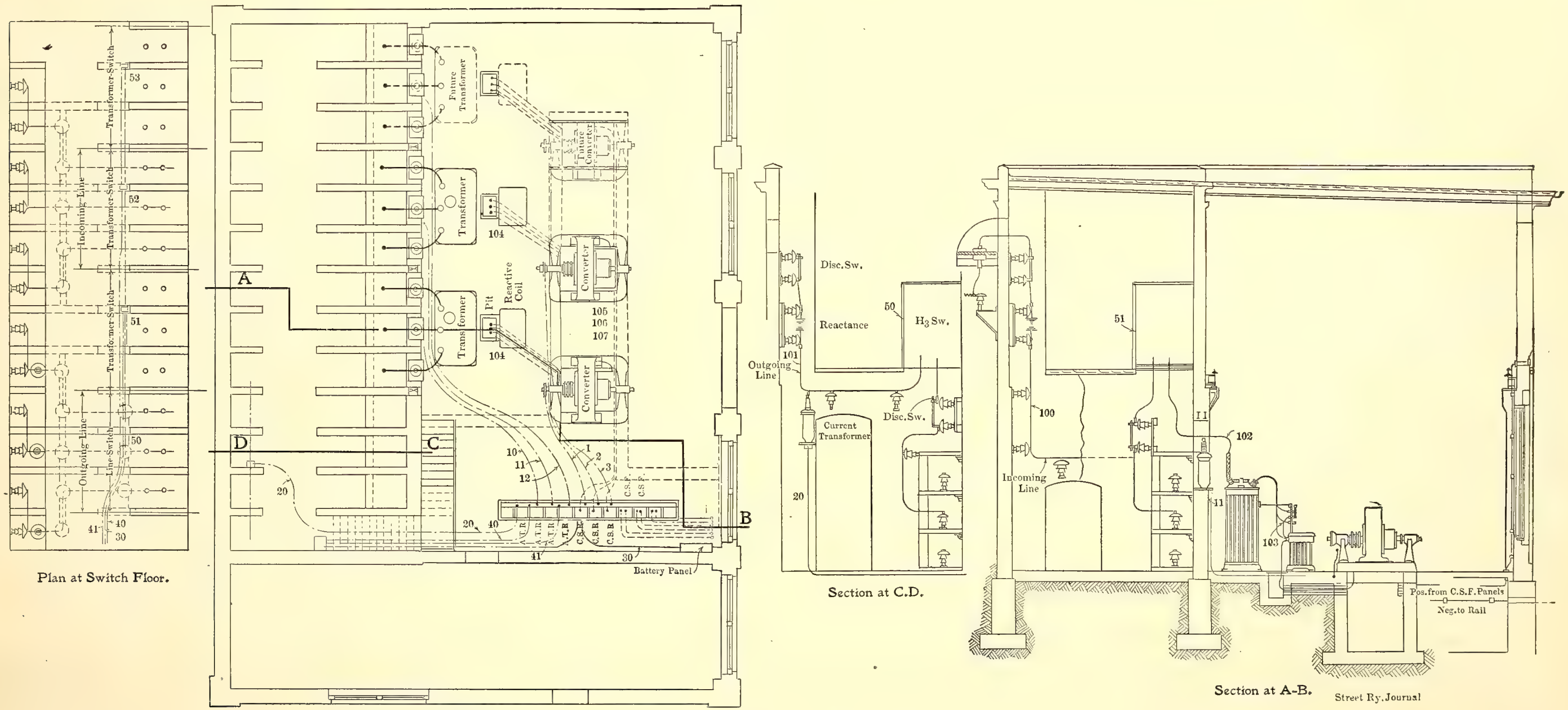
Pending the completion of these transmission lines, and to fulfil contracts which it had taken for power in the district around Utica, the Hudson River Electric Power Company has recently erected a temporary steam plant in that city. This station is equipped with steam turbines and is delivering power to the Oneida Railway Company at 60,000 volts, three-phase, and 40 cycles for its West Shore work. The contract of the Power Company provides that it shall deliver this power to the transmission circuit of the railway company, which commences at the Clark's Mills sub-station, which is that nearest Utica. The power company's transmission line for this distance of 4½ miles is constructed on a private right of way adjoining the West Shore tracks and is carried on two-circuit steel towers, spaced approximately 550 ft. apart. At Clark's Mills the current is taken by the Oneida Railway Company and is conducted to the three other sub-stations over its own transmission line, which is also built on the private right of way of the West Shore Railroad. For serving the entire section between Utica and Syracuse, about 44 miles, there are four sub-stations, as follows: No. 1, at Clark's Mills; No. 2, located 1½ miles west of Vernon; No. 3, located 1 mile west of Canastota, and No. 4, located at Manlius Center. The distance between the sub-stations averages approximately 10¾ miles. The transmission line is continuous; that is to say, it is carried into each sub-station and is there tapped to the bus-bar through disconnecting switches, then passes to the next sub-station.

The transmission towers used on the Oneida Company's transmission line were illustrated on page 76 of the STREET RAILWAY JOURNAL for July 13, 1906, and differ from those employed on the Power Company's line. They consist essentially of a square latticed structure composed of four angles, 3-in. x 3-in. x 5/16-in., carried down 5 ft. to reinforced concrete footings under each pier, measuring 5 ft. x 3 ft. x 10 ins. The distance between towers is 480 ft. These towers are figured for a side pressure of the wind of 1¼ lbs. per lineal foot of cable, which is based on a wind pressure of 30 lbs. per foot on a flat surface, or 15 lbs. per ft. on a round surface, acting upon the cable covered with a thickness of sleet equal to its own diameter. The maximum pull allowable on a single cross-arm tower is 1000 lbs. for each cable, the ties being designed to break at this tension. The cross-arms of towers at dead ends carry three insulators for each cable and are designed to resist the maximum calculated pull due to the assumed conditions of load and sag.

The heights of the towers are arranged to provide a minimum clearance of 10 ft. over buildings and over such wires as may be crossed by the line. At points where the transmission line makes an angle the towers are provided with enough insulators so that the cables do not make an angle of over 7½ degs. at any insulator.

The insulators are of porcelain, were supplied by R. Thomas, Sons & Company, of Lisbon, Ohio, and are placed at the corners of a 7-ft. triangle. They are carried on malleable iron pins 18 ins. high, which are designed to withstand a strain of 2000 lbs. applied in any direction at the top of the insulator. These pins are attached to the apex of the tower or the cross-arm with four ⅝-in. bolts and are cemented into the insulators at the factory.

A No. 0, seven-strand, hard-drawn copper cable is used for each conductor. This cable is strung on the towers with a sag of 12 ft. for a 480-ft. span, at 32 degs. F. This sag corresponds to a normal tension of 300 lbs. in the cable. Where the span varies from this length the sag is shortened or lengthened so as to keep the tension in the cable practically constant. Where heavy strains occur, necessitating a double cross-arm, the cable, instead of resting on insulators, is attached to an equalizing saddle to distribute the load equally over several insulators. These saddles are so designed that in case one insulator should be defective it may be removed and another substituted without removing the cable from the saddle. The use of lightning arresters is confined to the sub-stations themselves.



List of Conduits and Wires.

CONDUIT NUMBER	WHERE USED
1-2-3	Speed limit switch to C.S.R. panel
10-11-12	Current transformer to A.T.R. panel
20	Current transformer to A.T.F. panel
30	Battery panel to oil switch operating bus
40	Switch board to oil switch junction box
41	Switch board to oil switch junction box
50-51-52-53	Riser from junction box to oil switch motor

Cables Supported on Racks, Insulators etc.

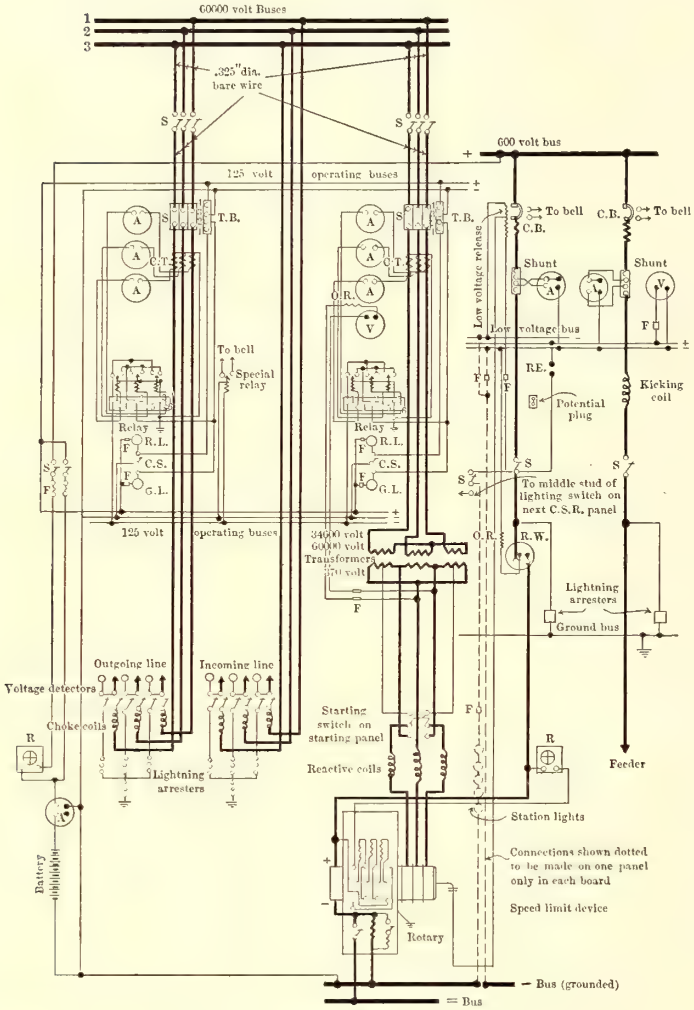
NUMBER	WHERE USED
100	Incoming line
101	Outgoing line
102	Oil switch to transformer
103	Transformer to starting panel
104	Transformer to rotary
105	Rotary positive to C.S.R. panel
106	Rotary equalizer
107	Rotary negative
108	Rotary field
109	Bus compartment

PLAN AND CROSS-SECTION OF SUB-STATION, SHOWING WIRING

SUB-STATIONS

The four sub-stations previously mentioned are of similar design. They are of brick with litholite trimmings, concrete roof and concrete floors. They are divided into two main compartments, at the rear the high-tension room, and in front the converter room.

This being one of the first 60,000-volt installations in this section of the country, extreme care has been taken to give the necessary clearances on the high-tension side. The layout in general is a typical General Electric layout, the high-tension line entering the under side of a protecting hood at the rear of the building and thence passing through circular openings 3 ft. in diameter in the wall of the building to the disconnecting switches and onto the bus compartments.



Key to Symbols used on Wirings.

A.	Ammeter	C.T.	Current transformer
V.	Voltmeter	P.T.	Potential transformer
R.W.	Recording wattmeter D.C.	S.	Switch
S.R.W.	Single-phase recording wattmeter	C.B.	Circuit breaker
B.R.W.	Balanced 3-phase recording wattmeter	RE.	Receptacle
P.R.W.	Poly-phase recording wattmeter	R.	Rheostat
S.I.W.	Single-phase indicating wattmeter	D.R.	Discharge resistance
B.I.W.	Balanced 3-phase indicating wattmeter	O.R.	Ohmic resistance
P.I.W.	Poly-phase indicating wattmeter	I.R.	Inductive resistance
S.I.	Synchronism indicator	F.	Fuse L. Lamp
R.L.	Red lamp G.L. Green lamp	C.S.	Controlling switch
T.B.	Terminal block for connections		Street Ry. Journal

SWITCHBOARD WIRING AT SUB-STATION

The high-tension room is two stories in height, the floor being carried only to the face of the barrier walls, which run 3 ft. apart and 3 ft. in depth, up and down the rear wall. This provides a number of cells or compartments, open from top to bottom, which are used for the installation of the lightning arresters and bus-bars. The second floor, extending through the room, permits an operator to handle the disconnecting switches, which are located at the top of these compartments. Against the forward wall on the second floor of this high-tension room are built similar barriers forming cells in which are installed the high-tension oil switches. Three of these cells are required for each switch, one leg being in each. These switches are General Electric type H, motor operated, the mechanism being placed at the top of the barrier. There are three of these in each station except the last, one controlling each of the two machines and one the out-going high-tension line. These switches are operated from the switchboard in the converter room. On the first floor of this high-tension room and immediately under the oil switch compartment and running transversely through these barrier walls supporting the oil switches there are three compartments, 3 ft. square, one above the other, and extending the length of the room. These are the bus compartments proper and carry the high-tension line through the station. It is from these buses that taps are made and carried up to the oil switches. This room is separated from the converter room by fire doors, and the second floor is reached by an iron stairway.

In the converter room are the transformers, rotaries and switchboard. Each transformer stands in front of its respective oil switch and the connections from each pass through openings 3 ft. square in the brick wall in which is inserted a pane of glass with a suitable hole for the passage of the wire. All of the high-tension wires, as far as the transformer terminals, are of bare copper wire. In recesses provided for the purpose under the openings in the wall where the high-tension line passes through to the transformers are located the current transformers. In the converter room are two units consisting of one 330-kw, 60,000:370-volt, oil-cooled tansformer, Y connected on the primary side and delta connected on the secondary side, and one 300-kw, 370-volt a. c. and 600-volt d. c. rotary converter. Between the transformer and the rotary stands the reactance which is used for starting the rotary converters. This is the General Electric Company's latest method of starting rotary converters without synchronizing.

The switchboard consists of the necessary a. c. and d. c. rotary converter panels, an outgoing high-tension line panel containing ammeters and voltmeter, storage battery panel and the necessary d. c. feeder panels.

The d. c. feeder panels are connected to the third rail at the station by means of rubber and lead-covered cable, as will be described later, each track being independently fed each way from the sub-station; that is, on a two-track section there would be four feeder panels. Auxiliary feeders will not be necessary for the service contemplated. A storage battery is located in the subway and is used in operating the oil switches.

The converter room is provided with a heater system, which is located in the west end of the building in an entirely separate room along with the toilet, lavatory conveniences and storage room for supplies. The building is of fireproof construction throughout.

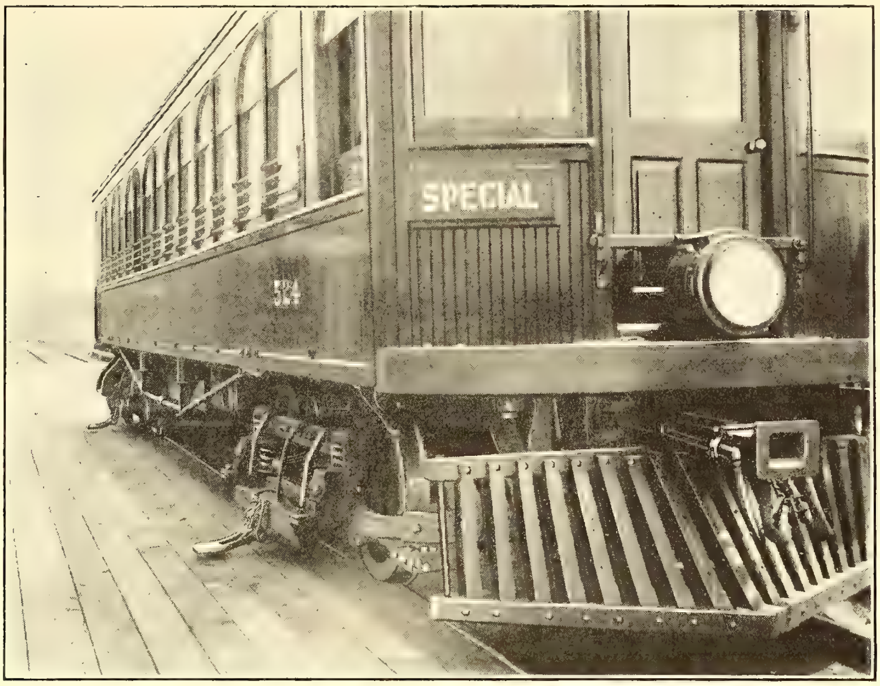
THIRD RAIL

The third rail is of the bull-headed or double-headed type, of the same section as that adopted in the New York City zone of the New York Central Railroad, and is adapted for under-running contact. It weighs 70 lbs. per yard, and was supplied in 33-ft. lengths by the Lackawanna Steel Company, but as the density of traffic did not require unusual

electrical conductivity, a special composition to secure low resistance was not used, as in the New York Central work. The composition is, in fact, that used in the standard 70 to 80-lb. rails rolled by the Lackawanna Steel Company, and consists of carbon 0.45 to 0.55; phosphorous, not over 0.10; silicon, not over 0.20, and manganese, not over 0.75 to 1.05. This gives a resistance of 0.0494 ohms per mile; in other words, the conductivity of the rail is equivalent to 1,023,000 circ. mils of copper. This conductivity is sufficiently large so that no auxiliary d. c. feeders are required.

The joints in the third rail are made by ordinary two-bolt splice bars with bolts ⅞-in. in diameter. The center line of the rail is carried 32 ins. outside of the gage line of the track and its lower surface is 2¾ ins. above the top of the running rail. These dimensions compare with those of the New York Central and the Long Island Railroads, as shown in the table below.

The Long Island Railroad dimensions have also been employed on the West Jersey & Seashore Railway. The clearance on the West Shore differs from that of either of the others mentioned, but was adopted after a study of the traffic passing over the road. It will permit the passage of all of the cars belonging to the New York Central system and all foreign cars except a very limited type of coal cars with low truss rods. Electric locomotives and motor cars designed for use on the Central tracks can also be run over the West Shore tracks without changing the position of the third-rail shoe.



CAR AT STATION PLATFORM, SHOWING POSITION OF SHOES

ROAD	Type	Height of Wearing Surface Above Top of Track Rail	Horizontal Distance Between Center of Third Rail and Gage Line
Oneida Railway......	Under contact	2¾-inches	32-inches
New York Central...	Under-contact	2¾-inches	28¼-inches
Long Island.........	Over-contact	3½-inches	27½-inches*

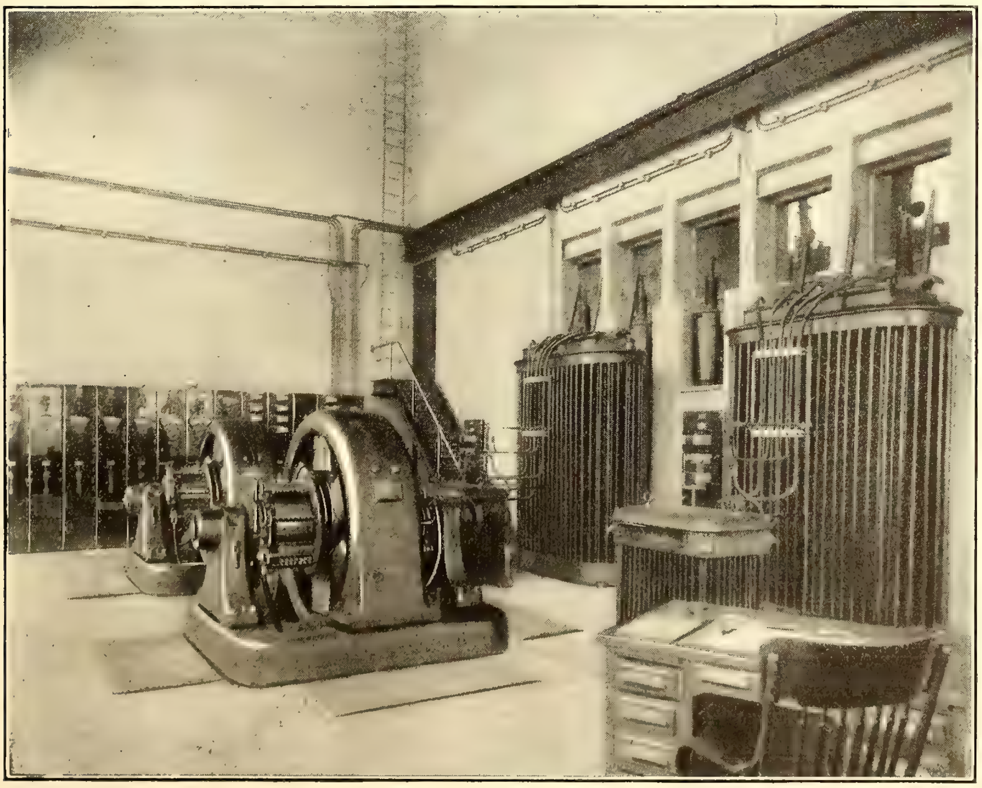
* 26 inches from gage line to gage line

The third rail is normally located between the tracks on tangents and on the high side of the track on curves.

BRACKETS

The brackets for supporting the third rail on the straight track are located 10 ft. apart, or on every fifth tie. They are of tough gray cast iron, and are of the same pattern as on the New York Central construction. The specifications require that sample pieces, 1 in. square, cast from the same heat of metal in sand molds, shall be capable of sustaining on a clear span of 12 ins. of central load not less than 2500 lbs., and shall deflect 0.15 in. before rupture.

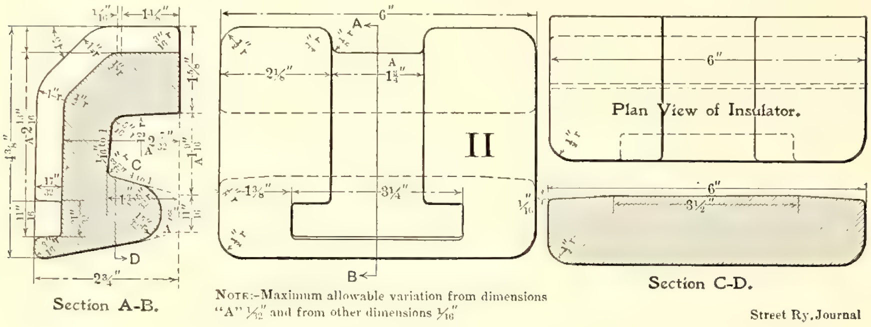
They are held to the tie by three-lag screws 4½ ins. long and ¾ in. in diameter. A templet, found of great convenience in boring holes in the ties for the third-rail brackets, is illustrated on page 1006. It consists of a ⅛-in. wrought-iron plate reinforced with 1-in. pine, and is provided with a bracket 4 ins. wide which fits over the top of the running rail.



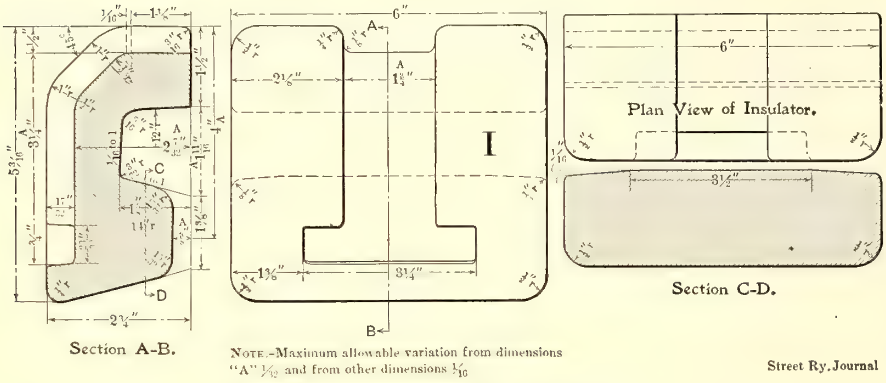
INTERIOR OF SUB-STATION NO. 2

INSULATORS

The insulators used for holding the third rail in the brackets were supplied by the Ohio Brass Company and are of

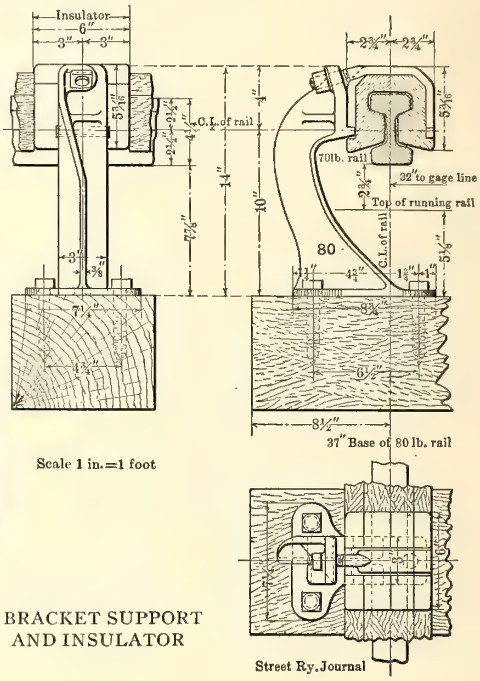


INSULATING BLOCK FOR INCLINE

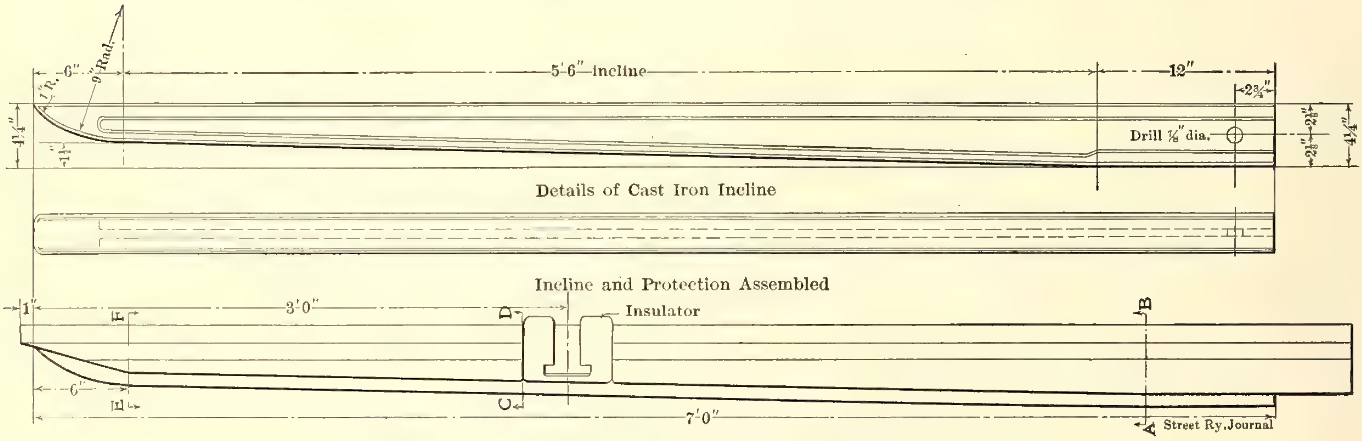


INSULATING BLOCK FOR THIRD RAIL

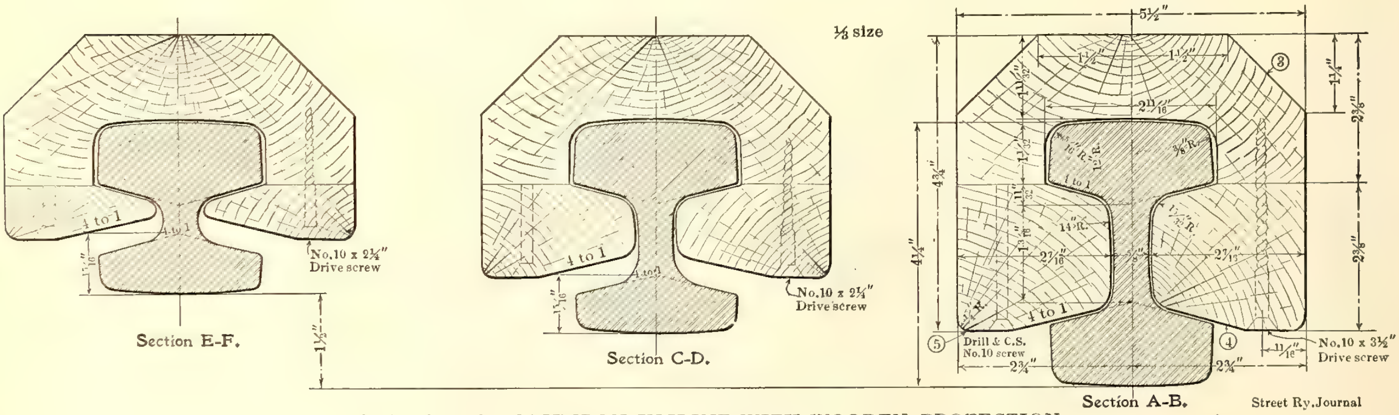
The insulators are required to pass the following tests: (a) Resistance. After immersion in water for seventy-two hours and the surface wiped dry, the insulation resistance of all insulators, measured from hook bolt slot to rail slot, shall be not less than 10 megohms. When subject to a precipitation of three-quarters of an inch of



BRACKET SUPPORT AND INSULATOR



DETAILS OF CAST-IRON INCLINE WITH WOODEN PROTECTION

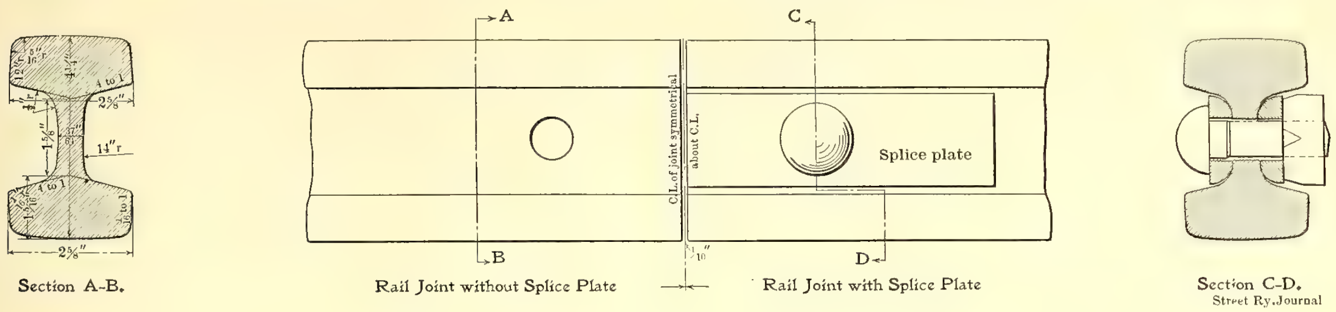


SECTIONS OF CAST-IRON INCLINE WITH WOODEN PROTECTION

semi-porcelain. Two sizes are used, one for holding the rail at the inclines where a shallower insulating block is required, the other for supporting the rail at other points.

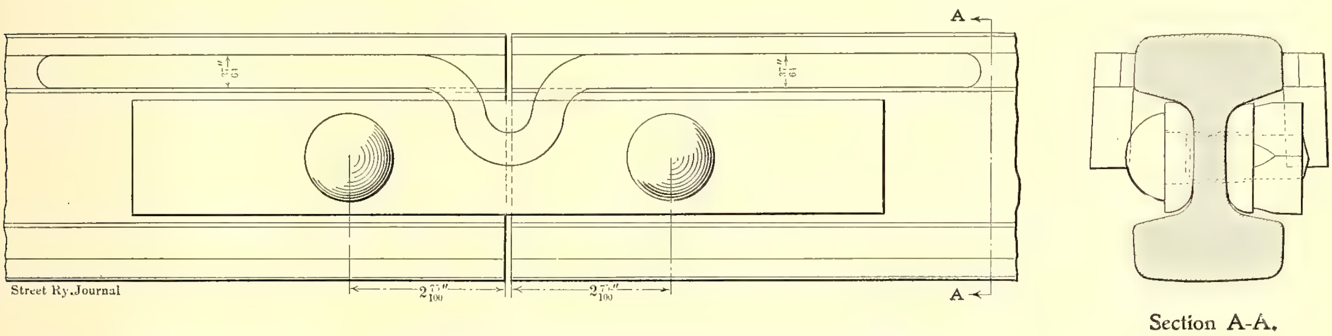
water per minute, the insulator resistance, measured as before, shall be not less than 0.2 megohms. (b) Compression Test. With pressure uniformly distributed applied, the in-

sulators shall be capable of withstanding at least 85,000 lbs. for type I. insulator, or that used everywhere except at inclines, and at least 70,000 lbs. for type II. insulator, or that used at inclines, without showing any indications of fracture. (c) Tensile Strength Test. All insulators shall be capable of withstanding a tensile stress of not less than 1400 lbs. without showing any indications of failure. (d) Impact



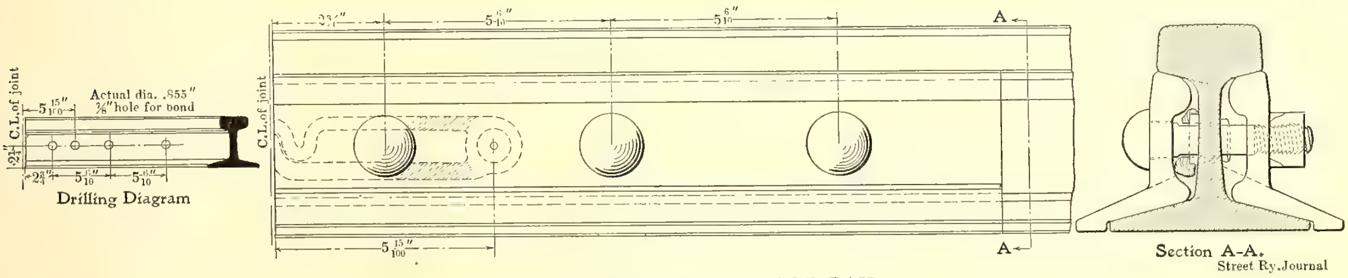
DIMENSIONS OF THIRD RAIL AND THIRD-RAIL JOINT

Test. Two per cent of each lot of insulators shall be subject to impact tests consisting of successive blows of a ¾-lb. weight in a form of a spherical steel ball dropped 30 ins. Insulators not showing signs of fracture after one hundred



THIRD-RAIL JOINT AFTER ADDITION OF BOND

blows shall be rated as 100. Other insulators shall be rated at the number of blows respectively on which they develop fracture. The average of these ratings shall not fall below twenty-five blows for the type I. insulator and a propor-



BOND ON RUNNING OR TRACK RAIL

tionate number for the type II. Each insulator is held to its bracket by the forged steel hook bolt which passes around the insulator and through a lug on the top of the bracket, as shown in the section.

INSULATING BLOCKS

A great deal of study was put upon the proper material for the insulating block. To secure good insulation through vitrification is necessary, but a thoroughly vitrified block is brittle, a condition incompatible with that required on third-rail construction. To secure the necessary combination of mechanical strength and electrical insulation, the manufacturers made an extended study of combinations of different clay and porcelain mixtures, as well as various methods of drying and burning the pieces. It was found that those employed with pieces of certain sizes and shapes were unsuitable under other conditions of material, also that the chances for cracking and deformation increased as the pieces became large and heavy and of irregular section. This required variations in the mixture. The resultant of these processes is termed "semi-porcelain."

SPACING AT JOINTS

In laying the third rail a space of about ¼ in. is left at each joint for expansion and contraction. The exact distance allowed depends upon the temperature at the time the work is done and is determined by the employment of a removable shim, which is placed between the ends of the rails when they are being put in place. The thickness of the shim used varies with the temperature during which the work is done, according to the scale shown on page 1006.

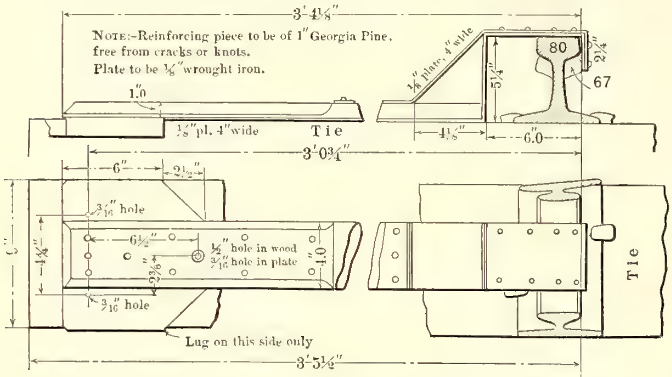
INCLINES

The inclines are of gray cast iron of the same quality as that specified for the third-rail brackets, and are attached to the third rail by standard two-bolt splice plates. The standard incline used whenever the shoes have to take the

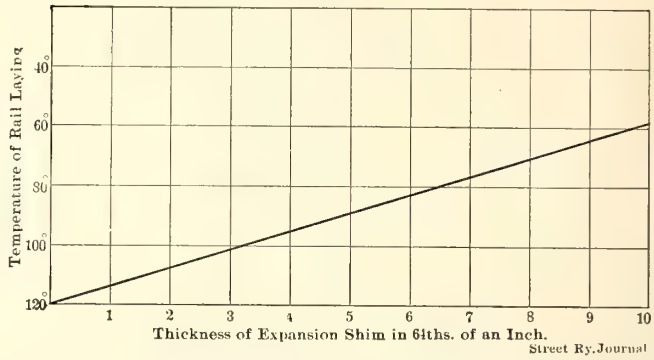
incline at high speed is 7 ft. in length, of which 1 ft. at the junction with the straight rail has a horizontal under-running surface. As the curved portion at the end of the incline takes up 6 ins., the length of inclined wearing surface is 5 ft. 6 ins. The difference of 1½ ins. in height between the ends of this surface gives the incline a pitch of 1 in 44. The inclines are supported by one insulator and bracket, as shown.

PROTECTIVE COVERING

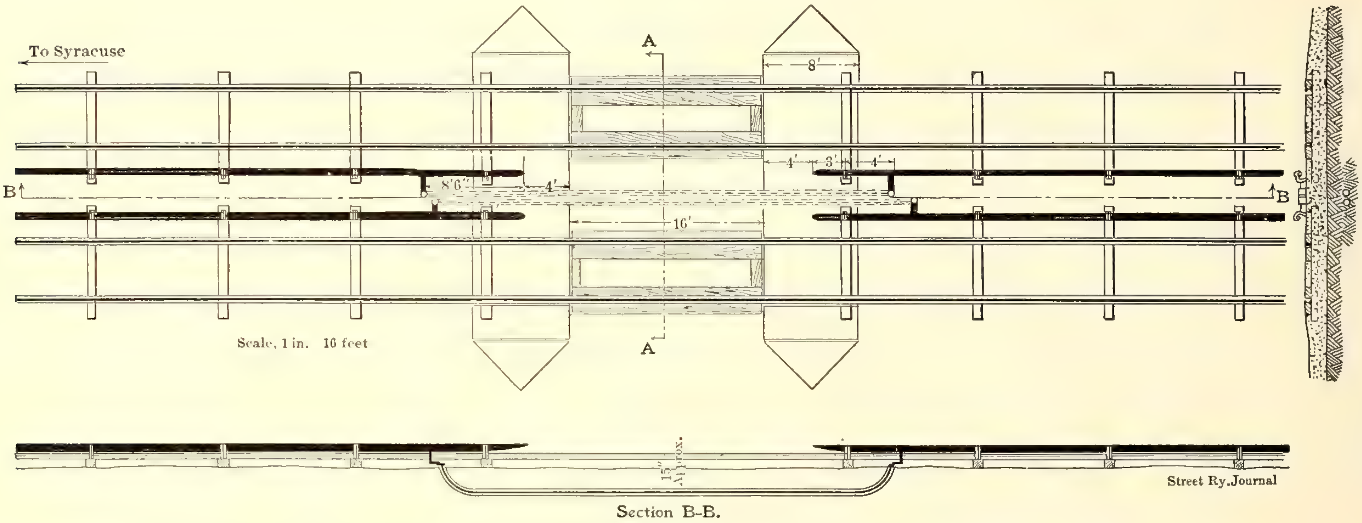
Two types of protective covering are used, as on the New York Central, viz., a three-part wooden covering which was originally adopted, and a single-piece fiber covering which was manufactured by the Indurated Fiber Company, and is considered preferable. Fiber covering is used between New York Mills and Clark's Mills, and would have been employed throughout if a sufficient quantity could have



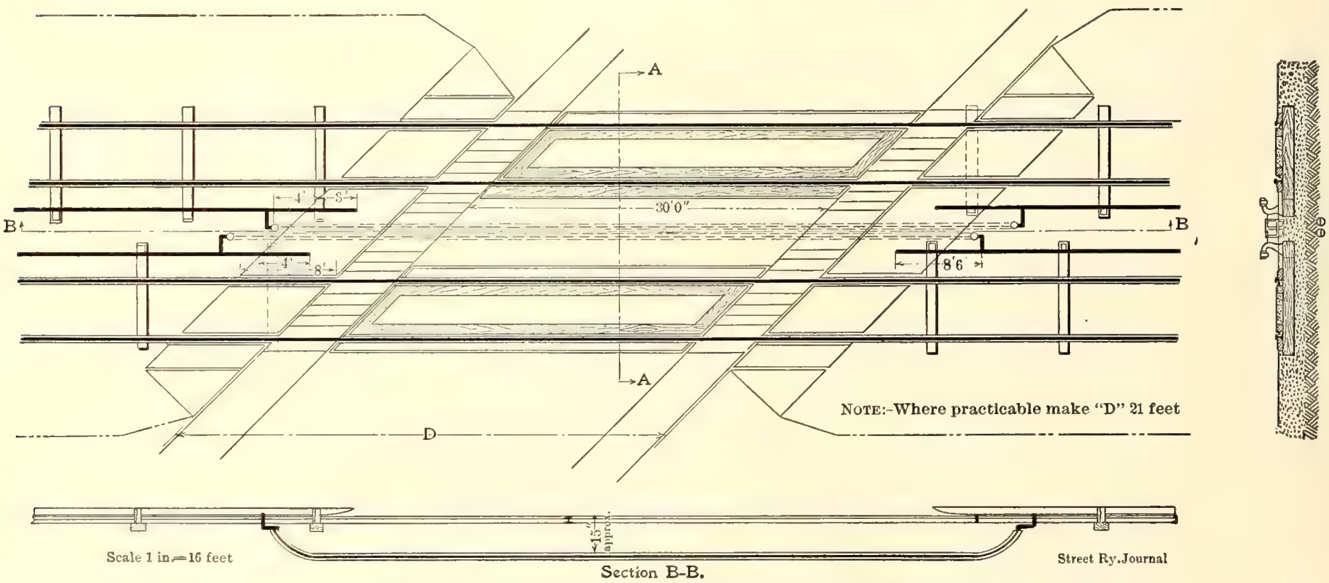
TEMPLATE FOR BORING HOLES IN TIES FOR THIRD-RAIL BRACKETS



CURVE SHOWING THICKNESS OF EXPANSION SHIM USED IN INSTALLING THIRD RAIL



ARRANGEMENT OF THIRD RAIL AND DUCTS AT MAXIMUM FARM CROSSING, WITH CATTLE GUARDS



PLAN OF TRACKS AT STANDARD 30-FT. HIGHWAY CROSSING, WITH SIDE WALKS

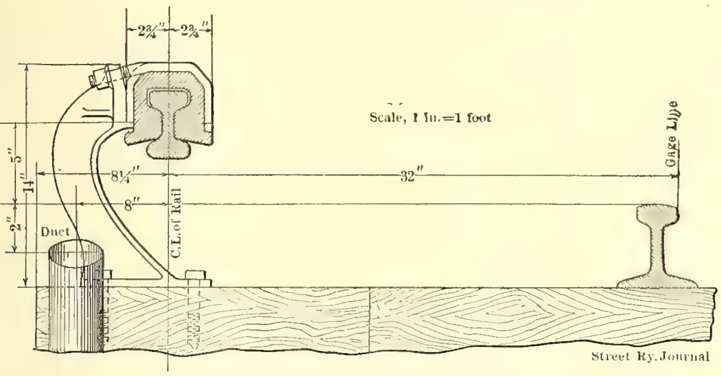
been secured in time for use on the entire installation.

WOODEN SHEATHING

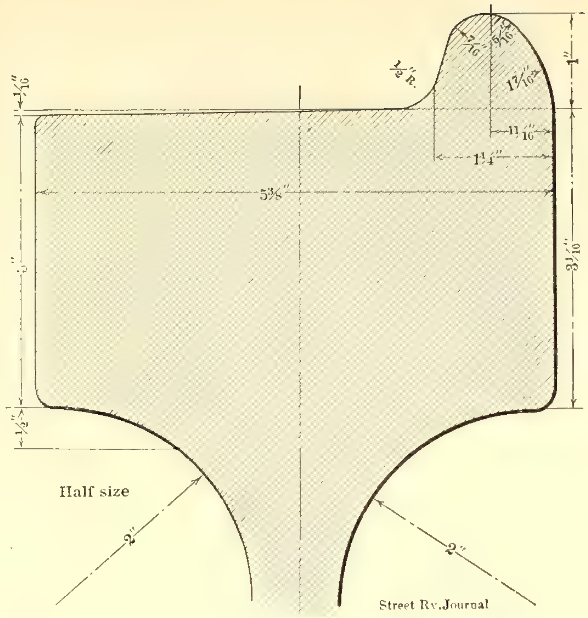
The wooden sheathing is of long-leaf yellow pine in three parts, top and two bases held together by No. 10 3½-in. diamond-pointed drive screws. It is not treated with any preservative except a coat of ordinary paint applied to the outside of the cover before being placed on the rail.

FIBER SHEATHING

The indurated fiber sheathing is molded for straight track in sections 43½ ins. long, so that it takes three sections to cover the third rail between brackets. The joints on straight track are covered by a 2½-in. lap joint of the same material. At the bonds a wider section of covering is used, as illustrated on page 573 of the STREET RAILWAY JOURNAL for Oct. 13, 1906, and also in Fig. 3 on page 909 of the issue for May 25, 1907. This arrangement allows the fiber covering to cover the bond and joint. The specifications



SECTION SHOWING POSITION OF THIRD RAIL AND DUCT

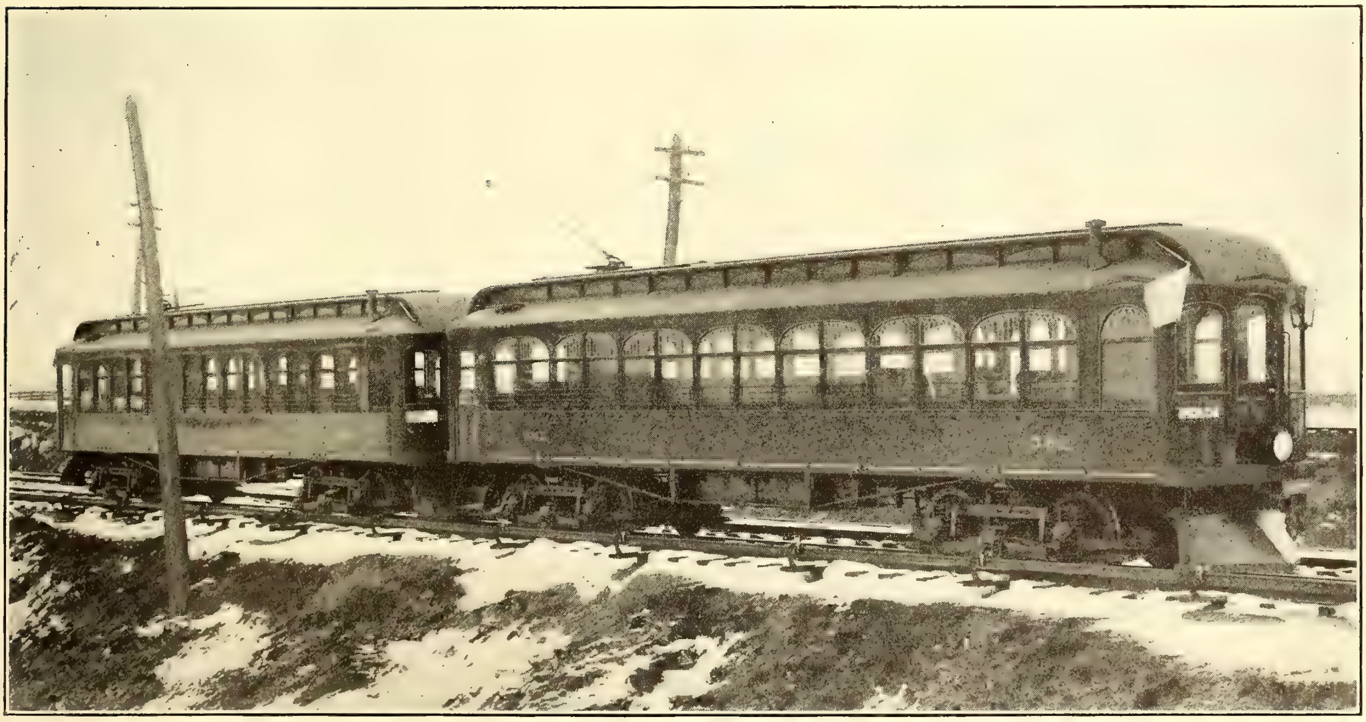


STANDARD TIRE SECTION OF 37-IN. ROLLED STEEL WHEEL

for the fiber insulation require that it shall stand an insulation test of 5000 volts before breakdown.

THIRD-RAIL BONDS

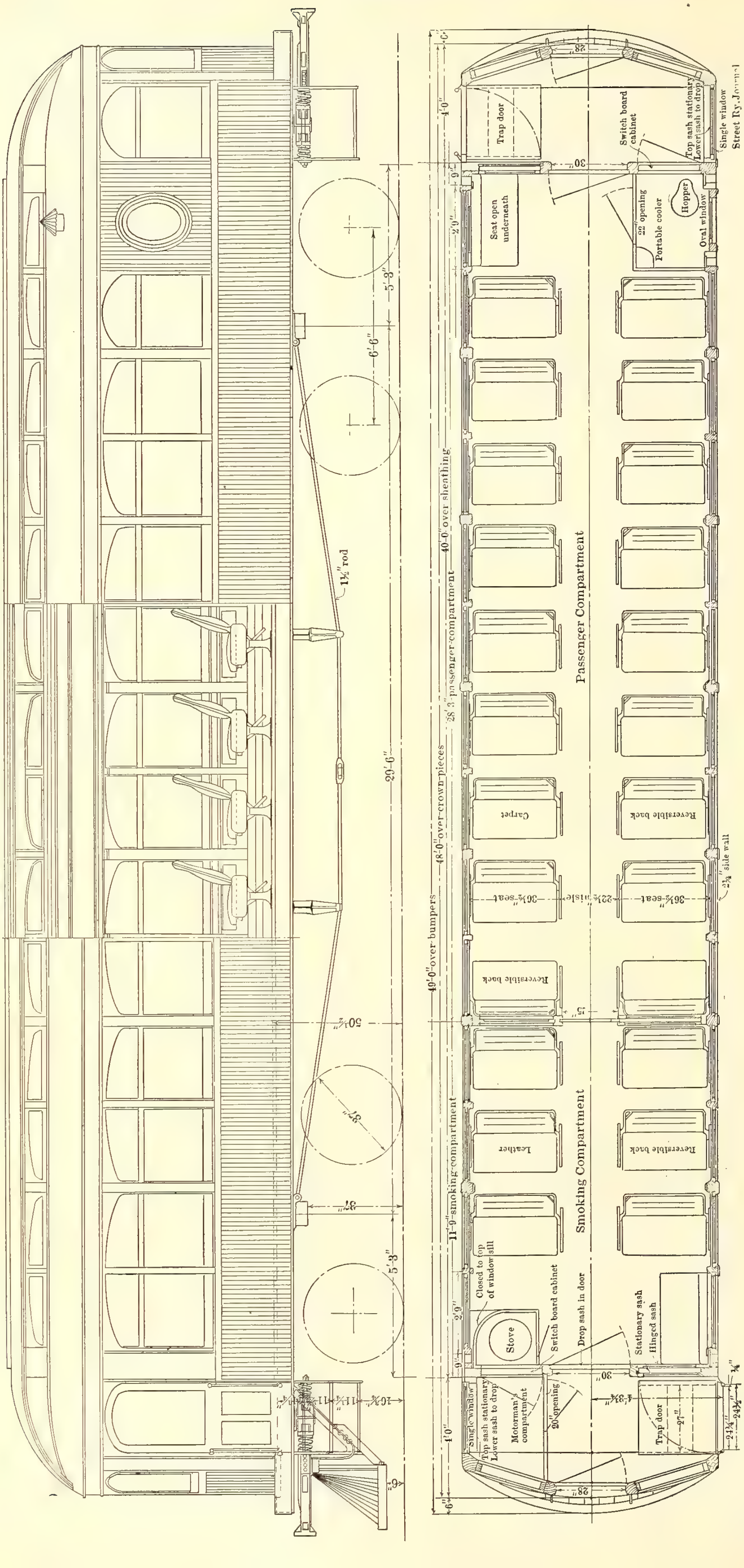
The majority of the bonds on the third rail are the John A. Roebling's Sons Company's ribbon bond. These bonds are 15 ins. in length over all and are soldered to the rail, one on each side of the upper head, and have a very large contact surface per terminal. There have also been installed on a portion of this line about 3000 Ohio Brass Company's ribbon soldered bonds and about 7000 American Steel & Wire Company's twin terminal bonds. These bonds are of 500,000-circ.-mil capacity each, and are installed two per joint on the upper head of the third rail. The wood cover is cut away at all joints, so as to allow the cover to go over the bond. The fiber cover has an enlarged section at these joints which allows for completely covering the bond.



MULTIPLE-UNIT TRAIN CONSTRUCTED FOR ELECTRIFIED WEST SHORE TRACKS

RUNNING RAIL BONDS

The running rail is bonded with the Ohio Brass Com-



PLAN AND SIDE ELEVATION OF CAR

pany's 11-in compressed terminal bond, placed under the fish-plate. There is one of these at each joint, and each bond is of No. 0000 capacity. The track is cross-bonded only at special work. Both rails are available for use for the return circuit.

CONNECTIONS TO THIRD RAIL AND THIRD-RAIL JUMPERS

The connection between the d. c. bus-bars in the various sub-stations and the third-rail system is made through several cables of 1,000,000-circ.-mil capacity, carried in iron ducts 3 ins. in diameter. The cable is insulated with 3/32-in. rubber and is lead encased. The end of this duct at the track is brought up to 2 ins. below the top of the track rail or 2½ ins. above the surface of the tie. Where both third rails are on the inside of the track care is taken to separate the track terminii of the ducts for the east and west-bound tracks by several feet.

The cable, after emerging from the duct, terminates in a T with twisted arms, commonly known as a ram's horn or pig's tail, to each terminal of which is attached a solid terminal for bolting and soldering to the rail. Great care is taken to insulate and protect the cable at the point at which it emerges from the duct by taping and painting with insulating and waterproof paint. The ends of the duct are also plugged with oakum around the cable to keep dirt from entering the duct and to prevent any movement within it of the cable.

The third-rail jumpers used to secure continuous electrical connection between the sections of the third rail are of 1,000,000-circ.-mil capacity and have the same form of ram's horn terminals as the leads from the station to the third rail. Diagrams of the layout at different typical crossings are presented on page 1006 and show two of the different arrangements adopted. The

longest gap between sections of third rail is 108 ft., while the distance between shoes of a single car is 29 ft. 6 ins.

At the sub-station end, the connections to the east and west-bound tracks are carried to separate panels on the switchboard so that electrically the east and west-bound tracks are kept entirely distinct except through the bus-bars. In this way an interruption on one track has no effect on the other. The panels in each sub-station connecting with each track, however, are in parallel, and no section switches are used. In one or two instances, where there are long sidings equipped with the third rail, as at Clark Mills, an extra panel has been added to the switchboard to supply the current for this section.

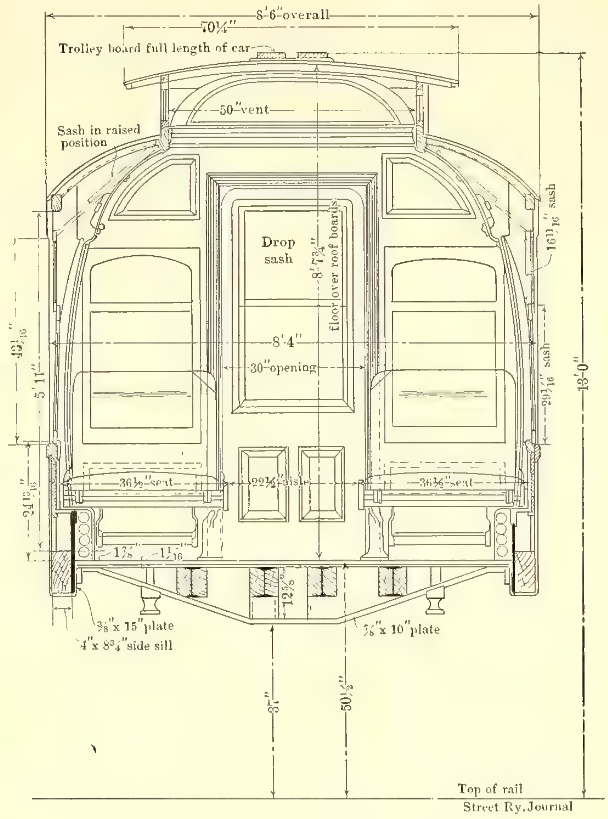
CARS

As the cars are to operate over the city system in both Utica and Syracuse, a different type was adopted than if they were to use the West Shore tracks exclusively. The main dimensions follow: Length over end panels, 40 ft.; over crown pieces and vestibules, 48 ft.; width over sills, including sheathing, 8 ft. 4 ins.; size of side sills, 4 ins. x 8¾ ins.; end sills, 6 ins. x 8 ins.; sill plates, ⅜ in. x 15 ins.; thickness of corner posts, 4½ ins.; thickness of side posts, 2¾ ins. and 4¾ ins.; centers of posts, 2 ft. 9 ins.

INTERIOR OF WEST SHORE CAR

The bottom framing consists of two intermediate and two center sills composed of 6-in. I-beams extending under the vestibules, with malleable iron caps and supports for main truss rods; the latter are 1½ ins. in diameter. The interiors are of inlaid mahogany, which includes the doors; the ceilings are full Empire decorated. The floor is covered with interlocking elastic tile, while a rubber mat is furnished for each vestibule. Storm sash are furnished for the side windows, which replace window guards in winter. The cars are equipped with twenty-four reversible and two stationary plush seats with high backs and head rolls. Each car is also fitted with a toilet lined with "Mettile."

The truck used is the Brill No. 27 E-2, with a wheel-base of 6 ft. 6 ins.; the wheel diameter is 37 ins.; the axle di-



FRONT ELEVATION OF WEST SHORE CAR

ameter 5½ ins. and 6 ins. The wheel tread is 4 ins. wide and the depth of the flange is 1 in., to allow the cars to operate over the city systems in Utica and Syracuse.

Each car is equipped with four G. E. 73 motors with Sprague-General Electric multiple-unit control. Westinghouse automatic air brakes with graduated release and Peter Smith hot water heaters are used.

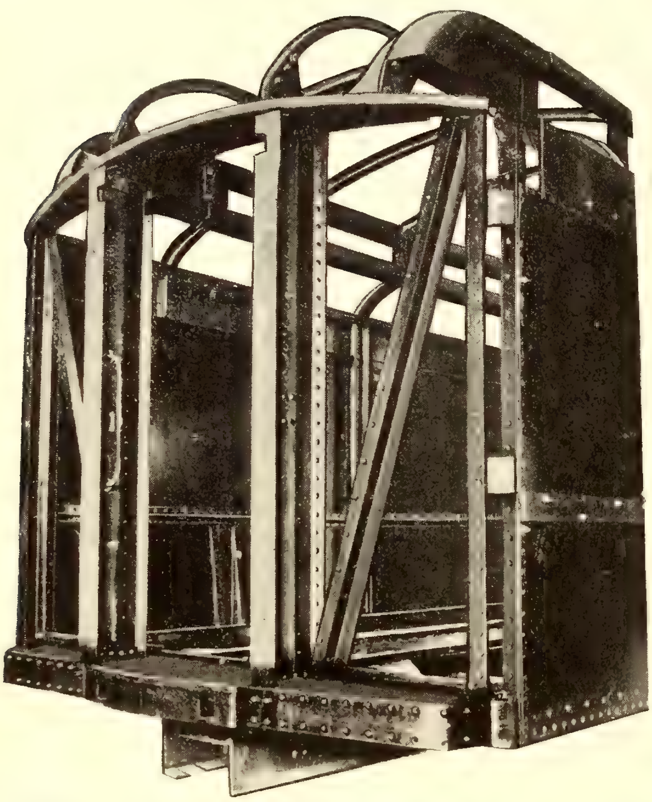
ENGINEERING

The installation of the electrical equipment of the line has been conducted by the engineering force of the Oneida Railway Company, of which C. Loomis Allen is vice-president and general manager, W. J. Harvie is electrical engineer, and M. J. French, Jr., is engineer of maintenance of way.

Official notice has been given that the fast Fort Wayne-Wabash-Indianapolis service over the Fort Wayne & Wabash Valley line will remain. Originally it was the intention of the company to change the routeing of the big cars, but this will not be done. It has been the popular belief that with the opening of the new Logansport-Lafayette extension of the Fort Wayne & Wabash Valley Traction Company, when limited service will be established between Fort Wayne and Lafayette, the limited line between Fort Wayne and Indianapolis would be discarded. Original plans of the two companies did not contemplate the retention of the Fort Wayne-Indianapolis limiteds. It was the intention to have the Fort Wayne-Lafayette cars merely connect at Peru with Indianapolis cars between Peru and Indianapolis. The traffic on the limited cars has grown to such an extent that it was deemed unwise to discontinue it.

STEEL PASSENGER CARS FOR THE PENNSYLVANIA RAILROAD

The Pennsylvania Railroad Company has ordered the construction this year of 200 all-steel cars for its passenger equipment. Great interest attaches to these cars from the fact that the company was one of the pioneers in a design of steel cars. When steel cars were proposed for the New York Subway none of the car builders in the country was in a position to furnish them, so that the first steel car for the subway was built in 1902 at the Altoona shops of the Pennsylvania Railroad Company. The company has gone further in the direction of the use of steel than has hitherto been attempted, and the order now placed is the largest yet given by any steam road for this class of equipment. The company, as will be described later, is constructing steel cars both for suburban use, where provision is made for the application of motors, and also for through passenger service. The Pennsylvania's policy in this respect is the result of a long period of inquiry and experiment in which the late President Cassatt took an active part. After several cars had been built the president appointed a committee of motive power officials to make a thorough report on the design to be adopted, and the orders just placed are in accordance with the recommendations of that committee. The growing scarcity of suitable timber and its rapidly increasing price have played an important part in the development of the steel car, whose cost is not so very much greater than a wooden car. Moreover, it is expected that a steel car will not only be non-combustible, but will show a lower maintenance cost.



END FRAMING OF PENNSYLVANIA STEEL MAIL CAR, SHOWING TYPE OF CENTER SILL USED IN PASSENGER COACH

Two standard types of steel passenger equipment have been adopted: (1) for through trains drawn by a steam or electric locomotive, and comprised of mail, baggage, sleeping, dining or day coaches, and (2) a lighter and shorter car for suburban trains to be drawn by a locomotive or propelled by motors upon the truck axles. The dimensions of these cars follow:

	Length.	Weight.	Trucks.
Passenger	70 feet $5\frac{3}{4}$ inches	113,500	4-wheel
Mail	71 feet $10\frac{3}{8}$ inches	91,000	4-wheel
Baggage and express	60 feet $10\frac{3}{8}$ inches	91,000	4-wheel
Special baggage and express	70 feet	120,000	6-wheel
Passenger and baggage	71 feet 1 inch	130,000	6-wheel
Dining	71 feet $11\frac{3}{4}$ inches	140,000	6-wheel
Suburban passenger	54 feet 4 inches	75,000	4-wheel
Suburban passenger and baggage	(Same as suburban passenger.)		

In the design of framing for steel cars two general types have been developed. In one the center sill is made strong enough to resist the end loads developed by pulling and buffing, in addition to the transverse loads due to the weight of underframe, superstructure and loading. In the other type the plate girders formed by the sides of the car beneath the windows are relied upon to carry the transverse load due to the weight of the underframe, superstructure and loading. The center sill in the latter type is usually rather light, being designed to resist the end loads developed by ordinary pulling and light buffing. This type of framing follows the general form used in wooden cars where the transverse loads are carried by wooden trusses within the sides of the car reinforced by truss rods beneath the side sills.

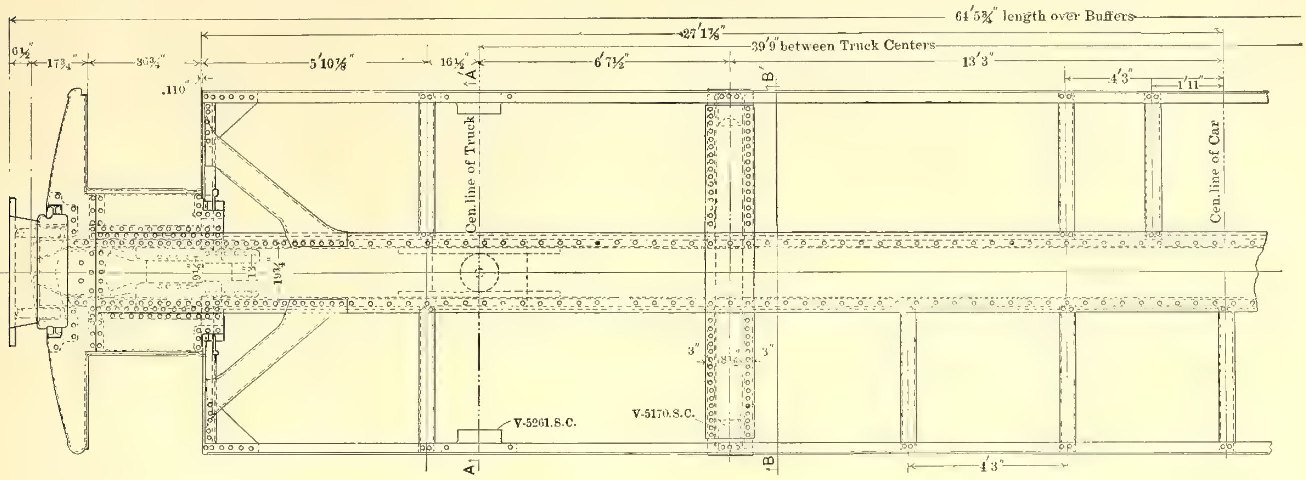
UNDERFRAME AND SIDE POSTS OF PENNSYLVANIA STEEL MAIL CAR, SHOWING TYPE OF CENTER SILL AND CROSS BEARERS USED IN PASSENGER COACH

By careful calculation, it has been found that when the loads due to pulling and buffing are less than 100,000 lbs. the weight and cost of a car frame of either type will be practically the same. Where loads due to pulling and

buffing exceed 100,000 lbs., the framing for the type, where the sides carry the loads, increases considerably in weight. For the center sill type, the loads due to pulling and buffing may equal the assumed value of 400,000 lbs. without a material increase in weight.

For through train service subjected to heavy buffing and heavy equipment except that it is shorter and lighter, the description will be confined to it.

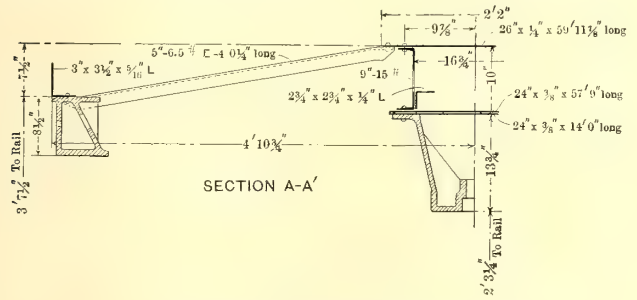
The center sill is a continuous box girder formed of two 9-in., 15-lb. channels spaced 16¾ ins. apart and extending the entire length of the car from buffer to buffer. The channels have one 26-in. x ¼-in. cover plate on top and



HALF PLAN OF FLOOR FRAMING

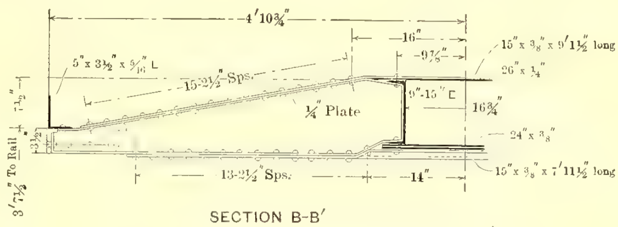
pulling, the center sill type of frame has been selected. It has also been used in designs for suburban type equipment, as it has been found that, with a modified form of center sill, sufficient room for motors can be provided between the underframe and track.

The height from the track to the center of coupler is determined by law, and the height to the top of the floor is practically regulated by custom. The center of the drawbar is, therefore, fixed at about 17 ins. below the floor. The suburban car has a height from top of rail to underside of

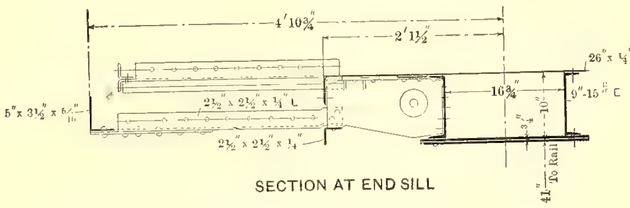


HALF SECTION THROUGH BOLSTER

one 24-in. x ⅜-in. plate on the bottom extending the entire length of the car. In addition, there is an auxiliary ⅜-in. bottom plate 14 ft. in length at each end. The entire



HALF SECTION THROUGH CROSS BEARER



HALF SECTION AT END SILL

frame of 41 ins. to admit the application of electric motors. The total height of this car above the rails is 13 ft., to permit the installation of a trolley. Other data follow:

	Standard Wooden Passenger Coach 53 Feet Long.	Heavy Type Steel Passenger Coach 70 Feet Long.	Suburban Steel Passenger Coach 54 Feet Long.
Number of passengers	62	88	72
Car weight, pounds	91,000	*113,500	†75,000
Car weight per passenger, pounds	1,470	1,290	1,042
Area central sill at middle of car, square inches	152	50	24.32
Area centre sill at center plate of car, square inches	152	50	33.32
Stress in center sills due to 150,000 pounds compression on draft gear and 250,000 on buffer, pounds per square inch	10,850	11,000	18,500
Comparative value of center sills, per cent	25	100	60

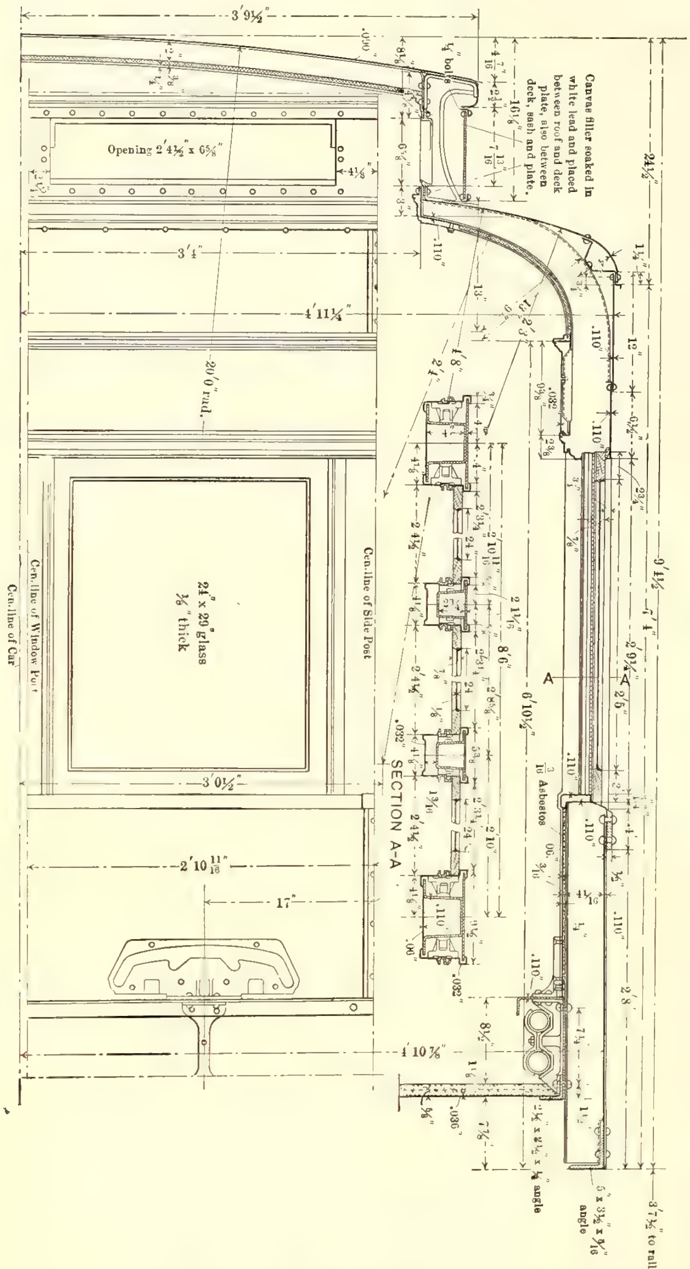
* Estimated weight (including 6,000 lb. storage battery).
† Estimated weight

As the suburban car is of most interest to our readers, and as it follows largely the general arrangement of the load is carried on the center sills, and the side sills are made part of the body by the construction.

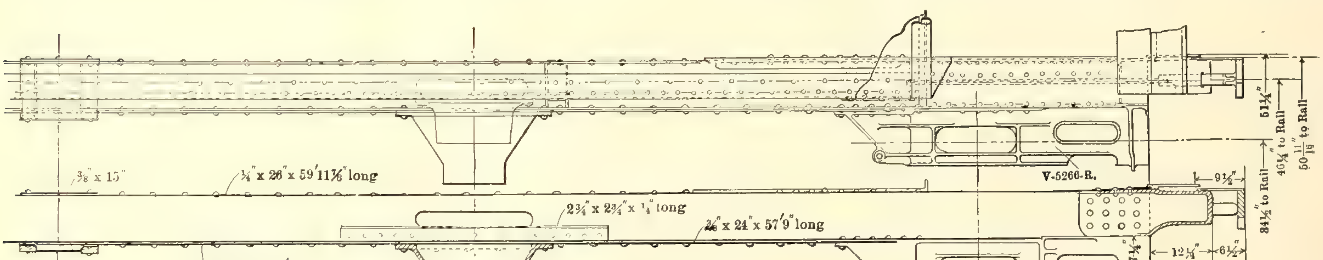
The side sills are 5 ins. x 3½ ins. x 15/16 in. angles and are connected to the center sill by two end sills, two cross bearers and fourteen intermediate struts, seven on each side of the car. The end sills are built up of 2½-in. x 2½-in. x ¼-in. angles connected to the center and side sills, as shown, and with the outside sheathing plate acting as the web.

In addition to the use of a center sill, the most novel feature of the car is the fact that the body is supported by cross bearers instead of the usual body bolster. There are two of these bearers, which are set back from the truck center a distance of 6 ft. 7½ ins. They are composed, as shown in the section B-B′, of triangular plates flanged about the edges and riveted at the ends through the top and bottom flanges of the channels composing the center sill. Opposite cross bearers are joined by cover plates, which pass over the top and under the bottom of each sill.

Each side sill is also held in line by the struts shown, which are of 5-in., 6½-lb. channels riveted to the center sill and side sills. These struts do not transmit any vertical load



HALF CROSS SECTION, SHOWING ALSO SECTION OF POSTS



SIDE ELEVATION AND LONGITUDINAL SECTION OF CENTER SILL

from the side sills to the center sills. Cast steel side bearings for engaging the trucks are secured to the side sill in line with the center plates. Pressed sheet steel posts, spaced 8 ft. 6 ins. centers, support the superstructure. They are of channel section and the edges are flanged out and riveted to the inside sheathing forming a box section. Their lower ends are securely riveted to the outside sills and their upper ends are tapered down and bent inward forming lower deck carlines. At their upper ends these posts are riveted to the plate carrying the deck sash. The lower edge of this plate is bent out beneath the ends of the posts and forms a continuous beam of angle section running the entire length of the superstructure.

Between the main posts are shorter intermediate posts, which extend only from the window sill to the plate carrying the deck sash. They are of light channel section with edges flanged for riveting to the outside sheathing, forming thereby a box section.

Upper deck carlines are of sheet steel pressed to channel section with edges flanged out for riveting to the 0.090-in. steel roof-plate. Ends of the carlines are riveted to the plate carrying the deck sash. The upper edge of this plate is bent outward and down, forming a continuous beam of channel section, to which the edge of the roof-plate is riveted. Malleable iron braces unite the end of each post and its corresponding carline.

Outside sheathing is of 0.110-in. steel, and the course below the belt rail is riveted to the outside sill and vertically to each post.

Headlining for the upper and lower decks is of composite board secured to the carlines and posts with metal strips. Below the belt rail the inside sheathing is of 1/16-in. steel, to the unexposed face of which 3/16-in. asbestos is cemented.

Bulkheads and remaining parts of the inside lining are of 1/16-in. sheet steel. Moldings, closely resembling those used in wooden construction, are pressed from steel and their use adds greatly to the artistic appearance of the interior. Through care in design it has been possible almost wholly to eliminate machine screws from the construction, and it is believed that economy in both construction and maintenance has been secured thereby.

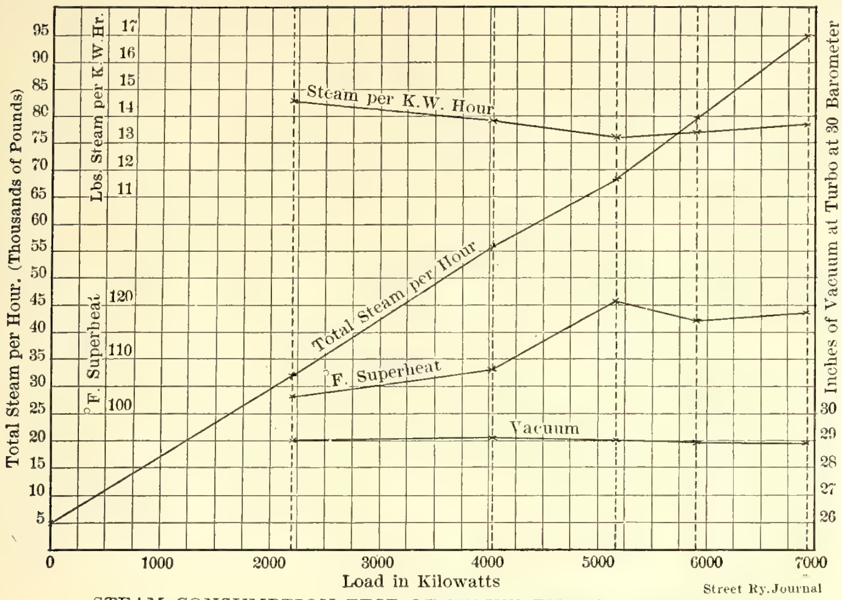
Window sash are of wood and slide in a formed steel frame. Steel sash have been successfully built, but after careful consideration, wooden sash were deemed preferable. Malleable castings riveted to the posts support the window frames. These castings are machined by jig, after riveting in place, so that the frames will be true and parallel regardless of any slight irregularity in location of the posts. Window stops, which also form ways for the curtains, are of extruded bronze. Deck sash are of malleable iron.

The floor is formed by corrugated steel plates, which are supported by the center sill and upon longitudinal angles secured to the side posts. These corrugated plates are covered to a maximum depth of 1⅛ ins. with a plastic surface filling, composed largely of cement.

EFFICIENCY TEST ON 3500-KW TURBINE

On Feb. 17, 1907, Chas. H. Merz, of Newcastle and London, conducted a series of tests of a 3500-kw Parsons turbo-alternator built by C. A. Parsons & Co., of Newcastle, and

STEAM CONSUMPTION TEST OF 3500 K.W.TURBO. PLOTTED FROM ACTUAL READINGS.



STEAM CONSUMPTION TEST OF 3500-KW TURBO. PLOTTED FROM ACTUAL READINGS

in use at the Carville power station at Wallsend-on-Tyne. The results of these tests have just been made public. Seven tests were made as follows: (1) no load (non-excited) of ½-hour duration; (2) no load (excited) of ½-hour duration; (3) 2000 kw load of 1 hour duration; (4) 4000 kw load of 1½ hours' duration; (5) 6000 kw load of 1½ hours' duration; (6) 7000 kw load of ½-hour duration; (7) 5000 kw load of 1 hour duration. The loads were kept as nearly constant as possible throughout by means of the exciter field rheostat.

The weight of condensed steam was measured by the company's tank and weighbridge, which had on the day previous to the test been calibrated in the presence of the government inspector of weights and measures and certified as correct. The vacuum was measured at the turbine exhaust chamber by a mercury column. Steam temperature and pressure were taken at the turbine stop valve. The speed was taken by tachometer. In the final consumption results only the actual output of the generator has been taken into account, no deduction being made for any auxiliaries. The field current of the exciter was supplied from an entirely independent source, but apart from this the machine provided its own excitation. The neutral point of the generator windings was disconnected from earth, and the three phases were loaded by means of a water resistance.

The output of the machine was measured by a special wattmeter and by the switchboard integrating wattmeter. The same meter was used for tests 1, 2, 3, 4, 5, and 6; for test No. 7 a meter having a rather higher speed was used. The current was measured by a special ammeter connected to the same current transformer as the special wattmeters and by the switchboard ammeter. These instruments were connected in different phases, giving the balance of load between phases. An ammeter was also placed in the exciting circuit. The switchboard voltmeter, indicating wattmeter and power factor meter were in circuit, and were read every five minutes to check the accuracy of the wattmeter.

The special instruments and the switchboard integrating wattmeter were all carefully calibrated both before and after the test, and corrections were made in the measured output in accordance with the mean of the observed errors at the before and after calibrations. A summary sheet of results appears herewith. Consumption and load variation curves, which have been plotted from actual readings, are also shown.

To verify the steam consumption at the most economical load, a further test, consisting of three hours' run at a load of 5000 kw. was held on Feb. 23, under the same conditions as before. The figures obtained are shown in the table as test No. 8 and corroborate the previous tests, the slightly poorer results being due to the less superheat. The meter used on this occasion was the same meter which had been used for the 5000 kw test on Feb. 17. The same switchboard instruments were also in circuit.

RESULTS OF TEST

TEST No.	Duration (Hours).	Mean Calibrated K.W.	Steam.			Speed R.P.M.	At Turbo Exhaust.	Water.		
			Pressure.	Temperature at Turbo. °F.	Superheat °F.		Vacuum at 30″ Brm.	Total Condensed Lbs.	Lbs. per Hour.	Lbs. per K.W. Hour.
1	½	No load not excited.	180	460	80	1,200	28 875	1,835	3,670	......
2	½	No load excited.	211	453.3	61	1,200	28.95	2,693	5,206	......
3	1	2192.87	202.4	492.1	103	1,200	29.036	31,836	31,836	14 517
4	1½	4045.14	197.4	495	108	1,200	29 066	83,972	55,981.3	13.839
5	1½	5901.	195.8	503.2	117	1,200	28.95	119,182	79,454.6	13 464
6	½	6921.8	198.4	505.5	118.5	1,200	28 765	47,390	94,780	13.692
7	1	5164.07	199.9	508 5	120.5	1,200	29.039	68,180	68,180	13.189
8	3	5059.38	194.5	477.9	92	1,200	29.195	203,559	67,853	13.411

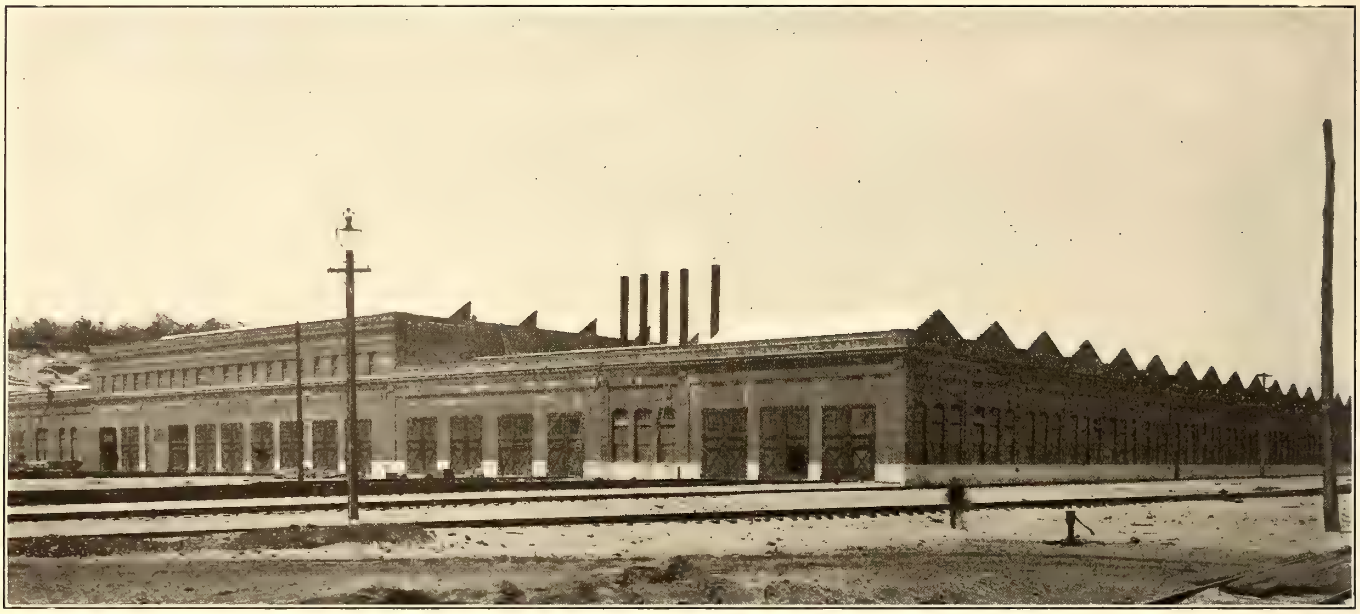
The results, 13.189 lbs. per kw-hour, are certainly very gratifying, as are as well the high efficiencies maintained over large ranges of output.

TRANSPORTATION AT THE JAMESTOWN EXPOSITION

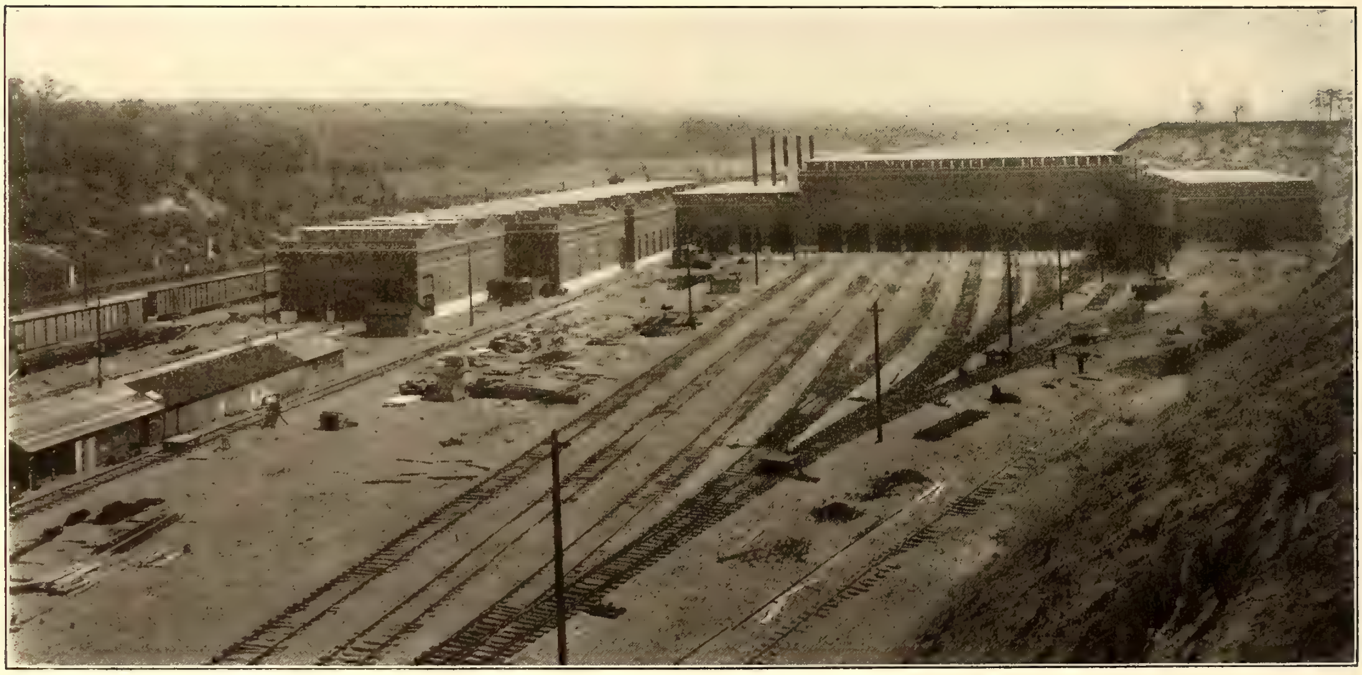
The Newport News & Old Point Comfort Railway & Electric Company has just published an attractive pamphlet relating to the Jamestown Exposition and the part taken by that company in transportation about the Exposition. A number of excellent maps and half-tones, engravings illustrative of objects of interest in the neighborhood, make the situation clear to the reader. The cover is attractively printed in colors and shows a bird's-eye view of the Exposition grounds. The Newport News & Old Point Railway connects the two places of that name on the eastern shore of Hampton Roads, and both of these cities are connected by ferry with the Jamestown Exposition.

THE ELECTRICAL MAINTENANCE PLANTS OF THE NEW YORK CENTRAL & HUDSON RIVER RAILROAD COMPANY

The maintenance structures built by the New York Central to care for the rolling stock used in the New York electric zone offer the first opportunity to describe the shop construction of an electrified steam railroad. The entire running of the very first electric train, temporary inspection facilities had been provided at Highbridge and Wakefield, on the Hudson River and Harlem divisions, respectively, but some time before work had been started on the permanent maintenance quarters. The latter are now completed, and comprise two installations—one at Harmon and the other at North White Plains. The second plant is practically for inspection only, while the first includes a large machine



GENERAL VIEW OF THE HARMON SHOPS, LOOKING NORTH, WITH THE INSPECTION SHED IN THE FOREGROUND



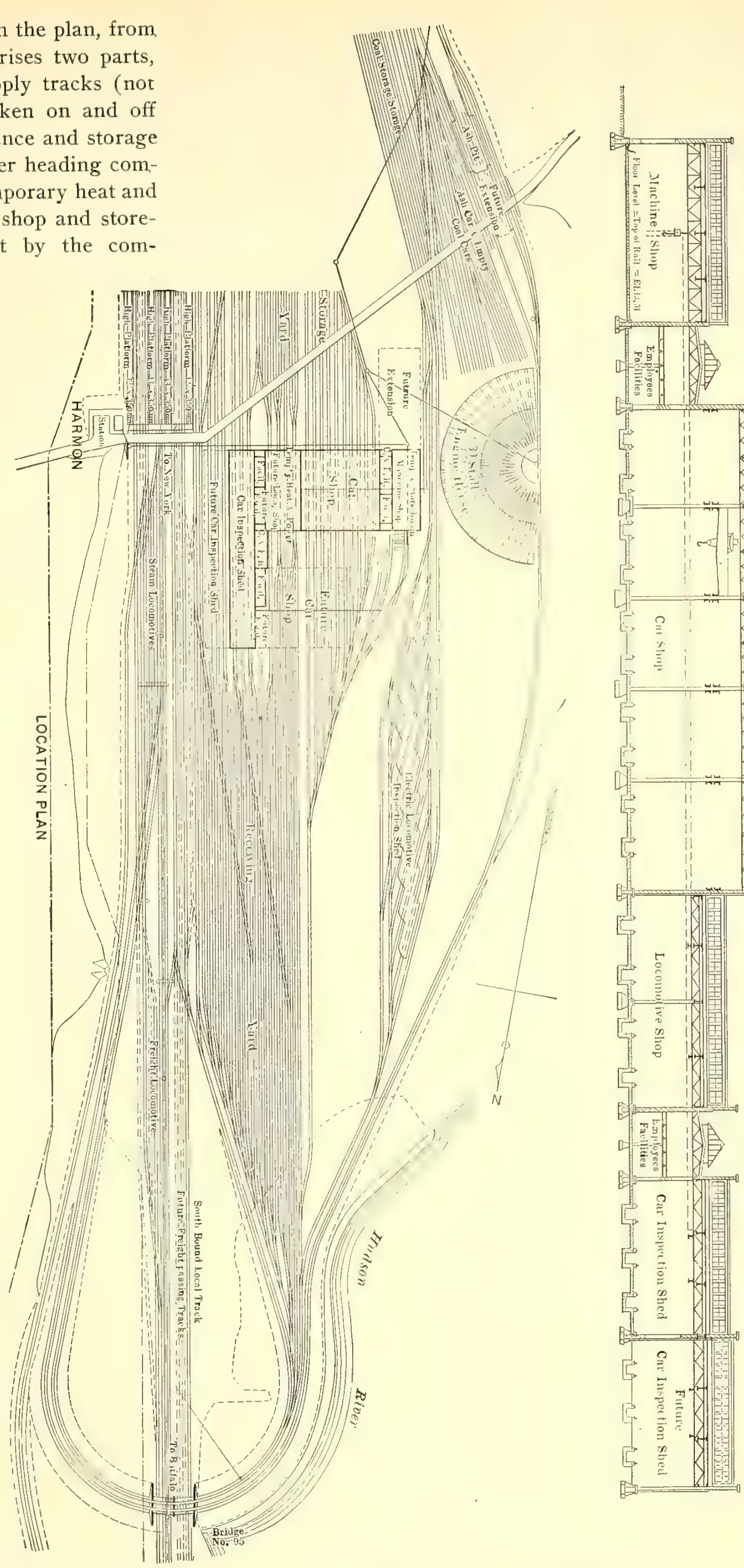
GENERAL VIEW OF THE HARMON SHOPS, LOOKING SOUTH

work was designed and constructed under the general supervision of William J. Wilgus, vice-president of the railroad company, the organization having in charge the details of the work being Edwin B. Katte, chief engineer of electric traction; G. A. Harwood, chief engineer of electric zone improvements; C. H. Quereau, superintendent of electric equipment; L. H. Byam, engineer of company forces, and Carl Schwartz, engineer of power stations. With the shop and other facilities for thoroughly overhauling motor cars and electric locomotives.

THE HARMON PLANT

The Harmon plant is erected on excavated ground along the Hudson River 33 miles from the Grand Central Station, or about ¾ mile below Croton, which marks the terminal of the electric zone on this division. The general arrange-

ment of the buildings and tracks is shown on the plan, from which it will be seen that the layout comprises two parts, namely, a thirty-stall engine house and supply tracks (not as yet built) for the steam locomotives taken on and off at Croton, and a general electrical maintenance and storage plant. The structures coming under the latter heading comprise a three-track car inspection shed, a temporary heat and power plant, a ten-track car shop, machine shop and storeroom. The property owned at this point by the company is so extensive that the most liberal provisions could be made for the enlargement of all the electrical facilities without affecting regular work in the first structures in any way. The same freedom in space permitted a track layout that is entirely free from dead-ends, a feature which is especially advantageous in the case of the suburban rolling stock which consists of multiple-unit equipment.



GENERAL PLAN OF THE HARMON INSTALLATION, WITH ELEVATION ON THE SOUTHERN SIDE

The car inspection building is located parallel to the main line just far enough away to allow the later construction of a duplicate structure. It is 448 ft. long, 56 ft. wide, and of brick construction resting on concrete piers and a concrete sub-base carried 4 ft. to 5 ft. above grade. Concrete is also used for the floors and pits.

The roof is of the saw-tooth type carried on steel framing. The lights are operated from the floor by wheel and chain. There are also numerous windows on the eastern side, with sliding sash below and swinging sash above. Wherever the sun strikes the glass the ribbed type is used, so that the light is evenly diffused and without shadows. The excellent illumination thus offered is enhanced by the interior painting, which is white with dark green wainscot for 6 ft. above the floor and around the doors and windows.

In general, the constructional features for the rest of the installation are the same, except that dome skylights are used on the flat roofs of the intermediate two-story "facilities" buildings. It may also be added that the roof structure in the machine shop is of sufficient strength to carry not only the telpher run mentioned later, but also 5000 lbs. suspended at any point.

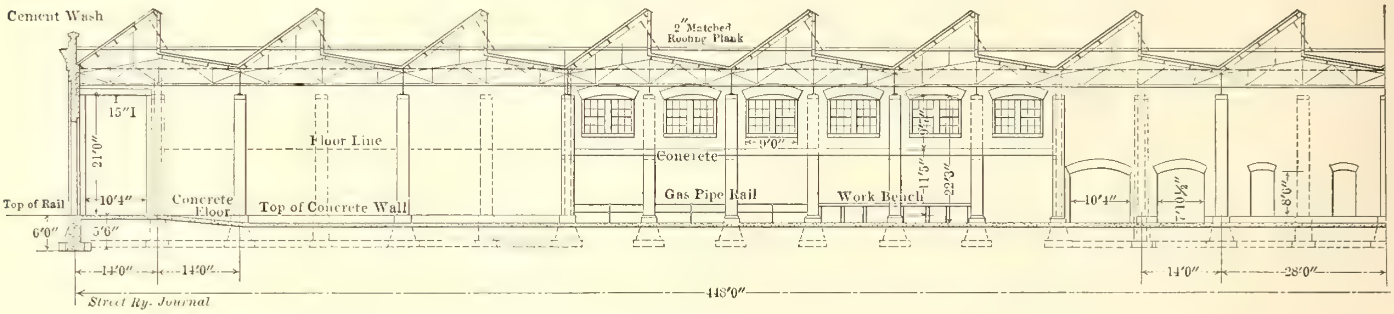
It will be noted from the main plan that adjacent to the inspection shed, but really forming a part of that structure, are three so-called facilities rooms—the southern room for a storeroom and minor tools for the inspection shed; the middle provided with toilet and washing arrangements for the car house men, and the third for the blower and coil apparatus which supplies heat chiefly to the inspection shed. The blower room is only one story high, but the other rooms are two stories in height, the upper floor being used for offices and locker rooms.

Beyond these facilities rooms and separated from it by a 12-in. brick wall is a section 79 ft. wide and 182 ft. long, now used for a power and heating plant, but eventually to be used as an electric locomotive shop. The remainder of the installation comprises a 176-ft. x 182-ft. car shop with ten tracks, another facility room, a blower room, a blacksmith shop, employees' quarters, offices, etc., and a machine shop. The latter is now 66 ft. wide and 134 ft. long,

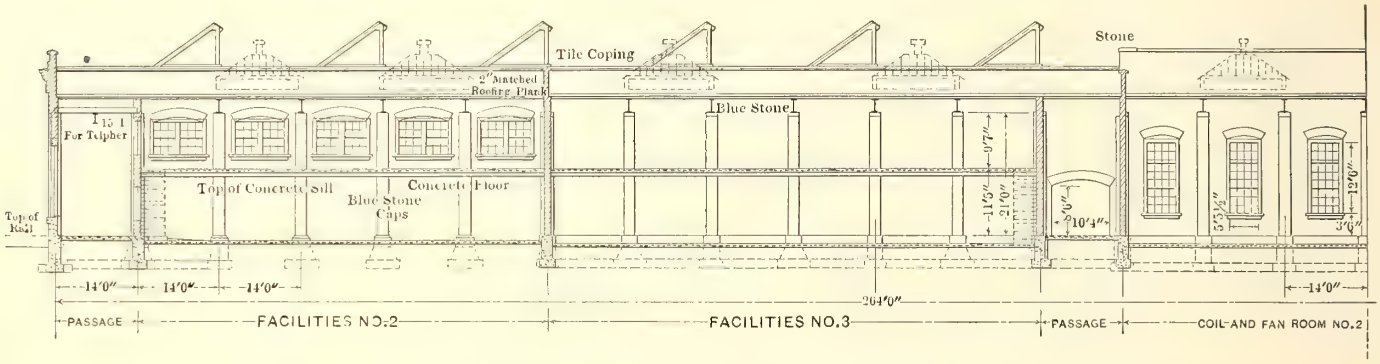
a space of 48 ft. x 66 ft. being occupied by a temporary storeroom.

DRAINAGE

The drainage problem has been carefully worked out for the entire installation, but as the system for the inspection away from the pits with a slope of 1/8 in. per foot to center drains placed every 23 ft. The water thus collected is discharged by wrought-iron pipes to one of the side valleys in the bottom of the adjoining pit and thence through gratings under the center of the pit floor to the 9-in. transverse



SECTION THROUGH THE INSPECTION SHED AT HARMON, LOOKING WEST



SECTION THROUGH THE FACILITIES ROOMS

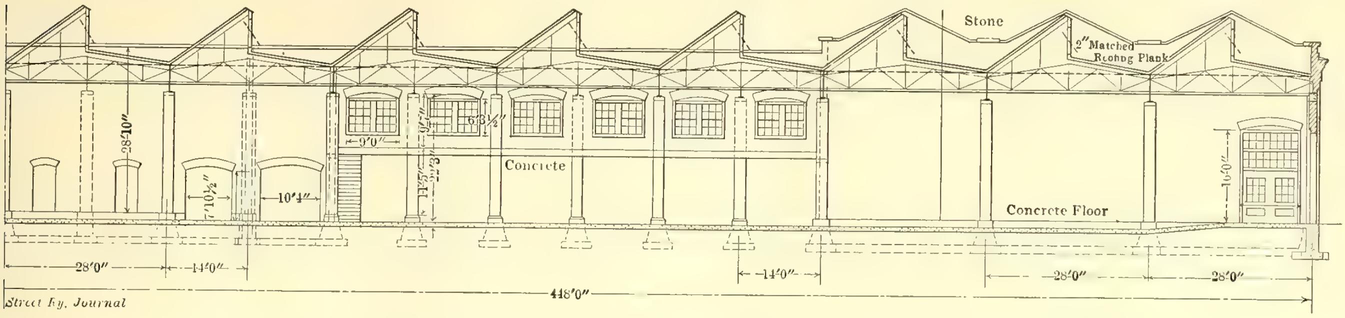
INTERIOR VIEW OF THE HARMON INSPECTION SHED, SHOWNG THE POSITION OF THE FACILITIES ROOMS

shed is typical of the rest, only this portion of the work need be described. The roof is drained by separate inside 4-in galvanized iron leaders, which are carried down the piers to cast-iron soil pipes extending 8 ft. above floors, which in turn drain to the sewers below. The floors are pitched sewers. The longitudinal sewers between the transverse or main sewers are 6 in. diameter. The sewer piping is furnished with stoppers at the points where extensions are to be made.

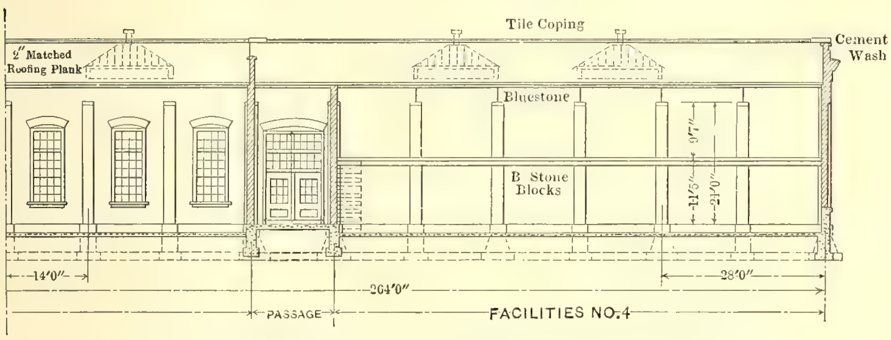
It will be noted upon examining a cross section of a pit

that the center of the pit floor is the highest, and, therefore, the dryest point, all water being carried away to the side gutters at once. The center floor drain between the pits serves as a hold for ladders placed against the cars, while the two-way pitch thus obtained is of further advantage since it reduces the angle necessary for rapid drainage, and as the water does not flow toward the pits, but from them, the discharge pipe need not be placed directly under the stringers, but can empty over the pit gutters far below the base of the track support.

The water supply for the entire installation is the same as that now supplying the Croton terminal, the pipe line having been extended to Harmon. It discharges into two 5000-gal. tanks which serve as reservoirs. Ample fire protection is provided by 4-in. diameter outside fire hydrants and inside hose reels hung from the piers at convenient intervals.



SECTION THROUGH THE INSPECTION SHED AT HARMON, LOOKING WEST—(CONTINUED)

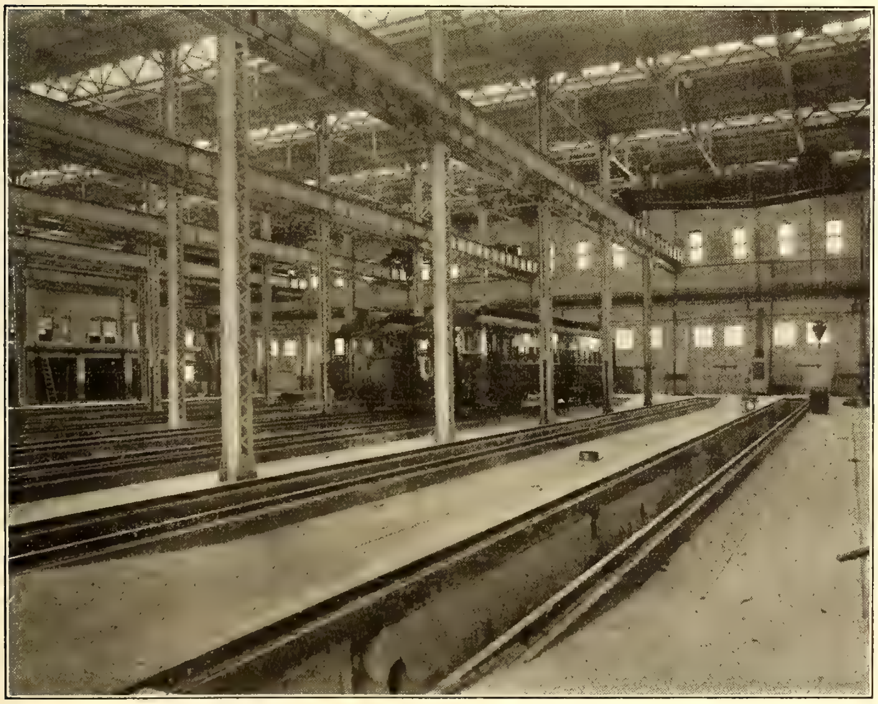


SECTION THROUGH THE FACILITIES ROOMS—(CONTINUED)

In connection with these hose reels there is installed an underwriter's type fire pump in the power plant. There are to be also eight standpipes and ladders to the roof outside the building. Fire extinguishers and pails are placed throughout.

PIT AND TRACK CONSTRUCTION

The inspection shed contains three pits spaced 16 ft. centers, 4 ft. 2 ins. wide and 420 ft, long. Including the steps at each end, they are constructed entirely of concrete except over the main heating conduit where the bottom of the pit walls is reinforced with 5-ft. to 6-ft. lengths of old T-rails. The compressed air pipe line supplied from a compressor in the power plant is carried along the track between the ball and the base of the pit rail with outlets every 20 ft. The compressed air sent through this line will be used for air brake testing, cleaning motors, etc. The lighting conduits are carried in the wall on the opposite side. Iron conduit boxes for the lamps are placed every 10 ft., with a separate connection for extension lights for inspection.



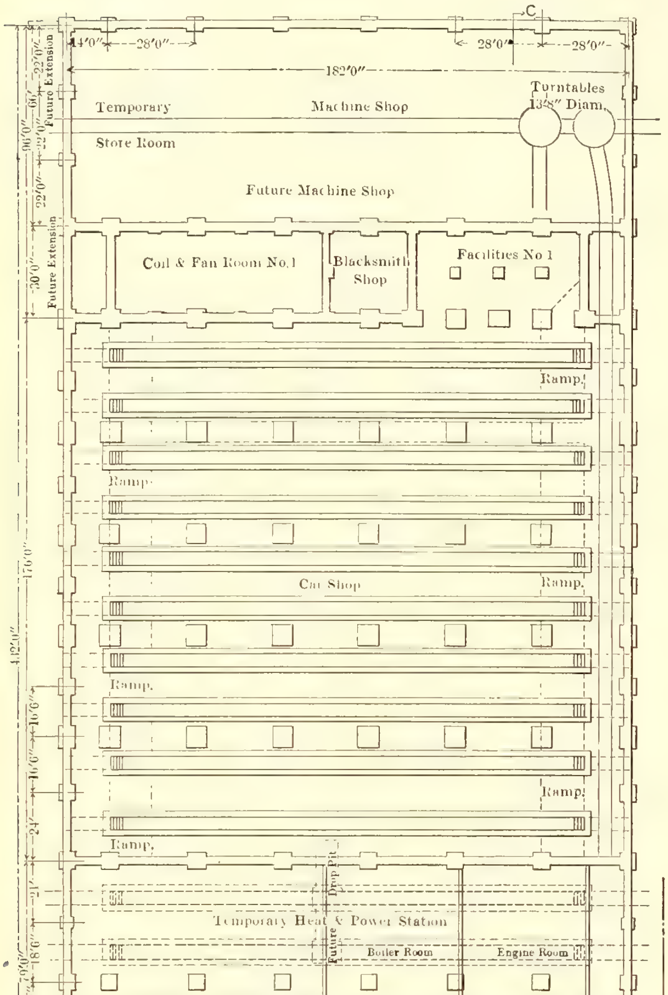
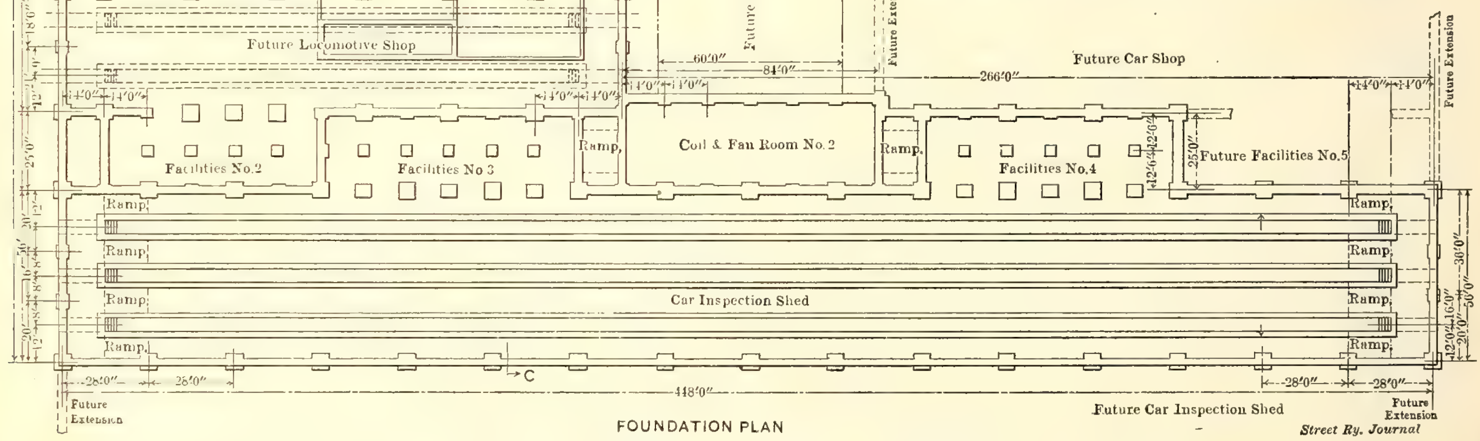
A VIEW IN THE CAR SHOP, SHOWING THE PIT-HEATING DUCTS AND RECESSES FOR THE LIGHTS

The pit tracks are of 80-lb., 5⅛-in. rail, and are carried on 10-in. x 10-in. yellow pine stringers bolted to the concrete. An interesting feature of the floor construction in this connection is that alongside the rails three 4-in. x 8-in. yellow pine planks are laid in the concrete flush with the rest of the floor to secure a good jack base. This will also enable the men to work alongside a truck without knee-pillows and will eliminate the electric shocks possible from current leakage through damp concrete.

Where the floor of the inspection shed or car shop is level with the top of the rail the flangeway, instead of being formed by concrete and angle irons, is made by inclining old rails against the base and web of the running rails, after the manner shown on page 1018. While this method is more

expensive than the other, it insures a permanent flangeway, because bolts, nuts or other loose pieces cannot injure it when pressed against the side by over-running wheels. Another interesting point in the track construction is that on the inner side of the rail the floor is sloped for 8 ins. at an angle large enough to permit the head of the rail to project ⅜ in. thus making the head of the rail take the brunt of passing traffic and saving the concrete from chipping. The flangeway in the maple floor of the machine shop is also formed by inclined rails.

The pits in the car shop are similar in every particular to those described for the inspection shed.

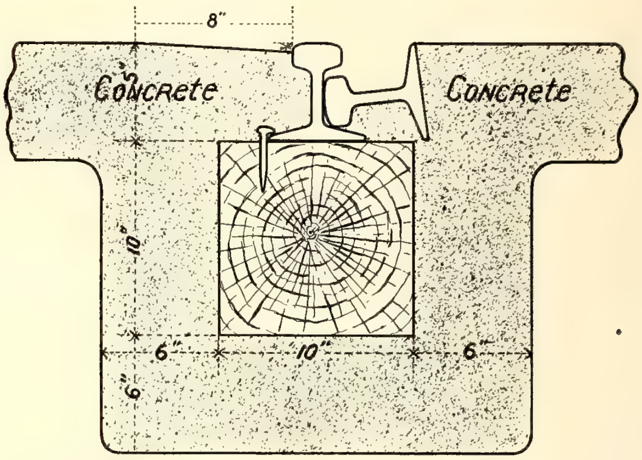



GENERAL PLAN OF THE HARMON INSTALLATION, SHOWING THE RELATIVE LOCATION OF THE PRESENT STRUCTURES AND THE FUTURE EXTENSIONS

POWER AND LIGHTING PLANT

Reference to the general plan will show that between facilities room No. 3 and the car house there is installed the temporary heat and power plant previously mentioned. It was necessary to install some immediate means for generating power, as the electrified section will not extend to this point until later.

The steam generators consist of five 150-hp locomotive type boilers operated to give a pressure of 120 lbs. per square inch. There is also a 6-in. x 4-in. x 6-in. feed-pump and a 750-hp open type feed-water heater. Non-condensing engines are used. These comprise two vertical engines each direct connected to a 150-kw, 220-volt, 225-r. p. m. compound-

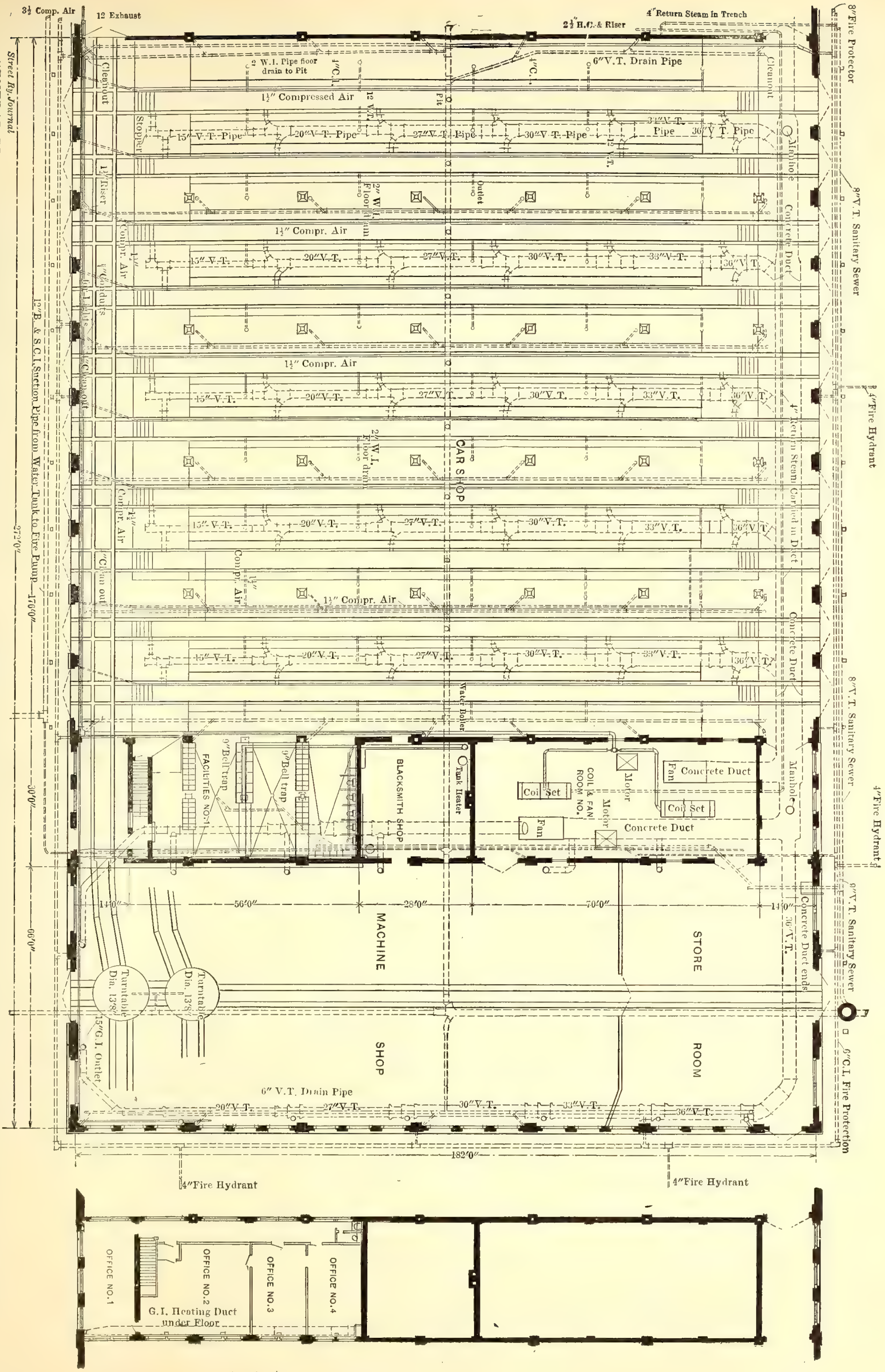


METHOD OF FORMING FLANGEWAY WITH OLD RAILS

wound generator and one vertical engine direct connected to a 100-kw., 440-volt., 275-r. p. m. generator. The low-voltage sets will take care of the lighting and machine tools and the higher voltage will be used for shifting cars in the car house and inspection shed and for testing out electrical apparatus on the cars. The entire installation is neatly laid out and isolated from the other departments by a corrugated metal partition. Coal is brought in and ashes removed on a temporary track leading to the southern storage yard.

The temporary station contains the main switchboard, consisting of generator and feeder panels. The negative side of the 440-volt circuit is connected to the running rails.

There is also located in the west portion of the building a distributing switchboard which consists of two sections, one for feeders connected to lighting and constant motor loads and the other for feeders connected to fluctuating motor loads. The switches throughout the building con-

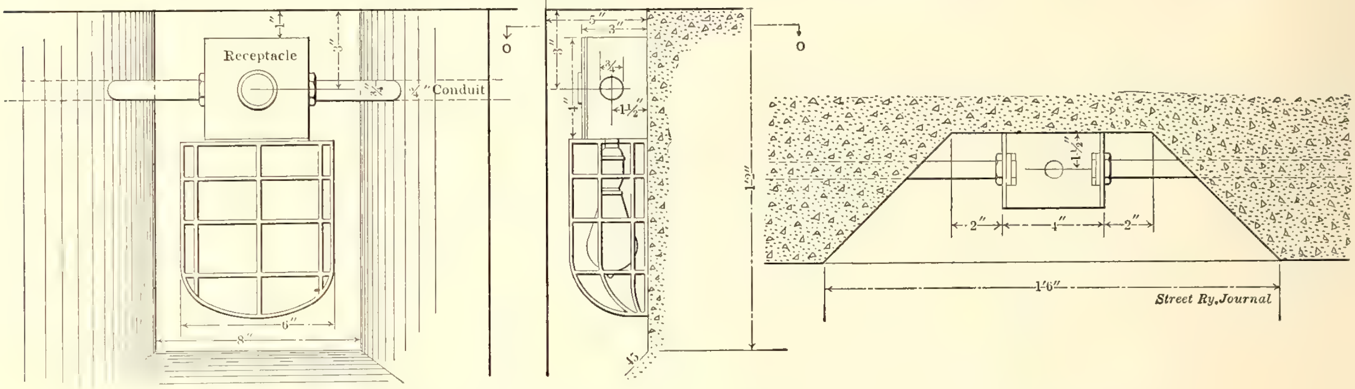


GENERAL PLAN OF HEATING AND DRAINAGE SYSTEM IN THE CAR HOUSE, SECOND SET OF FACILITIES ROOMS, MACHINE SHOP AND STOREROOM AT HARMON

trolling the crane motors, light, etc., are mounted in nearby slate-lined cabinets.

LIGHTING

There are about seventy inside arc lamps installed. Those in the machine shop are of the concentric diffuser type and lower shade with opal inner globe; the others are equipped with inverted concentric diffusers with opal inner and clear closed base outer globe. There are twenty-eight outside arc lamps. Incandescent lamps are used for the pits, offices, storeroom, blower rooms, and for individual lights in the machine shop.

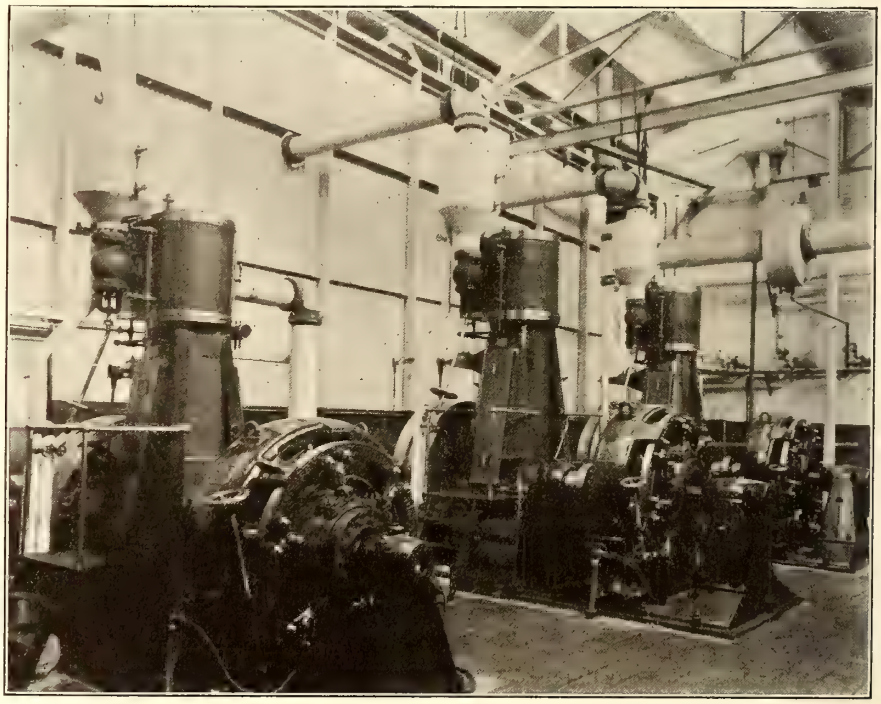


DETAIL OF PIT LIGHTING IN THE HARMON AND NORTH WHITE PLAINS INSTALLATIONS

THE HEATING SYSTEM

The indirect method of heating is used throughout the entire installation. The heated air is taken from two coil and fan rooms, No. 1 adjacent to the machine shop and containing two Buffalo fan blowers, and No. 2 nearest the inspection shed with a third unit of like type. The exhaust steam is supplied to the fan rooms from a 16-in. header from the power station. This header divides into two 12-in. lines running to the separate coil and fan rooms. The fan blowers are all 10 ft. diameter by 5 ft. width, and are three-quarters enclosed. Each is operated at 160 to 170 r. p. m. by a 35-hp Westinghouse 220-volt, constant speed motor running at 935 r. p. m., temperature variations of the heated air being secured by regulating the steam supply to the coils. The minimum capacity of each fan is about 72,000 cu. ft. of air per minute at a pressure of 1 oz. per square inch at the fan outlet. The heating coils are in a sheet iron housing supported and braced by angle iron framing. The coils are arranged so any section may be removed without disturbing the others. They are placed in sets of two, each giving 1990 sq. ft. of heating surface. The total volume of space to be heated is now 3,000,000 cu. ft., but the whole hot air system has been designed to care for the ultimate capacity of the plant, which then will have a capacity of approximately 5,300,000 cu. ft. The heating system has been designed on the assumption of three changes of air an hour being used, two of these being air returned from the shops and one being fresh air to maintain a temperature of 65 degs. F. in zero weather. The blower rooms are provided with metal louvers, which are adjusted for the required amount of returned air necessary under prevailing weather conditions.

The main duct is carried right through the east wall to permit extension of the system when a duplicate inspection shed is built. It will be noted that this main duct also serves for the compressed air transmission and the lighting conduits. Thirty-inch tile pipes between car pits run in both directions from this conduit and have 16-in. openings into pits at regular intervals. The plan shows that the pit branches on one side are also carried through the walls and furnished with stoppers, thus providing easy extension to a future pit. All ducts have the concrete floor which is over them reinforced with 3-in. x 8-in. mesh wire cloth.


AN INSIDE VIEW OF THE TEMPORARY STEAM PLANT AT HARMON, ENCLOSED WITH CORRUGATED METAL PARTITIONS

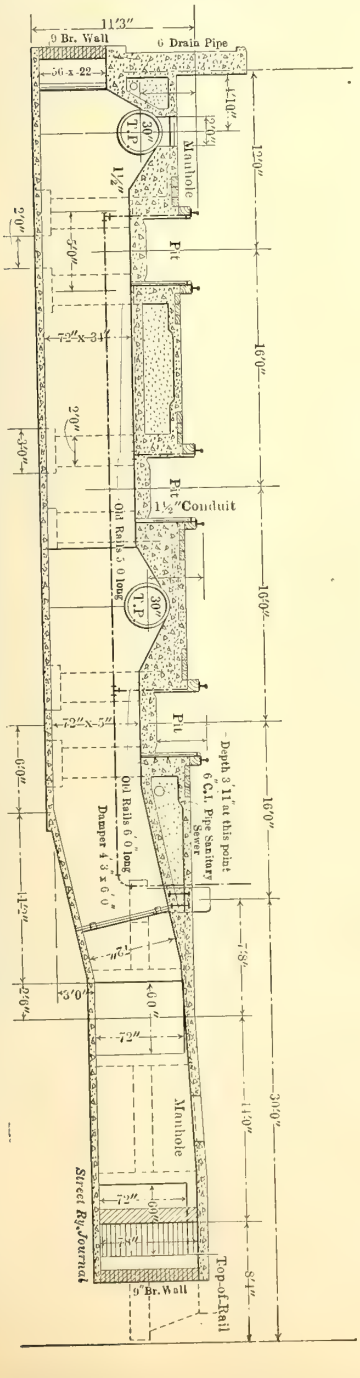
It will be seen from the layout that, in general, all of the heating ducts are so laid out as to reduce friction to a minimum. The heat entering the pits through the outlets is, of course, regulated at will by the use of dampers. It is hardly necessary to point out the many advantageous features of the indirect method of pit heating, such as its comfort, cleanliness, low maintenance cost, etc.

The machine shop and storeroom are heated by air sent

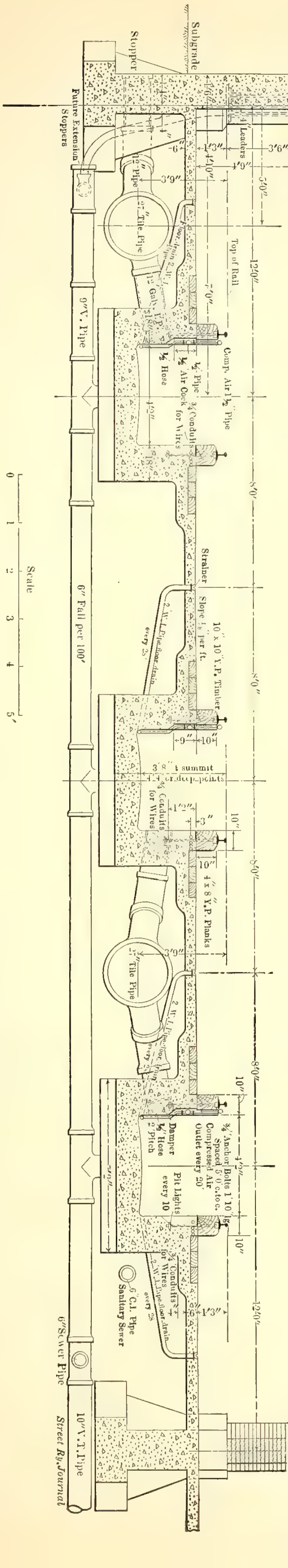
through fourteen damper-controlled outlets of galvanized iron. These, as shown on page 1022, are of the divided type, and each outlet is turned 90 degs., so the branches are parallel to the wall. The same drawing shows that they are placed only 15 ins. above the floor line, thus making certain that the lower part of the structure is warmed before the heated air ascends.

The car shop is heated from coil and fan room No. 1, as appears from the plan on page 1019. The trunk line is a concrete duct at the southern end, which is tapped between every other pair of pits.

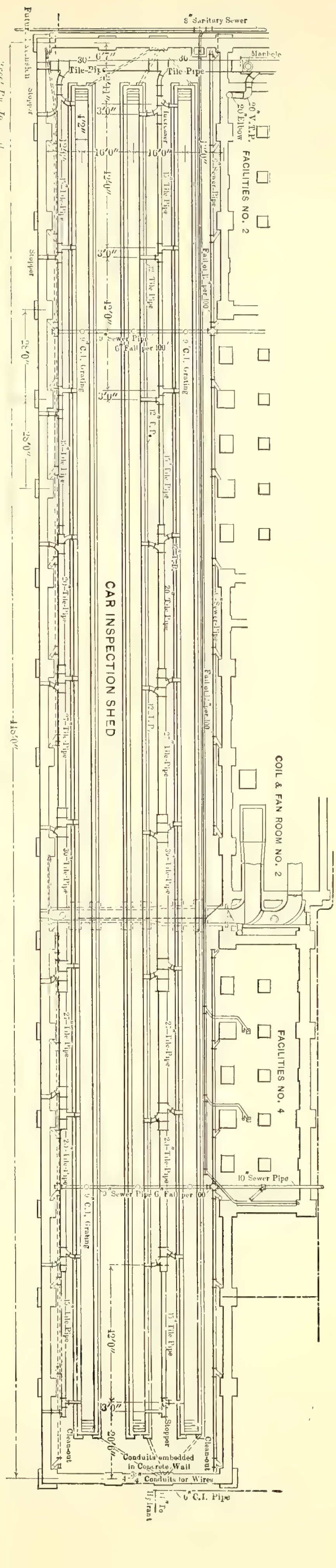
A portion of the heat supplied by No. 1 is carried through a vitrified tile pipe across the southern and then along the entire western wall of



FLOOR SECTION, TAKEN OVER THE MAIN HEATING CONDUIT



STANDARD CROSS-SECTION OF HARMON INSPECTION SHED FLOOR



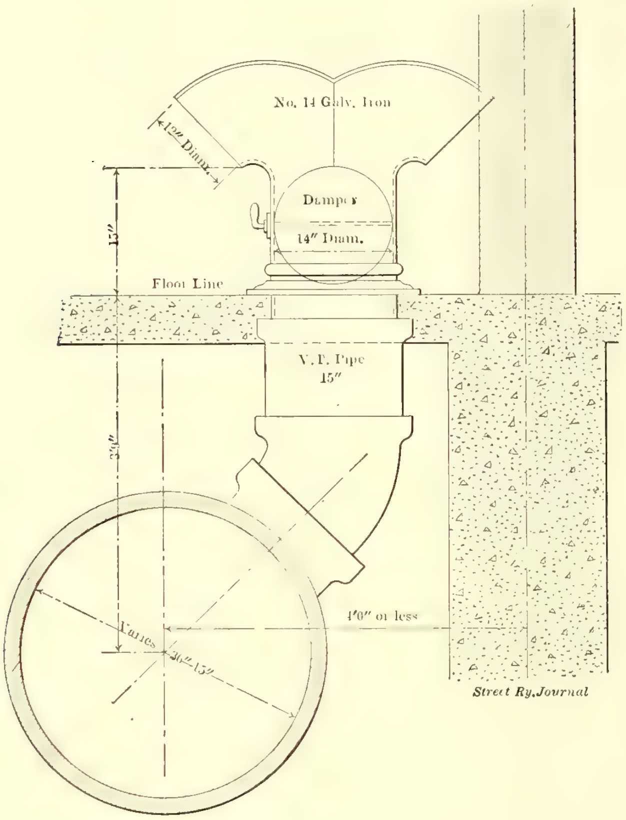
GENERAL PLAN OF PITS IN THE HARMON INSPECTION SHED, SHOWING THE HEATING CONNECTIONS, ETC.

the storeroom and machine shop to galvanized iron outlets. The same fan will also force heated air through another duct carried through the blacksmith shop and facilities room No. 1, thus saving space for machine foundations.

HOISTS AND CRANES

The car shop installation, as a whole, is well served in the transportation of smaller parts by a 5-ton Sprague telpher, which has a travel of 536 ft. on runway located along the southern wall of the inspection shed, car shop and through the center of the storeroom and machine shop.

The telpher was installed to give ready communcation between the inspection shed, heating shop and machine shop. Its run enables material to be delivered directly to the tracks in the inspection shed and car shop, as well as to a large number of the tools in the machine shop. Any machine that requires the service of a mechanical hoist has a 2-ton individual electric hoist leading to the telpher. An overhead traveling crane would have added greatly to the cost of the building walls, and it would have been very expensive to have a machine spanning fully 60 ft., which would have been the case if columns were to be avoided. At the same time, there is no delay in taking work to such machines as are concerned with the handling of the heavy parts since individual hoists make it unnecessary to wait until some other machine has been served.

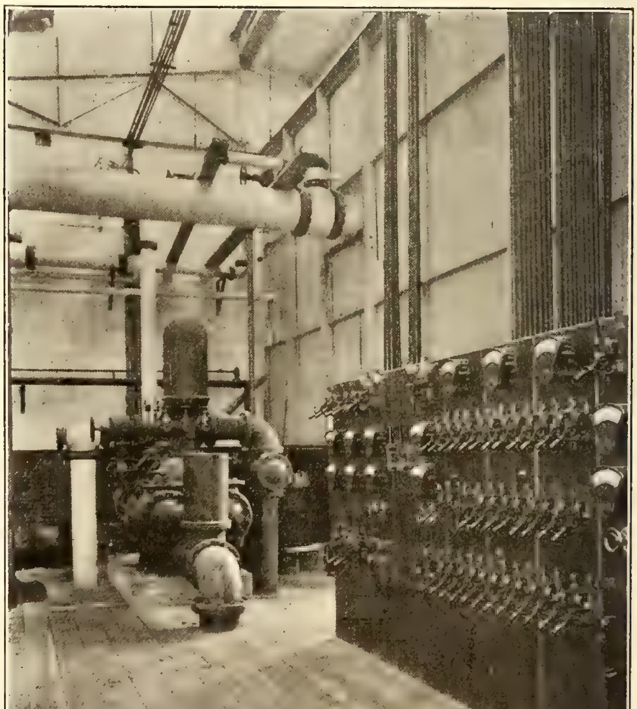


STANDARD HEAT OUTLET, SHOWING ITS CONNECTION TO THE DUCT, AND LIGHT ABOVE THE FLOOR

Three bays of the car shop are each equipped with an 18-ton Box single-trolley traveling crane. Each crane has a total lift of 30 ft., a runway of 175 ft., and a maximum capacity of 22½ tons. Runways are also installed in the remaining bays for the accommodation of future cranes. These machines are operated from the floor by ropes instead of having a man in a housing on each crane or controlling all the cranes from a switchboard. Aside from the hand control, there is an automatic mechanical safety brake which controls the load at all times except when the motor is revolved by power in the lowering direction. There is also provided an automatic electric brake so connected to the circuit as to operate only when the motor stops and current fails from any cause whatever.

ALONG THE TELPHER TRACK WHERE IT TURNS INTO THE MACHINE SHOP ON THE LEFT

In the locomotive shop now used for the power station no cranes will be installed, but instead there will be a drop pit so that trucks and drivers can be lowered and taken through the wall to the adjoining car shop, where they will be handled by cranes therein.



THE SWITCHBOARD IN THE TEMPORARY POWER STATION AT HARMON, WITH THE FIRE PUMP IN THE BACKGROUND

THE SECOND SET OF FACILITIES ROOMS

Aside from the blower room already noted, the section between the machine and car shops contains a blacksmith shop and offices. The rooms of the shop superintendent are located on the second floor, to give him an unobstructed view of both shops.

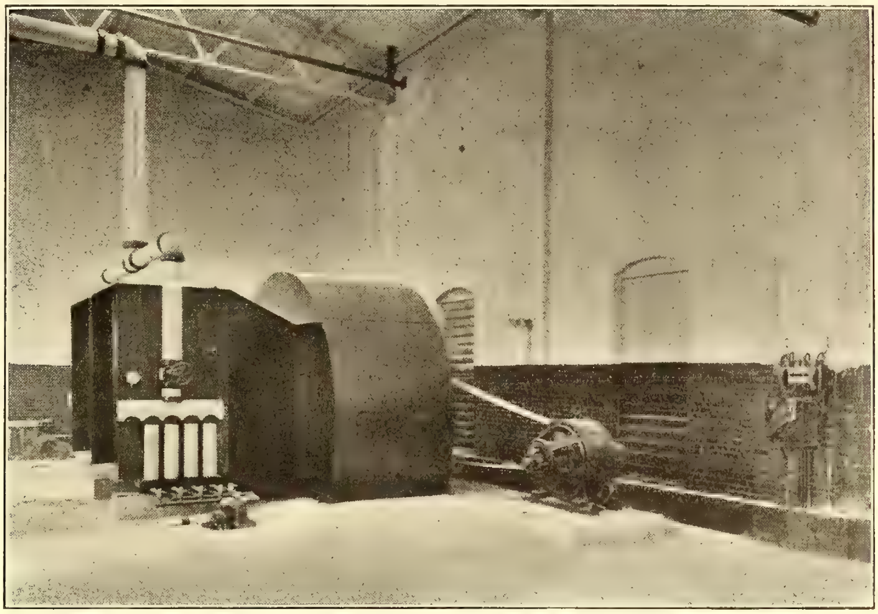
The blacksmith shop contains one hammer operated by compressed air, two forges and an emery wheel. The latter is placed there to avoid unnecessary dust in the machine shop.

THE MACHINE SHOP

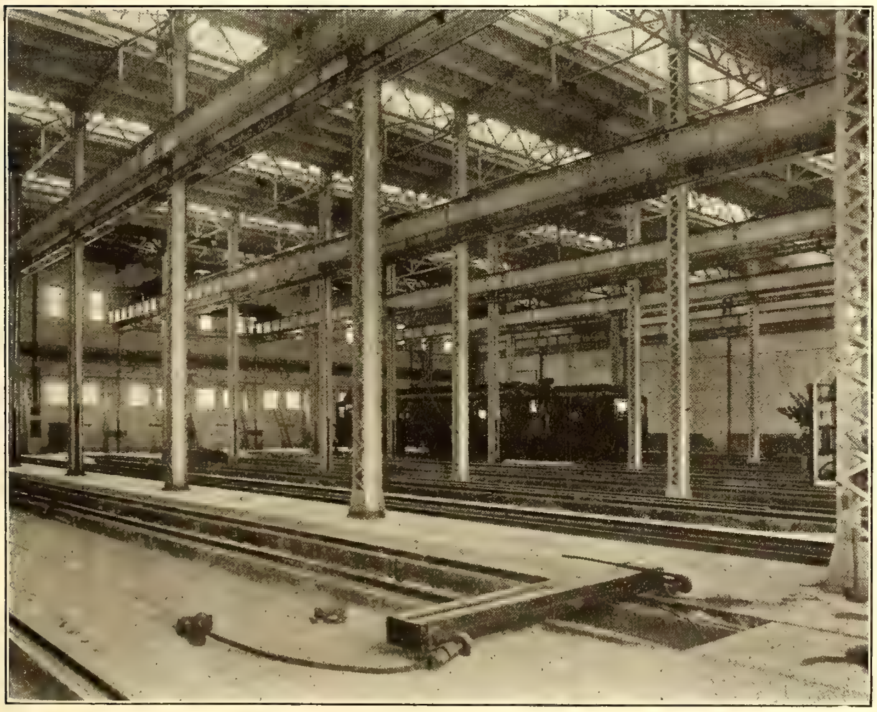
The machine shop at present occupies a space 66 ft. wide and 134 ft. long, which latter can be extended to 182 ft. by taking the space at the south now employed as a storeroom. The floor is made up of a top layer on 1⅛-in. maple over 3-in. hemlock placed on 6-in. tar concrete, but the tools are mounted on concrete piers. It is believed that the tar concrete not only will give an excellent foundation for the floor, but will also prevent any moisture getting in from underneath the planking and thus gradually rotting the wood. A wooden floor is also held to be easier for walking than an all-concrete floor for shop purposes.

The shop is furnished with a large variety of tools, some driven by single motors and others from line shafting. Their relative location and name is shown on the plan and key on page 1024. It will be seen from the range of the tools that while considerable maintenance work will be done at Harmon, such heavy repair work as would be due to collisions or other severe accidents involving car body injuries and truck breakage will be cared for at West Albany.

The northern end of the machine shop contains two 15-ft. 2-in. diameter turn-tables with track connections from both ends of the shop. Trucks or wheels brought in on these tables from one track can be shifted around to the nearby tools and taken along the other track running through the car shop at right angles to the pits.



THE HARMON BLOWER ROOM ADJACENT TO THE INSPECTION SHED, SHOWING THE LOCATION OF LOUVERS



IN THE CAR SHOP AT HARMON

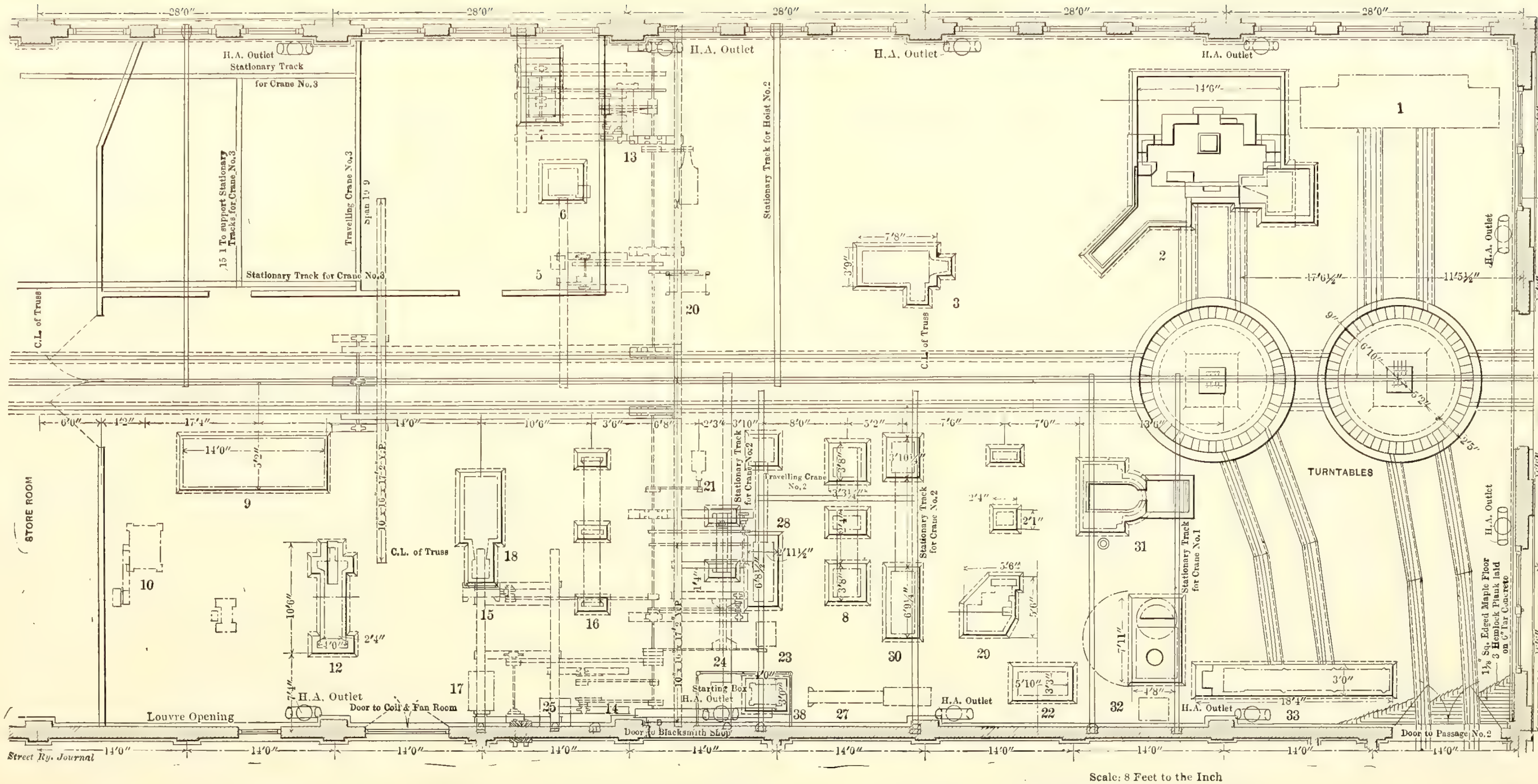
A car or locomotive brought in for truck or wheel repairs will not be kept out of service until the defective part has been put in order, but a duplicate equipment will be substituted at once to permit the rolling stock to go on the line without delay. In short, it is cheaper to pay the interest on the investment required to carry extra parts than to lose the mileage earnings caused by holding up a car whose total value must be far greater than any one or several parts of its equipment. Hence, there will always be on hand a reserve of trucks, motors, wheels and axles, as well as such parts as rheostats, contactors and air pumps.

THE NORTH WHITE PLAINS PLANT

The inspection plant at North White Plains is at the end of the electric zone on the Harlem Division, 24.4 miles from the Grand Central Station. The installation has been laid out on the west side of the running tracks. From the general plan on page 1025, it will be seen that the electric car storage yard is also on the same side, the steam rolling stock being cared for on another plot of the through tracks. The two plants, therefore, are entirely independent, except that the power equipment for the new installation has been placed in one of the old steam buildings.

The general plan also shows that at present only three of the tracks terminate in the inspection shed, but eventually the latter will be doubled in size to make room for three more. Space also is provided at the west for a locomotive shop.

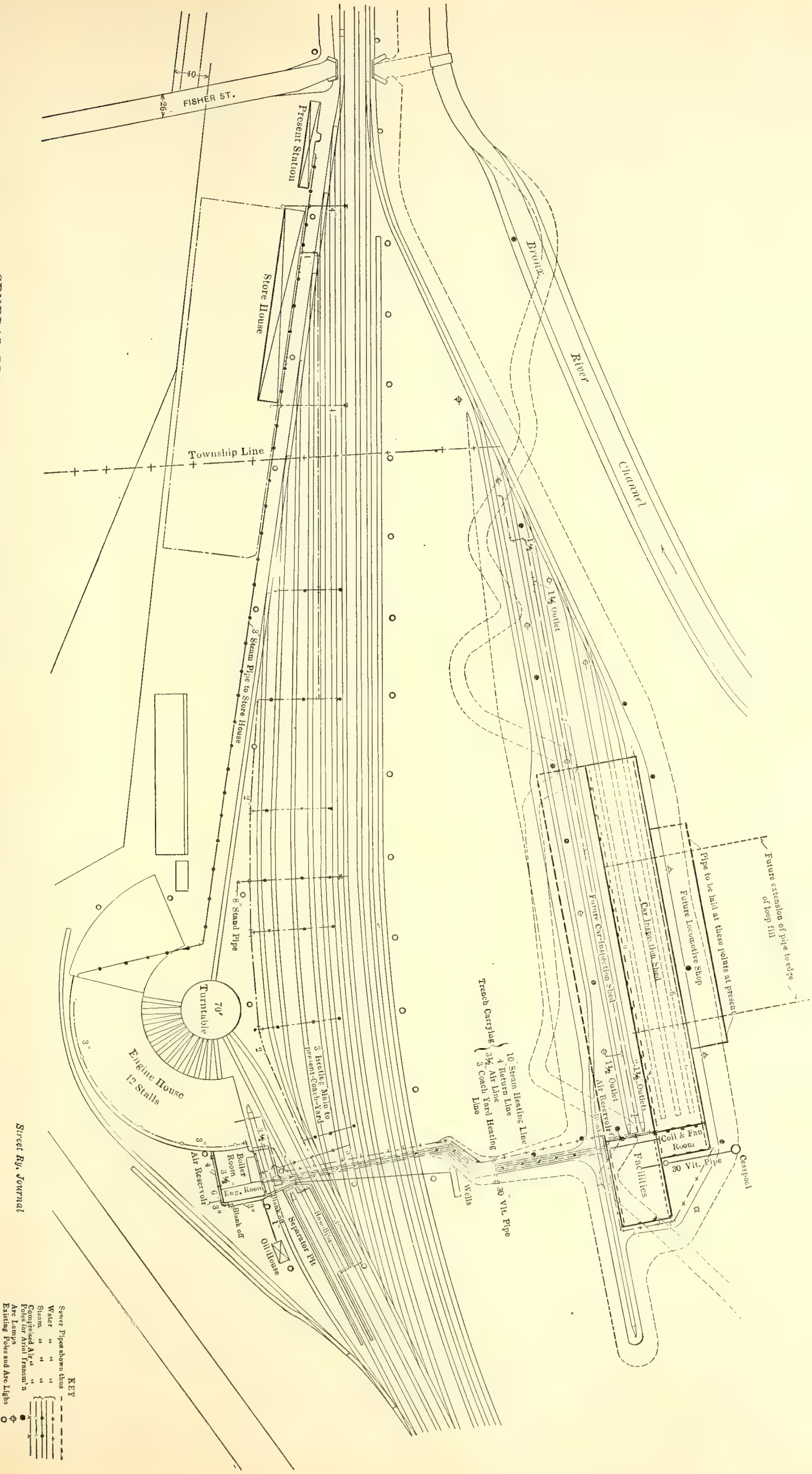
On the whole, the present inspection shed, which is 420 ft. long and 56 ft. wide, follows the constructional features



PLAN AND KEY OF HARMON MACHINE SHOP, SHOWING THE LOCATION AND CHARACTER OF THE TOOLS, ETC.

INDEX TO MACHINE TOOLS

1. Second-Hand Driving-Wheel Lathe, 25-hp Motor.
2. 42-in. Pond Tire Lathe, 25-hp Motor.
3. No. 1 60-in. Bickford Radial Drill, 4-hp Motor.
4. 28-in. Cincinnati Upright Drill, Belted.
5. Sellers Drill Grinding Machine, Belted.
6. No. 2 Cincinnati Universal Cutter and Tool Grinder, 1½ + ⅛ hp Motor.
7. No 4 Cincinnati Universal Milling Machine, Belted.
8. 36-in. x 14-ft. Schumacher & Boye Engine Lathe, 15-hp Motor.
9. Plate Straightening Rolls, 7½-hp Motor.
10. Rip Saw, 15-hp Motor.
11. Band Saw, 5-hp Motor.
12. No. 2 Hilles & Jones 25-in. Punch and Shear, 7½-hp Motor.
13. Pipe Threading Machine, Belted.
14. Cutting-off Machine, Belted.
15. Pratt & Whitney 2-Spindle Centering Machine, Belted.
16. 30-in. Pond Planer, 7½-hp Motor.
17. Acme Bolt Cutter, Belted.
18. 18-in. Dill Slotter, 7½-hp Motor.
19. Northern Electrical Company Emery Grinder, 10-hp Motor.
20. Pond Grindstone, Belted.
21. Rochester Davis 20-in. Drill, Belted.
22. Gould & Eberhardt 24-in. Shaping Machine, 3-hp Motor.
23. Fenn 4-in. Spindle Sadler Sensitive Drill, Belted.
24. Reed 11-in. x 5-ft. Speed Lathe, Belted.
25. No. 5 Greenard Arbor Press, Hand Power.
26. Hendey & Norton 14-in. Lathe, Belted.
27. Lodge & Shipley 16-in. Lathe, 5-hp Motor.
28. Lodge & Shipley 24-in. Lathe, 7½-hp Motor.
29. Niles No. 3 Double-Head Axle Lathe, 25-hp Motor.
30. Lodge & Shipley 30-in. Engine Lathe, 10-hp Motor.
31. Bullard 62-in. Boring Mill, 15-hp Motor.
32. Putnam No. 2 Car Wheel Boring Machine, 10-hp Motor.
33. Niles 48-in., 500-Ton Hydraulic Wheel Press, 7½-hp Motor.
34. Fan Blower, 15 hp.
35 and 36. Cast Iron Forges.
37. Chambersburg 1000-lb. Steam Hammer.
38. 35-hp Motor to Run Line Shaft.



GENERAL PLAN OF THE NORTH WHITE PLAINS OLD STEAM AND NEW ELECTRICAL INSTALLATIONS

of the Harmon buildings. However, owing to its erection over the old channel of the Bronx River, it was thought advisable to reinforce the pit floors longitudinally and transversely; the first reinforcement consists of six ¾-in. rods and the second of ½-in. rods spaced 18 ins. center to center.

The drainage and pit lighting also follow the Harmon practice. Fire protection is secured by outside fire hydrants, inside hose connections, chemical extinguishers, dry powder extinguisher and fire pails. There will also be the same standpipes and roof ladders as at Harmon.

Aside from the coil and fan room mentioned later in connection with the heating, the facilities rooms comprise offices, a storeroom, small machine shop and blacksmith shop, employees' locker room and toilets. This section is built in the same style as the inspection shed, except that a 10-in. cinder floor replaces concrete in the blacksmith shop, and in the offices a pine floor is laid over the concrete on 3-in. x 4-in. sleepers. The relative location and size of these rooms is shown on page 1027.

For the lighting and power equipment of the inspection shed there has been added to the present 300-hp plant one 150-hp locomotive type boiler and two direct-connected engine-driven sets. The latter comprises one horizontal automatic engine connected to a 100-kw, 220-volt, 250-275-r. p. m. generator and one vertical automatic engine connected to a 100-kw, 440-volt, 250-275-r. p. m. generator.

A VIEW TAKEN IN THE MACHINE SHOP DURING THE INSTALLATION PERIOD

ENTRANCE TO THE NORTH WHITE PLAINS INSPECTION BUILDING

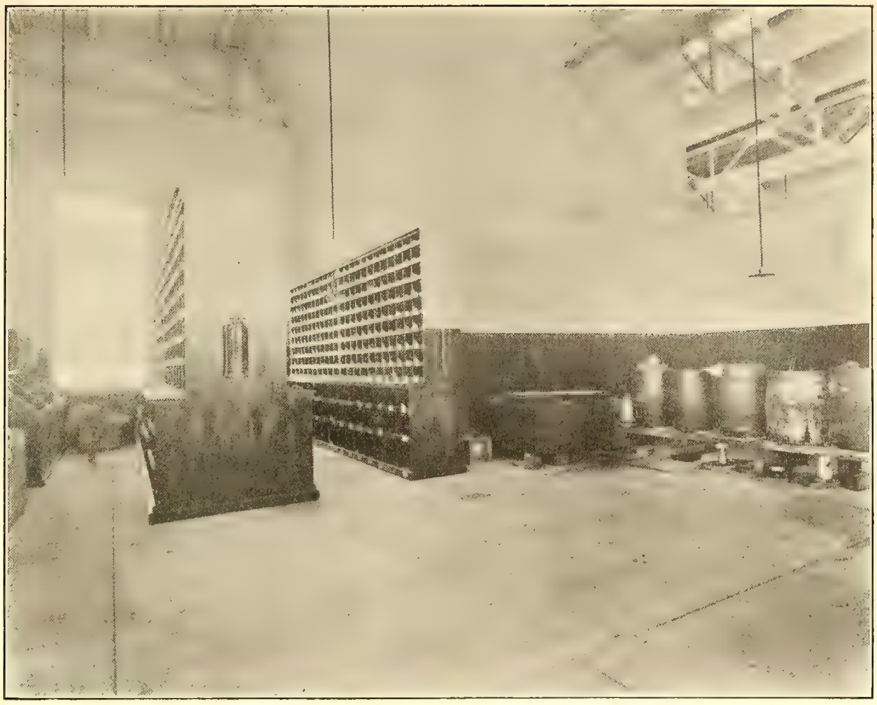
All of the electrical equipment is controlled from a switchboard in the power station. The control switches for different parts of the installation are mounted in slate-lined cabinets. In all, there are about 400 16-cp incandescent lamps, sixteen inside arc lamps with inverted concentric diffusers, and eleven outside arcs.

The steam and compressed air lines are carried over to the new plant in a buried rectangular wooden conduit built up of 4-in. yellow pine planks waterproofed with tar paper. This duct contains a 10-in. exhaust steam-heating line; a 3½-in. air line; a 4-in. return line, and a 3-in. coach yard heating line.

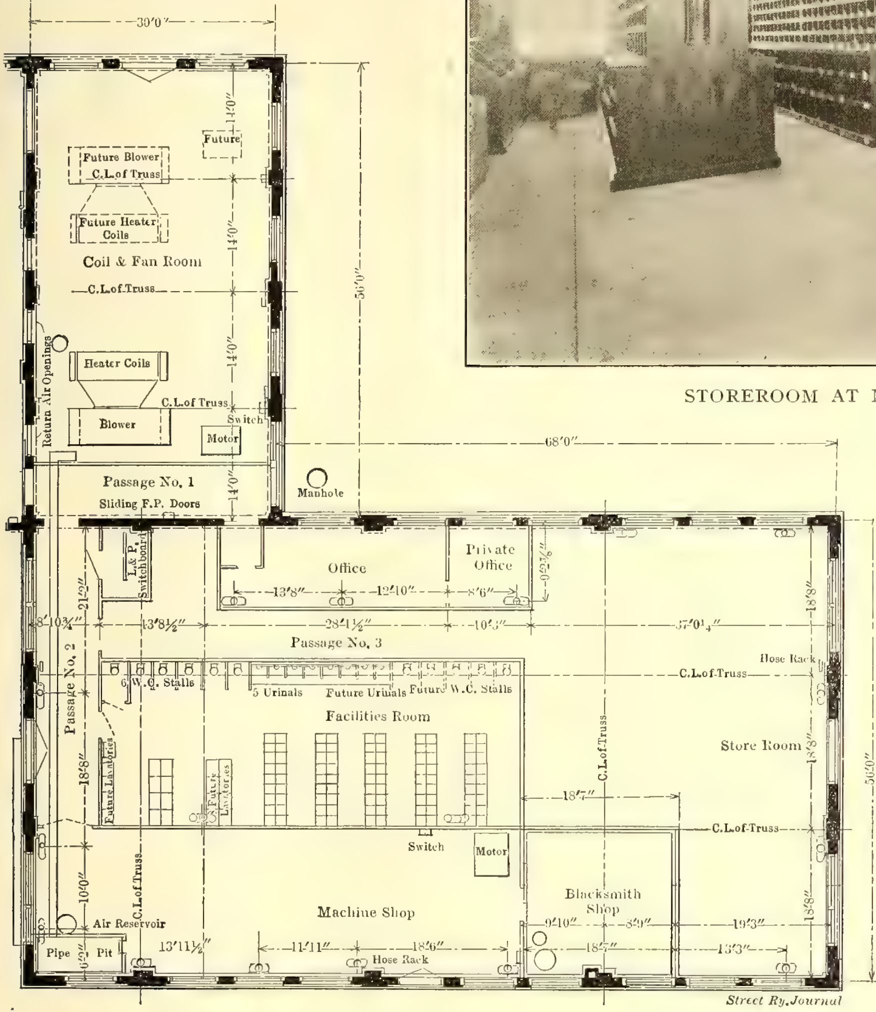
The steam for the heating system is brought to the blower and coil room which is directly behind the three tracks of the inspection shed, from which it is separated by a brick

wall with the openings protected by standard fire doors. This room is 56 ft. long and 30 ft. wide, which gives sufficient space for the installation of a duplicate equipment. The present apparatus consists of a 9-ft. three-quarters-enclosed wheel $4\frac{1}{2}$ ft. wide driven at 180 to 190 r. p. m. by a 30-hp, 1025-r. p. m. motor. The minimum heating capacity is not less than 57,000 cu. ft. of air per minute at a pressure of 1 oz. per square inch at the fan outlet. The heating coils are arranged in two groups, each giving a heating surface of approximately 2100 sq. ft. The volume to be heated is about 320,000 cu. ft., and the apparatus is figured to maintain an average temperature of 65 degs. in zero weather. The entire heating system is designed for about double its present capacity.

The heated air is forced through a concrete duct extending across the back of the pits. This duct is tapped at two points for the pit heating, one branch serving two pits and the other taking care of the third. The facilities rooms are heated through galvanized iron outlets, as at Harmon, except that floor registers are installed in the office.



STOREROOM AT NORTH WHITE PLAINS



LAYOUT OF THE NORTH WHITE PLAINS FACILITIES ROOMS

THE NORTH WHITE PLAINS PLANT, SHOWING THE POSITION OF THE FACILITIES ROOMS

THE NEW STEEL CARS OF THE HUDSON COMPANIES

BY HUGH HAZELTON

The plans of the Hudson Companies, which are building a double set of tunnels from Cortlandt Street, New York, through Jersey City and Hoboken to Christopher Street and thence by Sixth Avenue to Thirty-Fourth Street, New York, have been generally discussed in the technical press, but little has been said about the rolling stock to be used. In designing the cars for this service the engineers have had three requirements constantly in mind:

First—The car must be absolutely fireproof.

Second—Doors must be arranged so that passengers may enter and leave with least delay.

Third—The weight must be kept as low as is consistent with safety.

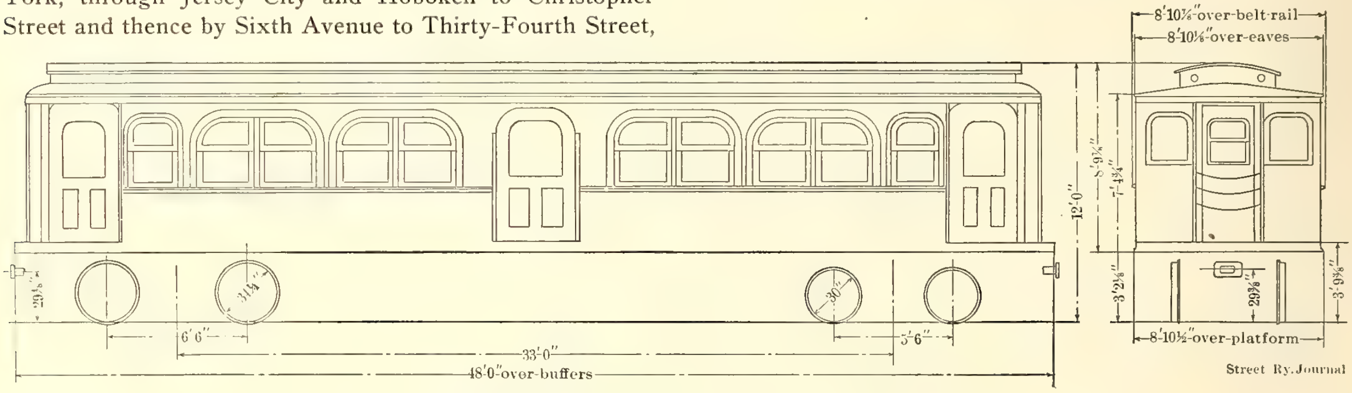


FIG. 1.—SIDE AND END ELEVATION OF HUDSON CAR

FIREPROOF MATERIALS

In order to make the car absolutely fireproof unusual precautions have been taken. The entire car body is made of steel, including doors, roof and headlining. The floor is made of "monolith" cement laid on steel, with ¼-in. finish of carborundum cement, which is used as a substitute for maple strips. The seat cushions and backs are covered with a metal fabric instead of with rattan. All insulated wires are covered with an asbestos braid and are placed in iron conduit pipes. The magnet coils of the control equipment are insulated with mica and asbestos in place of the usual covering of cotton tape.

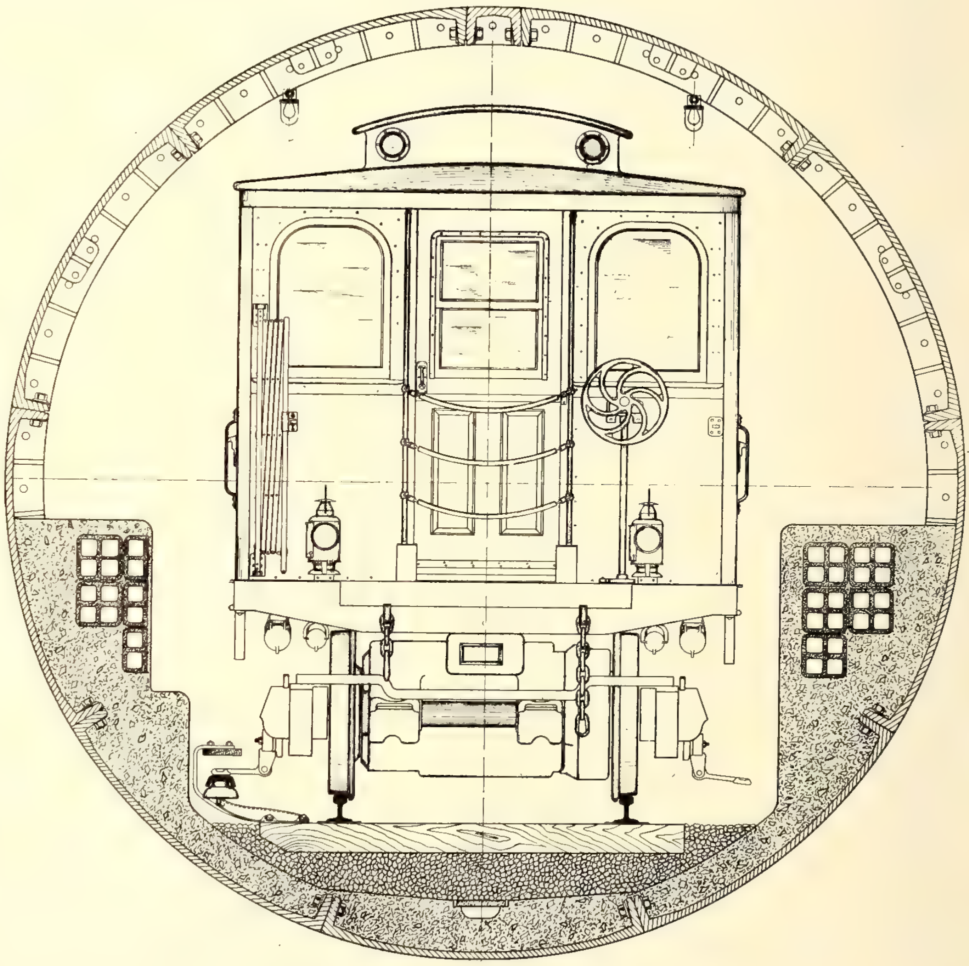


FIG. 2.—SECTION OF TUNNEL, SHOWING END OF CAR

ARRANGEMENT OF DOORS

In order to facilitate rapid movement of passengers, the car is designed as indicated in Fig. 3, with wide center doors, side seats, and an unobstructed passageway between the car platforms and the interior of the car. This arrangement minimizes the time of station stops without sacrifice of carrying capacity. At the terminals the cars will discharge passengers on one side to an incoming platform and will receive passengers on the opposite side from a special outgoing platform. These provisions are particularly necessary owing to the density of traffic and the close headway of trains during the rush hours.

REDUCTION IN WEIGHT

In a local service like that of the Hudson Companies the stations are from 1/3 to ½ a mile apart, and a large percentage of the power for operating the cars is required for their acceleration. For this kind of service it is particularly desirable to minimize the weight of the cars as much as considerations of safety will permit. The problem which presented itself to the engineers of the Hudson Companies was to design a steel car with center doors and of the least possible weight.

The type of construction used on Interborough subway steel cars was at first considered, but was not found appli-

cable on account of the decision to use center doors. The unbroken side of the Interborough car below the window sill forms a plate girder about 3 ft. in depth. To introduce a center door in a car of this type would have made it necessary to cut the girder in two, and no satisfactory way was found to frame around the door without adding materially to the weight.

The use of drop frame girders at each side of the car below the floor line was also considered, but as such girders are limited in depth by clearance requirements to 16 ins. or 18 ins., it would have been necessary to make them of heavy sections which would have added materially to the weight of the car.

TRUSS FRAME

The truss frame illustrated in Fig. 3 was finally designed as the best solution of the problem. This truss frame is arranged in five panels, the center door occupying the middle panel. As the depth of this truss is about 7 ft., it follows that its weight, for a given strength, is much less than that of any girder or truss construction which can be placed below the car floor. The bottom chord of the truss is a 6-in. channel carried below the door sills and extending from end to end of the car. The top chord is a similar channel placed above the doors and extending the length of the car. The vertical members of the truss frame are 8-in. channel posts spaced at uniform distances, and placed between pairs of win-

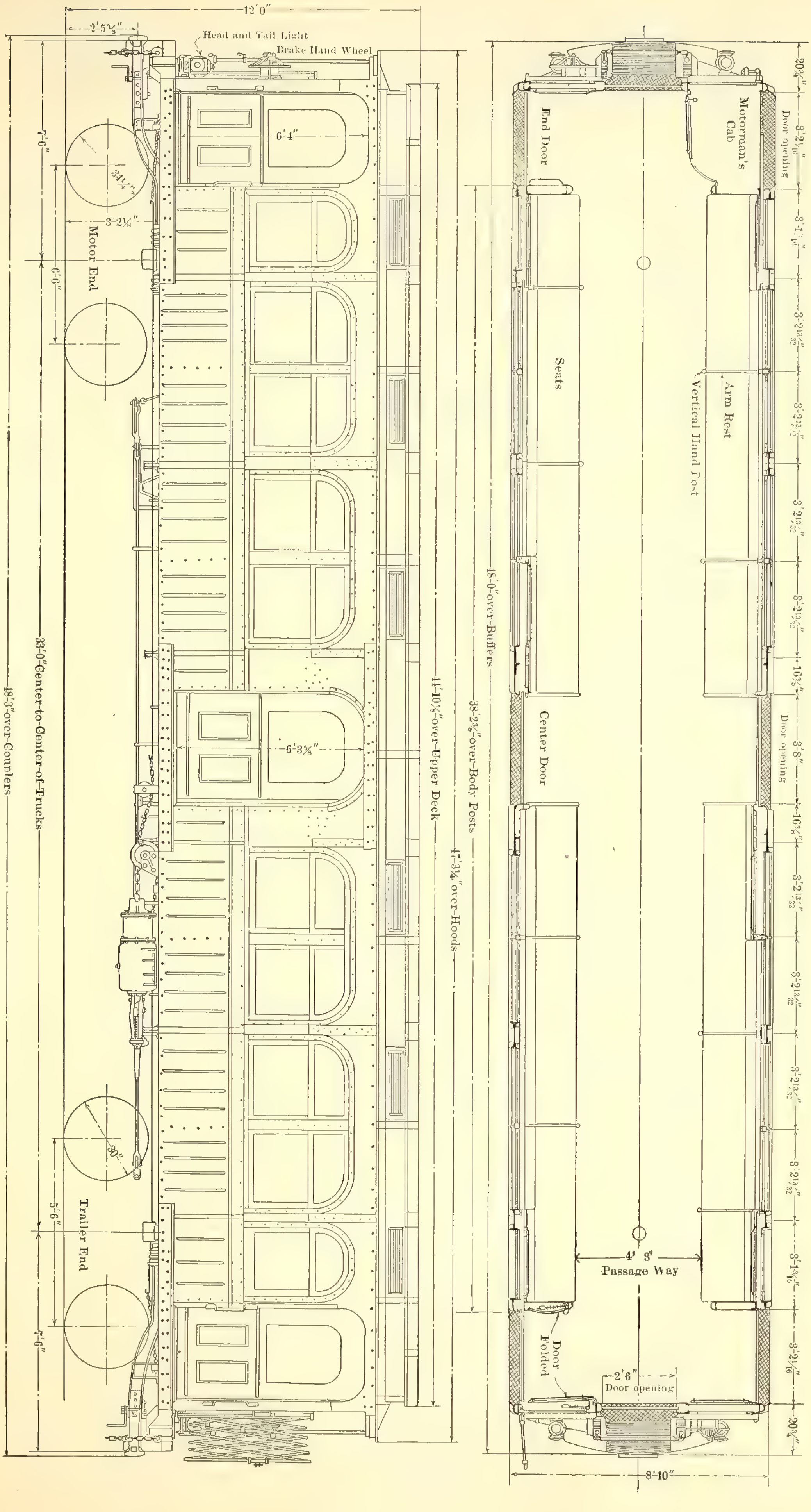


FIG. 3.—PLAN AND SIDE ELEVATION OF HUDSON CAR

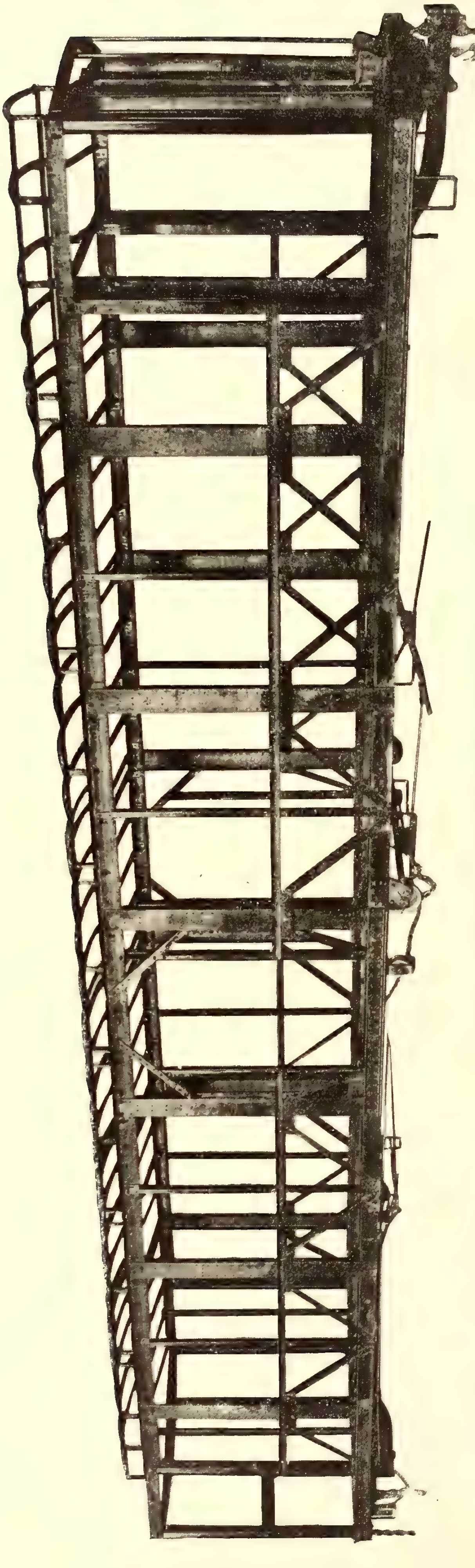


FIG. 3.—FRAMING OF CAR BEFORE SHEATHING IS APPLIED

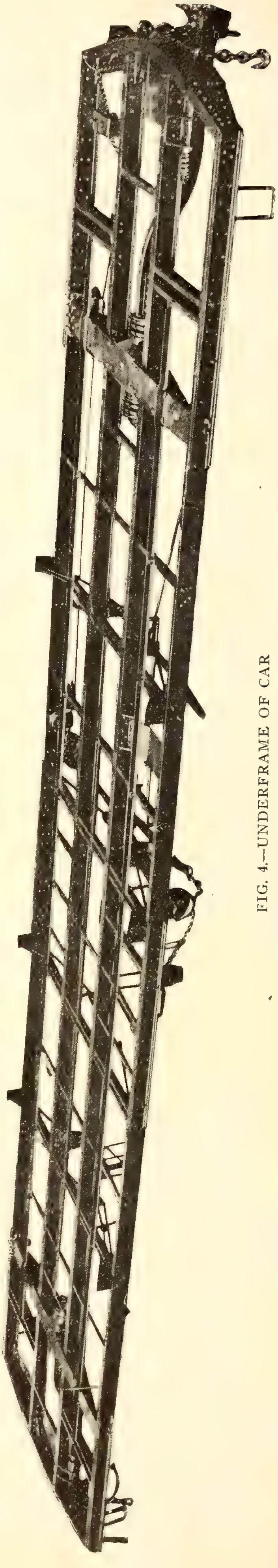


FIG. 4.—UNDERFRAME OF CAR

dows. Below the window sills these posts are braced by diagonal members to the bottom chord. Above the window sill the posts are reinforced by angle irons and plates, which arch over the pairs of windows and are riveted to the top chord. At the center door the top and bottom chords are reinforced by bulb angles, and similar bulb angles are riveted to the bottom chord below the end doors to furnish additional support for the car platforms. The truss frame is designed to carry the entire weight of the car with full passenger load with a fiber stress not to exceed 12,000 lbs. per square inch in any member.

UNDERFRAME

The underframe of the car is shown in photograph Fig. 4. The side sills are made of the 6-in. channels already described as a part of the truss frame. The center sills are 6-in. I-beams, which run from end to end of the car. The needle beams are composed of angles with truss rods and turn buckles. The attachment of the needle beams to the side sills is made by means of bent plates which serve also to stiffen the posts against side pressure.

END SILLS

The end sills shown in Fig. 5 have been made unusually strong in order to distribute the strains due to impact to the center and side sills. Attention is called to the shelf angle which is secured to the end sill for the support of the drawbar. This shelf angle furnishes a stronger sup-

port than the sector bar usually employed for the purpose.

To prevent the telescoping of car platforms in the event of a collision, two heavy steel castings, shown in Fig. 6, have been riveted to the ends of the center sills. These castings extend about 8 ins. above the top of the buffer timbers, and if the buffer timber of one car is forced up over that of the adjacent car, it will be stopped by the steel castings before damage is done to the end of the car.

SIDE SHEATHING

The sheathing of the ends and sides of the car consists of steel plates 1/16 in. thick. These plates are riveted to the truss frame after the latter is in place, and none of the rivets which hold the truss frame together pass through the sheathing. Therefore, the plates may be removed for repairs without disturbing the truss frame.

CAR ROOF

The roof is made of 1/16-in. steel plates coated on both sides with lead. The roof plates are supported by angle irons bent to conform to the shape of the roof and spaced about 14 ins. apart. The plates are secured in place by ¼-in. rivets with heads soldered, and all seams between plates are lapped and soldered.

INTERIOR FINISH

The headlining and side panels on the interior of the car are of steel 1/32 in. thick, and all window guides and post covers are made of steel plates pressed to the required shapes.

MONOLITH FLOOR

The floor is made of "monolith" cement laid on galvanized "Keystone" iron, which securely holds the cement down to the metal. The top surface is coated with a layer of cement containing about 30 per cent of carborundum. This forms a hard wearing surface, and the sharp particles of carborundum prevent slipping.

SEATS

The longitudinal seats are provided with partitions, as shown in Fig. 8. These partitions consist of steel plates which extend from the seat cushion to a height a little above the shoulder of a seated passenger. The top edge of the partition is finished with a 1-in. pipe bent to a graceful curve. These partitions are high enough to form a support to the passenger and thus obviate the disagreeable effect due to the sudden starting and stopping of trains.

The Hale & Kilburn Manufacturing Company, which is furnishing the seat cushions and backs, has developed for the Hudson Companies' cars a metal fabric which is to be used as a covering in place of rattan. The frames of the cushions are made of pressed steel, and the seats are, therefore, fireproof throughout.

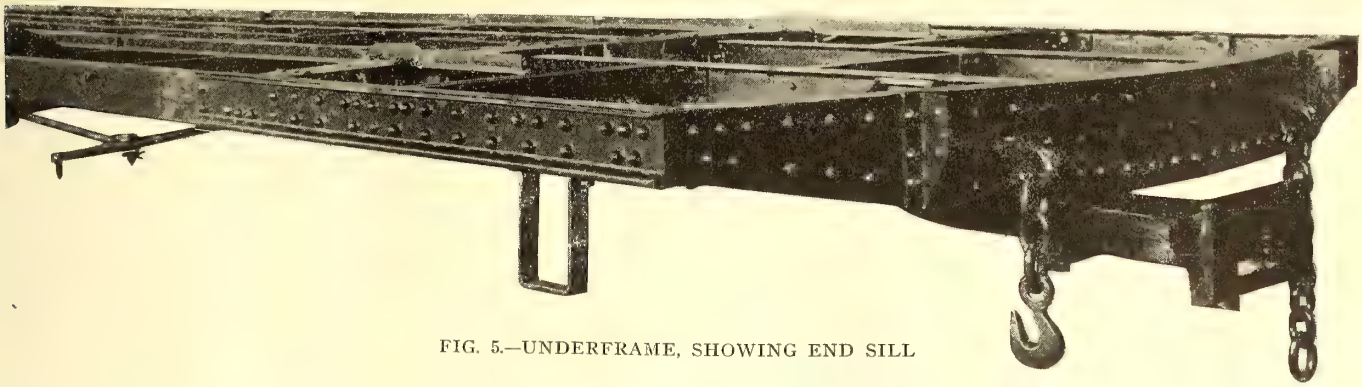


FIG. 5.—UNDERFRAME, SHOWING END SILL

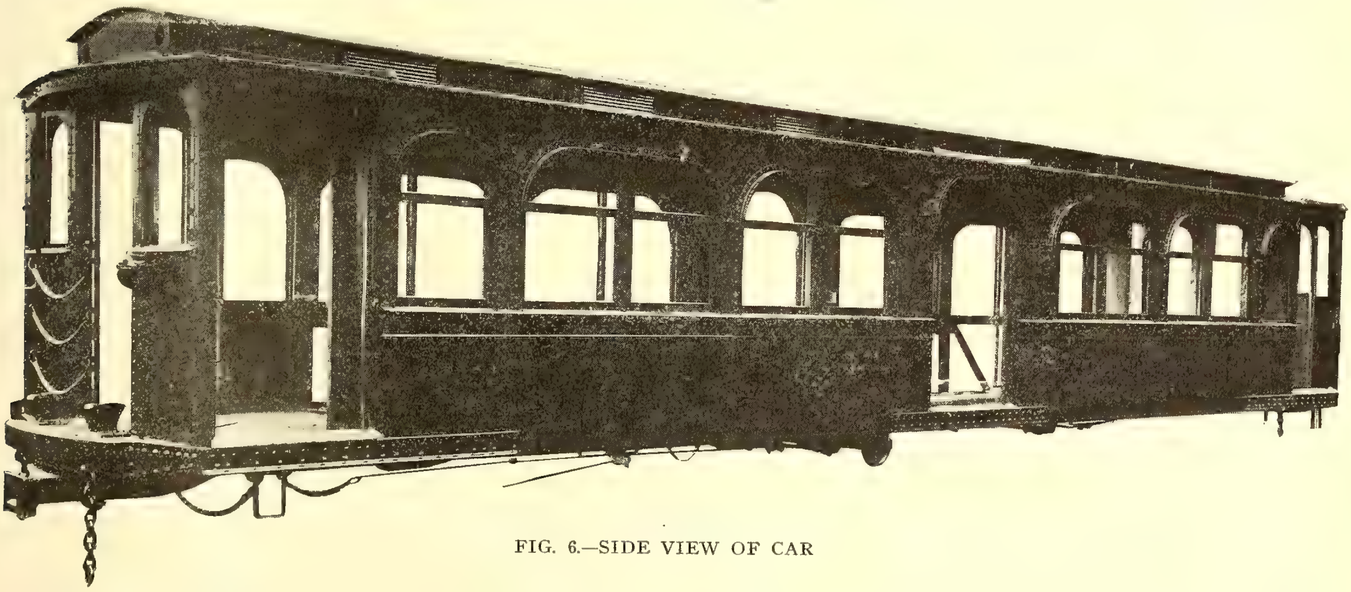


FIG. 6.—SIDE VIEW OF CAR

VERTICAL HAND RODS

A vertical hand rod is located at each of the seat partitions; this rod extends from the seat to the ceiling fixture which supports the hand strap rod. The vertical hand rods furnish convenient supports for standing passengers.

SLIDING DOORS

Steel sliding doors are provided at the sides of the car and in the vestibuled ends. Each door is supported on a ball-bearing hanger which runs on a track above the door. A piece of rubber hose is attached to the edge of the

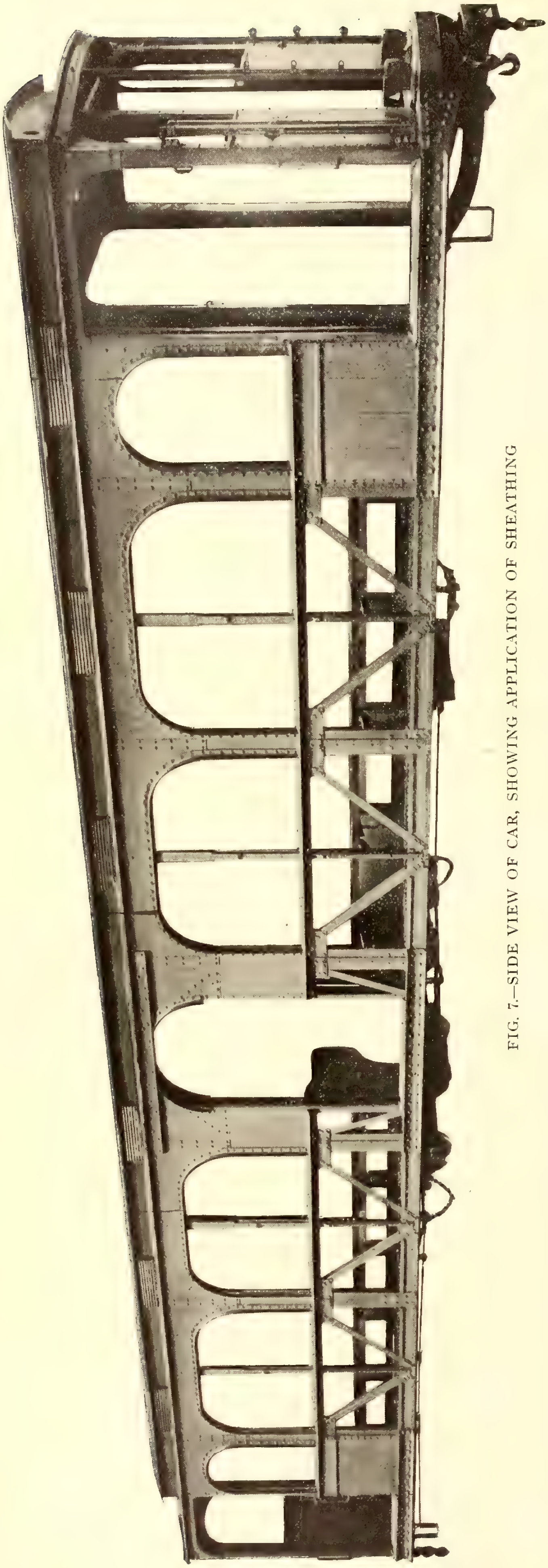


FIG. 7.—SIDE VIEW OF CAR, SHOWING APPLICATION OF SHEATHING

door to prevent the possibility of pinching the fingers of passengers when the door closes.

The doors are being furnished by Hale & Kilburn Manufacturing Company, and the ball-bearing hangers by the Pitt Car Gate Company.

DOOR-OPERATING MECHANISM

The doors are operated by air cylinders controlled by the guard. The piston has a stroke of about 15 ins., and in order to increase the movement to equal the door travel a rack and pinion is used. The mechanism is so arranged that the door moves up to the end door post, but does not strike against it.

The air cylinders are connected by pipes to air valves, which are located at the ends of the car. The guard opens and closes the doors by operating these air valves. This door operating mechanism is supplied by the Burdette & Rountree Manufacturing Company.

DOOR SIGNAL

To prevent the starting of the train before all doors are closed, it is proposed to provide an electrical signal wire throughout the train, with a bell or indicating lamp in the motorman's cab, and with contacts at each door so arranged that every door must be closed before the motorman receives the signal to start.

CAR LIGHTING

Each car is equipped with thirty 10-cp incandescent lamps, two of which are placed above each vestibule. Switches are provided so that the current may be transferred from the two vestibule lamps, in the end occupied by the motorman, to the two lamps in the destination signals. As the cars are to be operated exclusively in tunnel service, the thirty lamps will be lighted continuously.

EMERGENCY LIGHTS

In addition to the thirty lamps in the regular lighting system, each car is provided with four emergency lamps, which are supplied from a 60-volt storage battery on each car. In case the power goes off the line, the emergency lamps continue to be lighted from the battery.

STORAGE BATTERY

The storage battery consists of thirty cells having a discharge rate of 1½ amps. for eight hours. The battery is placed in series with the six circuits of five lamps each, and the four emergency lamps are connected across the terminals of the battery. The four 60-volt lamps take nearly the same number of amperes as the thirty lamps in the main lighting system, so that the battery normally "floats" on the line. The storage bateries are furnished by the Gould Storage Battery Company.

DESTINATION SIGNALS

The destination signals are placed above the ceiling of the vestibule at each end of the car. Each signal consists of a stationary lamp surrounded by a cylinder containing four segments of glass of different colors. This cylinder may be turned from the vestibule by the guard or motorman. The lamp is accessible from the vestibule by means of a hinged door at the bottom of the cylinder. A fixed lens is placed in front of each destination signal. The destination signals were designed by Hudson Companies engineers and furnished by Adams & Westlake Company.

HEADLIGHTS

Two oil headlights are placed on the front end of the forward car in a train, and two similar lanterns are placed at

the rear end of the rear car, showing red to serve as "tail" lights. These lanterns are also furnished by Adams & Westlake Company.

HEATERS

The heaters are of the panel type placed below the seats. The heater coils are arranged in two circuits, which, at 600 volts, take 7 amps. and 14 amps., respectively. The heaters are furnished by the Consolidated Car Heating Company.

DRAWBARS

The drawbars are of the radial type designed for clearances with cars on a 90-ft. radius curve. The drawbars are made of 85-lb. bent rails with Van Dorn couplers.

AIR-BRAKES

The cars are equipped with Westinghouse automatic air brakes. The type of brake is designated as Schedule A. M. M., which includes the following features:

Quick recharge of auxiliary reservoir.

Quick service application of brake.

Graduated release of brake cylinder pressure.

High-pressure emergency application.

Electro pneumatic operation of triple valves.

This air brake equipment is intended especially for the class of service required of Hudson Companies cars, and is of the latest and most improved design.

Each car is supplied with air by a Westinghouse D-2-E.G. motor-driven air compressor, which has a piston displacement of 20 cu. ft. of air per minute. In addition to the air brakes, each car has a complete system of independent hand brakes.

CONTROL EQUIPMENT

The latest type of Sprague-General Electric multiple-unit control has been adopted, and a number of improvements have been made in the materials used for insulation to render them fireproof. For example, in the contactor and reverser coils mica and asbestos have been substituted for cotton tape, and all insulation in molded forms has been made of fireproof material.

The control equipment on each car includes a current limit relay which provides automatic acceleration of the train with predetermined current in the motors. This re-

FIG. 8.—INTERIOR OF CAR WITH SEATS IN PLACE

FIG. 9.—INTERIOR OF CAR WITH SEATS REMOVED

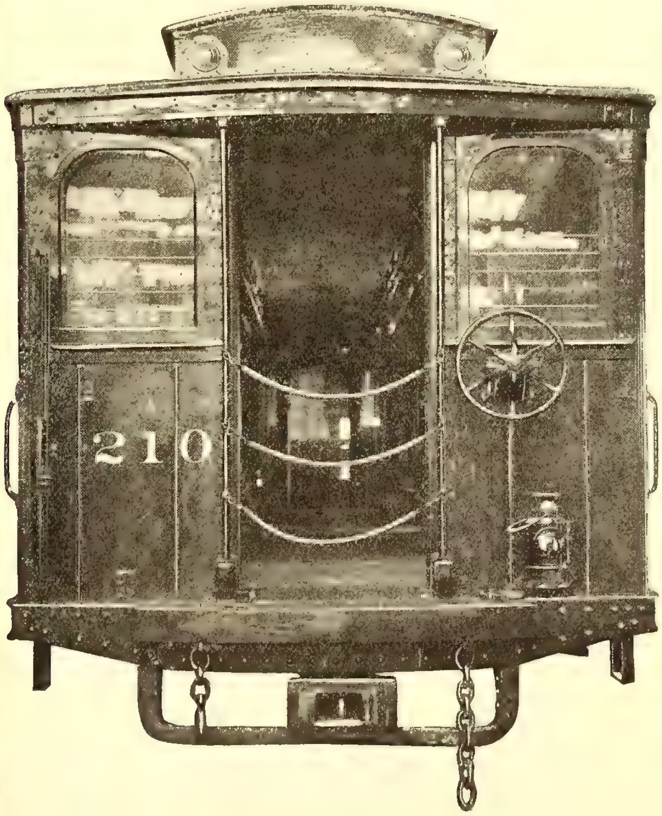


FIG. 10.—END VIEW OF CAR

lay, however, does not prevent manual operation of the master controller at less than the predetermined current, if desired.

The motor circuit is protected by a copper ribbon fuse with magnetic blowout, and, in addition, by a circuit-breaker with tripping and resetting coil. The circuit breakers in all of the cars in the train may be set or tripped by means of a switch located in the motorman's cab of each car.

A bus line cable is installed on each car which will connect the contact shoes of all cars in the train. The bus line cable prevents loss of current when passsing through crossovers.

TRUCKS

The motor and trailer trucks are of the M. C. B. type, and were built by the Baldwin Locomotive Works. The motor trucks have the following general dimensions:

Wheel-base, 6 ft. 6 ins.

Wheel diameter, 34¼ ins.

Tires, rolled steel, 5¼ ins., M. C. B. tread.

Axles, hammered steel, 6 ins. diameter at center, 6½ ins. at wheel seat.

The wheels have cast steel spoked centers and rolled steel tires held on by double retaining rings. One wheel on each axle has an extended hub upon which is shrunk the driving gear.

The general dimensions of the trailer truck are:

Wheel-base, 5 ft. 6 ins.

Wheel diameter, 30 ins.

Tires, 5¼ ins., M. C. B. tread.

Axles, hammered steel, 4¾ ins. at center, 5¾ ins. at wheel seat.

The wheels are of solid steel, forged, and were made by the Standard Steel Wheel Company.

MOTORS

Each car is equipped with two 160-hp motors furnished by the General Electric Company and of the type known as G. E. No. 76. This motor has been specially designed for the Hudson Companies service, but follows closely the design of the G. E. 66, a motor which has given such good service on the Manhattan Elevated. In the G. E. 76 motor the armature speed has been reduced and improvements have been made in commutation.

CONTACT SHOES

The contact shoes are of the hinged type, similar to those used in the subway cars of the Interborough Rapid Transit Railway Company. The shoe is pressed down on the contact rail by springs which give a tension of 15 lbs.

CONTACT-SHOE FUSES

An enclosed fuse protected by an asbestos-lined wooden box is located directly above each contact shoe. The fuse base is mounted on springs in order to reduce the vibration, and thereby prolong the life of the fuse link. Each fuse is designed to carry 650 amps. continuously.

The cars above described were designed and built under the direction of L. B. Stillwell, consulting electrical engineer, and F. M. Brinckerhoff, who has followed the details of this work and to whom many of the novel features are due.

Fifty cars have been ordered for the initial operation of the Hudson Companies tunnels. Forty of the car bodies are being built at Berwick by the American Car & Foundry Company and ten car bodies at McKees Rocks by the Pressed Steel Car Company. The writer is indebted to the latter company for several of the photographs which illustrate this article.

The first one of these cars is at present being equipped with electrical and air brake apparatus. The fifty cars are to be ready for operation in September, and it is expected that the line between Hoboken and Sixth Avenue, New York will be opened for passengers a few weeks later.

SOME SUGGESTIONS ON CAR LUBRICATION

BY AN OIL EXPERT

The high cost of oil lubrication on roads having the old type motors is not caused by dust or dirt but from the motors not being properly equipped with oil cups to regulate the flow of oil onto the bearings. In years past grease was considered a proper lubricant for both motor and truck equipment, largely because it was so easily applied. In those days, however, no attention was paid to friction nor to the causes of the wear on armature shafts or bearings.

It has not taken long, however, to demonstrate that with the proper use of oil on these motors the cost of repairs to motors and truck journals can easily be reduced 50 per cent; and if the oil is properly cared for and rightly applied its cost should be less than that of grease. Unfortunately, the crude conditions under which oil is being used on the old equipments on some roads, while greatly reducing the cost of repairs, still makes the cost of oil as a lubricant far more than that of grease. This high cost is due to the lack of proper oil houses, drip pans, oil cans, soaking tanks for the waste packing. Having no oil cups for their motors, these companies use felt and waste in attempting to regulate the flow of oil, thus causing a loss which amounts to over 60 per cent. There is no excuse for this condition, as there are now several cups manufactured for use on the old type of motors which are giving very satisfactory results.

ADAPTING OLD MOTORS FOR OIL

A little difficulty may be experienced in fitting the oil cups to old motors, as the grease opening in the motor frames varies from ¼ to ⅜ ins. It will perhaps require several patterns, as it is impossible to cut the opening in the motor frame to fit the cup. There is also some trouble to hold the cup in place securely and keep it from jumping up and down in the grease opening. One method of holding the cup in the motor frame is to drive wooden wedges around it. On a large Eastern city system it is customary to put a set screw in the side of the cup, set it up against the side of the motor frame, and secure it with a lock nut.

If one does not care to use oil cups, he could fill the hole in the bottom of the cup or opening in the bottom of the motor frame with babbitt. Then drill a 3-16-in. hole and countersink same and fill the opening with cotton waste well soaked in oil. This is the next best thing to the automatic oil cup, but very expensive, as the oil flows constantly whether the car is in operation or not.

With the use of oil, men must be better trained as to what is required to get the best and economical results. In re-babbitting split bearings, the sharp edge left by the mold should be cut back at least three-sixteenths of an inch so that it will not cut the oil of the shaft, but enough should be left on each end of the bearing to keep the oil from running over the edge of box.

PACKING JOURNAL BOXES

In regard to the use of felt or waste packing with oil for car journal boxes, the writer has concluded that to get the best results in journal boxes one should use a good quality of waste. With regard to the difference between felt and

waste: in using the felt feed for carrying oil up to the axle it is necessary to have a fairly soft felt, which, however, does not last long otherwise; but on the other hand, if hard felt is used, it glazes over and the felt as an oil feeder becomes useless.

In packing journal boxes everything depends upon the way the waste is taken care of or soaked before it is put into the journal boxes and on the manner it is put in. To get the best results out of a journal, strict attention must be given to the brass. The latter should be made so that its two outer edges will not touch the axle from the time it goes in until it is worn out. The edge of the brass forms a scraper which takes the oil off the axle and therefore produces a hot box. The waste should not be allowed to get above the center line of the journal, for if it does get up under the brass, which carries from 250 lbs. to 300 lbs. per square inch, it wipes the oil off the journal and also causes a hot box.

In packing a journal box, especially of the old type, the two little shelves in the bottom of the box put in to support the felt should be cut out. This will permit packing the waste in proper form. The writer once observed a case where a man was packing out on the floor a journal box which previously had been used for felt feed with very bad results. He had placed his waste in the box and was jamming it down into the box with a bar. It is needless to say that good results cannot be secured by that style of packing. Another point about the use of felt is that it cannot be changed on the road but one is compelled to wait until the car gets into the shop. Then it is necessary to raise the truck frame enough to relieve the journal brass which must be taken out so as to drop the box to get at the felt. In several cases where users had a hot brass with a felt feed, they would pack waste in on top of the felt, but as the waste was not in contact with the oil it can readily be seen that this was a bad practice, as the car would not go very far before another hot journal appeared.

The writer does not approve the use of babbitted brasses in heavy service, for if the babbitt is very thick the hammer blow it receives in going over special work causes it to work out on the sides of the brass and to form a scraper which cuts the oil off the axle.

The results obtained with journal boxes packed with waste depends entirely on the quality of material used, the method of properly soaking and draining the same, and the manner in which the journal box is packed. The most successful practice is to pick the waste thoroughly, submerge it in oil for at least forty-eight hours, allowing about five pints of oil for every pound of waste. The oil room should be kept at a temperature of about 70 degs. F. After drainage, the packing should be placed in journal boxes as follows: The first lot should be in the form of a roll packed tightly around the back end of the box not only for the purpose of retaining the oil but also better to exclude the dust; the waste should be packed sufficiently tight under the journal to avoid the settling away caused when passing over special work; the waste between the side of the axle and journal box should be packed more lightly to avoid the wiping effect produced when waste is packed too tight.

Oil houses should be steam-heated in the winter so that the oil will not solidify or congeal, thereby keeping it at all times so that it can be readily handled. Once in the oil cup, the internal heat of the motor will keep it warm enough to allow it to feed with perfect freedom. The unavoidable loss caused through cold oil houses in the winter will more than make up for the cost of heating them.

STORAGE BATTERY EQUIPMENT OF THE NEW YORK CENTRAL & HUDSON RIVER RAILROAD

Of the eight sub-station batteries of chloride accumulators contracted for by the New York Central & Hudson River Railroad as a part of its electrical equipment, four have now been put in service at sub-stations No. 1, No. 2. No. 3 and No. 7. The entire equipment of the electric zone includes the following battery installations, which, together with two exciter batteries for the Yonkers and the Port Morris power stations, were included in the contract between the New York Central & Hudson River Railroad and the Electric Storage Battery Company:

LOCATION.	Number of Cells.	Capacity One Hour.	Number of Boosters.
In Service:			
Grand Central yards	318	4020 amp.	2
Mott Haven	318	3750 "	2
Kings Bridge	318	3000 "	2
Bronx Park	318	2250 "	1
Under Contract:			
Yonkers	318	2250 "	1
Irvington	318	2250 "	1
Ossining	318	2250 "	1
Scarsdale	318	2250 "	1

The cells are of the standard type maufactured by the Electric Storage Battery Company, the elements, consisting of Manchester positive and box negative plates, being installed in lead-lined tanks of sufficient size to permit of a future increase in capacity by the addition of plates. The tanks rest upon two tiers of glass petticoat insulators, separated by stringers in the usual manner.

The boosters are all identical and were built by the General Electric Company under specifications issued by battery maker. Each consists of an induction motor driving a d. c. generator, the latter being constructed with commutating poles. A maximum output of 6750 amps. for one minute was called for, but the machines were successfully tested under loads far exceeding this. To handle the maximum output of the three larger installations, two of these boosters are included in each, operating in parallel.

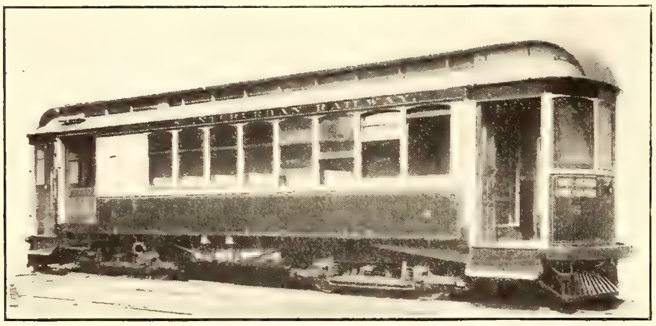
The automatic operation of the boosters, to cause the batteries to charge and discharge in response to fluctuations of load, is secured by motor-driven exciters controlled by the company's standard carbon regulator. Two of these exciters were included at each plant, each of sufficient capacity to excite the fields of two boosters operating in parallel, giving a spare exciter set at each station.

The batteries were installed to relieve the generating and transforming machinery of the violent fluctuations of load incident to the operation of heavy electric train service; also to provide a reserve source of energy for insurance of absolute continuity of power supply. The aggregate capacity of the eight batteries was sufficient to permit a reduction in the generating machinery by the omission of one of the large turbo-alternators at each of the power stations, which would otherwise have been installed, as well as a considerable reduction in the rotary converter capacity required. The saving in cost of machinery thus effected was almost sufficient to offset the cost of the battery installations, leaving the balance chargeable against the other advantages of the bateries quite negligible.

While the electric train service has not thus far been sufficient to provide the maximum load conditions for which the batteries were installed, the results already obtained in relieving the machinery of load fluctuations and maintaining a practically constant load on the rotary converters indicate that the accumulators installed are destined to be important factors in the economy of the distributing system.

THREE TYPES OF ROLLING STOCK FOR BOISE CITY

Three different types of cars were received last month by the Boise & Interurban Railway Company, of Boise, Idaho, from the American Car Company. The first lot comprised



EXTERIOR OF BOISE COMBINATION CAR, SHOWING PROXIMITY OF FREIGHT AND PASSENGER COMPARTMENT DOORS

four 30-ft. 8-in. grooveless post semi-convertible cars built under Brill patents. Two 31-ft. 8-in. cars with the same window system, but having in addition baggage compartments, were also received, and the third type to go forward was a 41-ft. baggage car. The interurban line forms a connecting link with the rich gold and silver mining districts in that part of the State near Boise. The terminus of the line is at Caldwell, which is situated near the borders of Oregon and about 30 miles distant from Boise City. The line will shortly be extended in a southerly direction to Nampa, about 12 miles distant. The passenger cars present no unusual features. The combination car, however, has a side door in the baggage compartment set next to the door at the passenger entrance, instead of next to the partition, which is the usual mode of construction. These cars, like the straight passenger cars, are equipped with

INTERIOR OF BOISE COMBINATION CAR, SHOWING SEATING AND LIGHTING ARRANGEMENTS

the No. 27-E1 trucks with a 6-ft. 6-in. wheel-base. Other features common to the types mentioned are Brill seats and specialties, such as gongs, signal bells, sand boxes, etc. The chief dimensions of the car shown are as follows: Length over end panels, 31 ft. 8 ins.; over crown pieces, 41 ft. 8 ins.; length of baggage compartment, 9 ft. 2 ins.; width over sills, including sheathing, 8 ft. 6 ins.; height from floor to ceiling, 8 ft. 5⅝ ins.; from track to platform step, 18 ins.; size of side sills, 4 ft. 7¾ ins.; end sills, 5¼ ins. x 6 13/16 ins.; sill plates, 12 in. x ⅜ in.

The baggage car is standard—four windows to a side and sliding doors at center and at ends of car. The interiors have the regulation folding seats, which, on this line, will be largely used by miners and others who wish to smoke.

EXTERIOR OF BOISE FREIGHT CAR

The truck employed in this case is the No. 27-G1 with 4-ft. 6-in. wheel-base.

A RETRIEVER OPERATED BY COMPRESSED AIR

A trolley retriever operated by compressed air is being placed on the market by the Milloy Electric Company, of Bucyrus, Ohio. This device, arranged to be installed on top of the car to the right-hand side of the car facing forward, is automatic in its action and pulls the pole down to a plane below the level of the wire the instant the wheel jumps. To adjust the pole, the rope is used. In this work the retriever plays no part, for it immediately readjusts itself for future service. It is even said that the retriever tends to lessen the labor of the conductor in replacing the pole by pulling the trolley down to a point directly beneath the wire, from which it is an easy matter to locate the wire.

INTERIOR OF BOISE FREIGHT CAR, SHOWING SEATS ADAPTED TO THE USE OF MINERS

A flexible steel cable is used to engage the pole about half way between the base and the wheel, thus giving the pole full lateral swing on curves. After a thorough trial of the retriever by the International Traction Company, of Buffalo, N. Y., thirty-seven of them were ordered and are in regular service on the Lockport branch of the system, over which a speed of 60 miles an hour is not infrequent. In addition, the Milloy Company only a few weeks ago supplied this company with a hundred retrievers for service elsewhere on its lines.

METAL MOLDS FOR CASTING BRAKE-SHOES

The Keystone Brake Shoe Company, of New York, whose brake-shoe was exhibited for the first time at the Columbus Convention, has been experimenting since then with sandless molds for casting its brake-shoes. The company was led to develop this process of manufacture by the belief that it would result in more perfectly finished shoes, and at a less cost than by the old method of casting in sand. The company has now perfected the process and is casting brake-

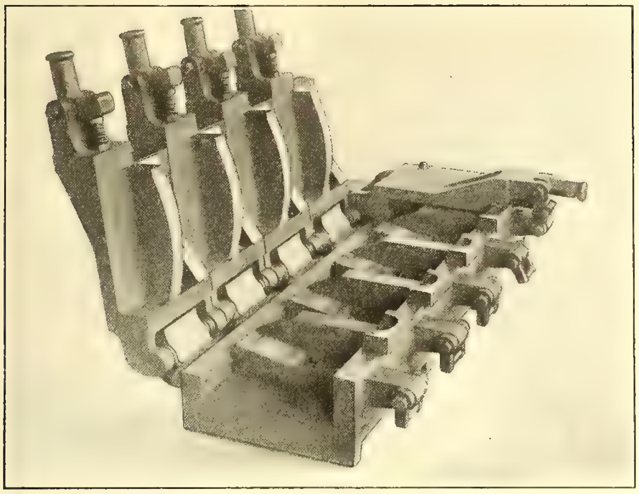


FIG. 1.—MOLD FOR M. C. B. SHOE

shoes in sandless molds to its satisfaction. As soon as enough molds can be made to handle the manufacture on a commercial basis, the company will be ready to deliver shoes. The company will not only manufacture the special Keystone shoe, but also ordinary brake-shoes M. C. B. patterns, steel brake-shoes, etc. It is now negotiating for foundry facilities, and is planning to have its first foundry located in the East, with a capacity, when completed, of 250 tons of shoes a day. It is hoped to have the product ready for delivery this fall.

In this connection, it may be of interest to publish a paper describing this process which was written by John H. Shaw and read by V. B. Lamb before the American Foundryman's Association in Philadelphia, on May 22, 1907.

THE MANUFACTURE OF SANDLESS CASTINGS

Casting in so-called chills is a method well known at the present time. Outside of the making or rolls and ingot molds, we find it used for making bedsteads, sash weights and other simple castings where there is no difficulty from undue expansion and contraction. The troubles arising from an iron mold and the lack of understanding of the regulation of temperature in casting have caused many a failure of an otherwise good idea. These objections have been largely overcome by the construction of a peculiarly arranged mold, such as those shown in Figs. 1 and 2, which are used in casting brake-shoes. The parts of the mold are so arranged that they automatically open out sufficiently to take care of the expansion due to heating up without destroying the correctness of the castings made.

The mold is constructed essentially in two parts: the outer shell, which may be locked readily, and the inner dies in close contact with the shell and securely fastened to it. The design of the mold is such that expansion in two directions may readily take place unhindered except for powerful springs. The arrangement of dies and shell allows of a ready replacing of the former when damaged, this depending upon the thickness of the mold and the temperature they are allowed to reach, their composition, of course, being such that a high melting point is attained. Further attention is given to the molds in designing them so that they may be closed and opened very quickly, and thus rapid work accomplished.

In operating a sandless mold it is necessary occasionally to coat the metal in contact with the molten iron with a compound containing graphite and crude oil or other refractory substance carried in a vehicle, which, in being driven off by heat, will not ruin the surface of the casting. In operating the mold, after spraying it, the first few castings are rejected, the intention being to heat up the mold, though in continuous work this may be accomplished in a special heating furnace or oven if desired. Any cores required are set in the regular way before casting. The metal is poured in rapidly, and the mold opened as quickly as may be, provided that the metal is set sufficiently that no bleeding takes place. The elastic condition of the mold, however, prevents trouble if this time is not kept properly, and the casting allowed to remain in the mold too long. When the castings are taken out they are piled up for the whole mass to cool slowly, so that the chilling effect of too quick cooling may not cause hard spots. The molds should not be allowed to get too hot—that is, beyond 900 F.—otherwise they are liable to expand permanently and cause trouble. It is only necessary to coat the dies about every fifth pouring, the idea being to get a thin layer of the refractory material evenly spread over the face of the dies. Between this and a hot mold and fairly soft iron no undue chilling effect results in the casting beyond the very desirable closing up of the grain of the metal. In the case in point, the making of brake-shoes, every fifth cast requires a spraying of the mold.

The system is, of course, adapted to mechanical elaboration, in order to get the lowest shop cost. Thus, by performing many of the small operations automatically, by special devices, or arranging the molds to pass the point of pouring, much labor can be saved. The work that can be made by sandless molds is naturally of a standard kind, where large quantities of the same piece are required. Hence its introduction for the brake-shoe, iron bedstead and other work. Moreover, for the car wheel, the usual cold chill, with a suitable adaptation of a center core, makes a very easily handled wheel.

The sandless mold is best adapted only to work of fairly good bulk, though practically everything can be made in this way, with proper care of the niceties of construction and manipulation. The heating up of the mold consumes some time, and uses metal which must be returned to the cupola, though this can be avoided by heating in the oven. Molds are naturally expensive at first, and hence advisable only when a large number of castings are to be made of a kind. The red-hot castings, if small, where machining is to be done, or special requirements are demanded, must be practically annealed either in pile or by an

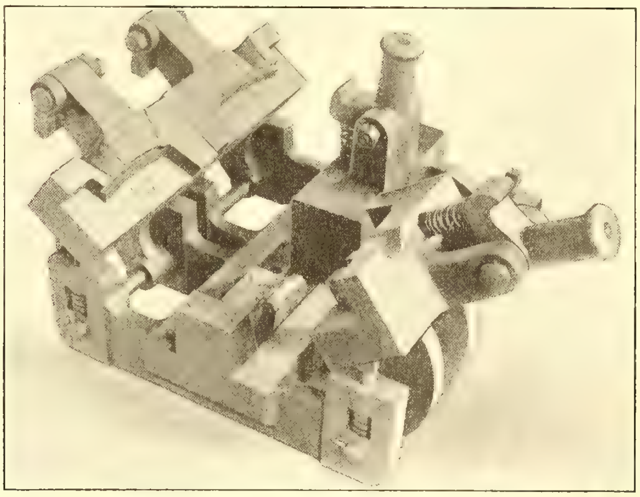


FIG. 2.—MOLD FOR KEYSTONE SHOE

oven. The silicon of the metal also must be a little higher than for sand castings.

The advantages are the following: A limited number of molds will make a great quantity of casting with very little labor, and this is not high class. The surface of the castings being practically smooth and accurate in dimensions, the loss of extra metal through excessive rapping of patterns in sand work is avoided, and no expensive cleaning department is required beyond some little grinding of thin fins. The life of the molds is long, as may be seen in ingot molds for brass and iron bedsteads. The foundry plant is very small for a heavy tonnage, and the process is adaptable for continuous melting and operating.

COMBINATION INTERURBAN CARS FOR THE LOS ANGELES PACIFIC RAILROAD

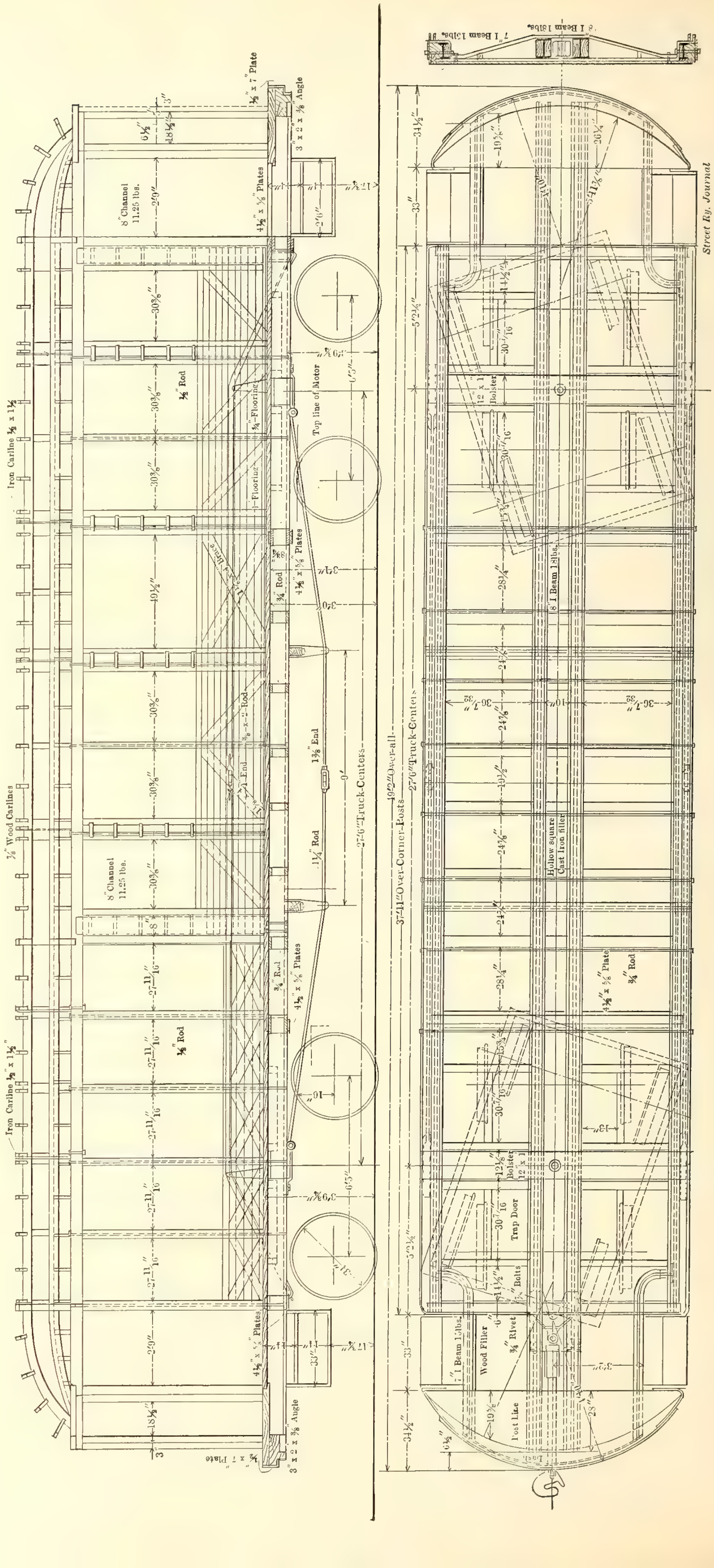
Some interurban cars of interesting design have recently been built for the Los Angeles Pacific Railway Company by the St. Louis Car Company. The cars are built with both an open and closed compartment. They are 49 ft. 2 ins. long over all and 9 ft. 4 ins. wide over posts. The height from the rail to the top of the car is 12 ft. 8 ins. The closed compartment is 24 ft. 2 ins. long, and the open section 13 ft. 1 in. in length.

The bottom framing is of rather heavy construction. Two center sills are each formed of an 8-in., 18-lb. I-beam sandwiched between wood fillers, while the side sills are made up of a 7-in., 15-lb. I-beam placed between a 5-in. x 8-in. wood sill on the outside and a filler block inside. The wood sill is further reinforced by a ½-in. x 8-in. steel plate bolted to the outside. The center sills run the full length of the car.

The double floor is made up of an under one of 1-in. x 5¼-in. yellow pine flooring laid diagonally, and an upper one of ¾-in. x 3¼-in. flooring. The roof sheathing is double with felt paper between the two layers.

The car, although built for double-end operation, has but one vestibule. On the open end there is no partition or railing between the passengers and the motorman, but at both ends of the car are end doors, which permit passage from car to car. No vestibule doors are provided, but instead there is an ingeniously contrived bar, which is so connected with the trap door underneath that both are raised and lowered together.

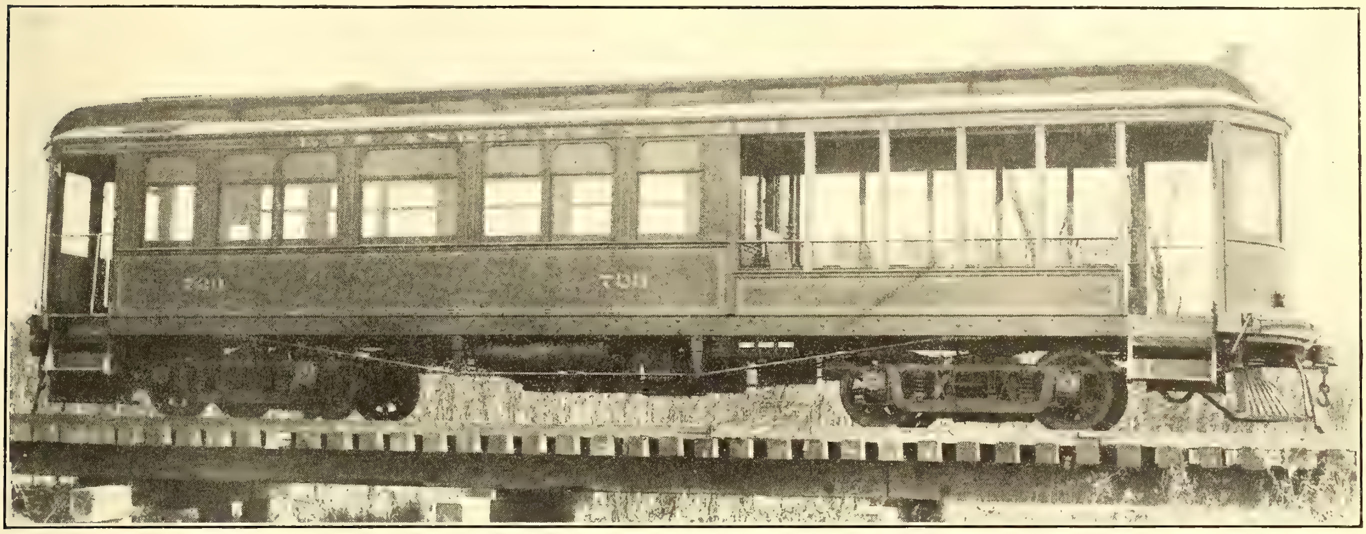
The interior of the car, which is finished in inlay mahogany, is noticeably free from metal fixtures. No registers are employed, and consequently no register brackets and rods are installed, and there are no ventilator fittings visible.



SIDE ELEVATION AND PLAN OF LOS ANGELES COMBINATION CAR

In each corner of the enclosed portion of the car is a 10-in. mirror placed diagonally across the corner. There are four short seats placed longitudinally in the corners. The remaining seats are 37 ins. long. All are covered with green plush. The seats in the open compartment are of the slat type. The metal trimmings of the car are all nickel-plated.

The car is equipped with Washburn radiating M. C. B. couplers slotted to take a link. The trucks are the St. Louis Car Company's 61-A type. They are fitted with 34-in. steel tire wheels having 3½-in. treads and 1-in. flanges. The wheels are mounted on 5½-in. axles. The trucks are mounted with four G. E. 73 motors controlled by the G. E. Type M controller.



COMBINATION CAR FOR LOS ANGELES INTERURBAN SERVICE

The cars which have just been completed, fifty in number, were shipped from St. Louis to Los Angeles on their own wheels.

KERN RIVER PLANT OPENED

Kern River Station No. 1 of the Edison Electric Company, of Los Angeles, which is located in the lower Sierras of California, almost at the headwaters of the Kern River, has been placed in operation. The route of transmission lies through the canyon in a direct line, thence over the hills, plains and divide, to follow the course of the Piru River and its tributaries. Large galvanized iron towers carry the heavy wire cables of the transmission line. In many respects the Kern River development is unique. It is claimed to be the largest hydraulic electric plant west of Niagara. The transmission line, which is 117 miles long, is one of the longest in the world. The pressure over the line is 75,000 volts. The conduit which leads to the pressure main is the longest underground tunnel system in use for this purpose. The four impulse wheels were built by the Allis-Chalmers Company, of Milwaukee, and have each a capacity of 10,750 hp at full gate and a speed of 250 r. p. m. when operating under a net effective head of 865 ft. In addition to the main turbines, there are two exciter turbines, also of Allis-Chalmers design, each with a capacity of 450 hp. and a speed of 430 r. p. m. The Kern River installation of the Edison Company is but one of three water-power developments owned by this company, in addition to six or seven steam plants located within a radius of 200 miles, all of which will operate in synchronism. A portion of the output of this plant will be disposed of along the line to Los Angeles. A very considerable amount of power will be utilized in the city of Santa Barbara. The Edison Company contemplates building plants Nos. 2, 3 and 4 on the Kern River, which will aggregate over 100,000 hp in addition to the output of the present station.

ABESTOS-WOOL MIXED GREASE

An asbestos-wool mixed grease that has been in use for a number of years on steam railroads for car journal lubrication is being introduced for service on electric railways by the Crosby Lubricating Company, of New York. In this preparation grease and wool waste are mixed, and it is only necessary in applying the material to twist it into the form of a loose rope and pack the box until it is entirely filled. The material, when pushed hard up against the back of the box and the dust board, acts as a dust protector to the bearings. Stirring the material freshens it and presents a new surface to the bearings. The grease will lubricate at 20 degs. below zero and its melting point is 350 degs. F. It is now in use on a number of city and interurban roads throughout the country, and the company has in its possession a number of letters testifying as to the results attained in operation, and also figures showing the actual record of the grease. A report from the company's own engineer of a series of tests made on a large city system shows interesting results. These tests were made under instructions issued by the superintendent of car equipment of the railway, and the first one was started April 21, 1906, and concluded August 3, 1906. On April 20 the trucks were packed with 32 lbs. of No. 1 grease, and at the conclusion of the test the grease taken out of the boxes weighed 31¾ lbs. This left a consumption of only ¼ lb. to be charged up to cost of lubrication for four boxes for a run of three months and eleven days, in which were recorded 15,736 car-miles, after which the material was replaced for service.

In a test now under way on another road the company filled the boxes of a double-truck Brill car on Dec. 20, 1906, proposing to run the car without touching the material until hot-boxes develop. On June 4 the car had been in service 166 days continuously, and there were recorded to its credit 25,232 car-miles.

THE WORK OF AN ELECTRICAL TESTING LABORATORY

The commercial electrical testing laboratory is a development of the last few years. Up to that time a laboratory was looked upon principally as a means for research in pure science, not as an adjunct to the purchasing department of an operating company. Here and there some of the larger corporations had started laboratories on their own account, but even they could not afford to secure more equipment than that needed for testing only a fraction of the varied sorts of material purchased. The pioneer in the field of the commercial laboratory was undoubtedly the Electric Testing Laboratories of New York, whose field has grown so rapidly that some account of it is worthy of remark.

At first nearly all of the work was confined to incandescent lamps, but while some 13,000,000 lamps were examined in 1906 alone, the Laboratories have carried out thousands of trials on almost every article of electrical interest. This work is not limited to the headquarters of the company, for the organization undertakes, if desired, to serve its client's interests in the shop of the manufacturer or at the place of installation.

In electric railway work the field of the laboratory is principally in the analysis of insulating paints, bonds, lightning arresters, line material, signal apparatus, and the like, as a basis for purchases. Where the nature of this material is such that the real merits are difficult to ascertain by anything but actual service, the tests are conducted with these conditions approximated as closely as possible. In one instance rail bonds were tested in sea-water because they were to be used in a locality where provision had to be made against corrosion; and quite frequently insulators are tested in artificial showers at voltages far above those expected after installation on the line.

A very interesting feature of the Laboratories is that their clientèle embraces numerous manufacturers, who send their own and competitors' products for comparative tests. Thus a rail-bond manufacturer may learn all he desires about the merits of different styles of terminals, or an insulator maker satisfy himself as to shapes and compounds. It is hardly necessary to add that all tests are absolutely confidential, the custom being to indicate the pieces tested by numbers or letters and not by names. The latter need be known by the client only.

The equipment of the Laboratories includes both low and high-tension direct and alternating currents, which are received from the New York Edison Company and converted by motor-generators, frequency changers, storage batteries and transformers to supply a great variety of currents and potentials. For insulator testing and other high a. c. voltage work, there is a transformer with a 100-volt primary and a secondary wound for 30,000 to 120,000 volts. Another high-potential outfit is a glass plate condenser used for lightning-arrester tests. It is built in sections and in full series discharges at 144,000 volts. The storage-battery outfit supplies the high-ampere currents. There are numerous measuring instruments, including frequency meters, potentio-meters, oscillographs, and the like. The line of photometers is probably the most extensive in the United States.

A notable point about the equipment is the division of the laboratory into testing units, each of which always contains exactly the apparatus needed to carry out a particular kind of experiment. This scheme is a valuable one in cases where orders for material must be placed or shipped in a hurry, for it enables the tests to be started immediately.

The room where lamp-endurance tests are conducted contains fully 6000 sockets for potentials from 1 to 300 volts. Photometric tests of incandescent and other lamps are also conducted on a large scale. Other features of the Laboratory are the carbon-tube electric furnace for finding the fusing temperatures of materials, a constant-temperature room for such work as varnish testing, a room for trying out incandescent lamps at high temperatures, and private laboratories where clients may do their own testing without observation or disturbance.

RULES FOR THE FIRE ALARM AND SPRINKLER SYSTEM AT THE PLANK ROAD SHOP OF THE PUBLIC SERVICE CORPORATION

In connection with Martin Schreiber's article on "The System of Fire Protection at the Plank Road Shops of the Public Service Corporation of New Jersey," published in the STREET RAILWAY JOURNAL of June 1, it is interesting to note the following rules which have just been adopted by the company for the fire alarm and sprinkler systems:

(1) PAINT SHOP OR PAINT STOREROOM, Sections 1-7, one long and one short blast of whistle.

(2) ERECTING SHOP AND DRY KILN, Sections 9-11, one long and two short blasts.

(3) MACHINE SHOP BUILDING, Sections 12-16, one long and three short blasts.

(4) STOREROOM, Section 18, two short blasts.

(5) STORAGE BARNS, Sections 19-24, two long blasts.

(6) BOILER HOUSE, three short blasts.

(7) ANY OTHER LOCATION, as yard etc., four short blasts.

(8) Fire alarm to be sounded distinctly and repeated three times in succession, with an interval of 5 seconds between each alarm.

(9) During nights the night engineer at boiler house on sounding an alarm will then turn in city alarm and start pump. He then will take a position in Ferry Street, opposite the pump house and direct the city fire department to the fire. After directing the fire department to the fire, boiler-house engineer will return to pump house and see that pump is kept going.

(10) All night watchmen on property will proceed to building where fire is located and do what they can to extinguish the conflagration with the chemical fire extinguishers and local apparatus.

(11) In the day time the duties of the engineer in boiler house are the same as those of the night engineer, as explained above, while the regular fire brigade will take action as trained.

(12) If there are no indications of fire, and water is found running from the sprinkler heads, turn off post indicator valve or outside screw and yoke valve and close air-supply valve on system in service, and then drain system.

(13) If water is not found running from any sprinkler head, no action need be taken during clear weather, but during cold weather when pipes are liable to freeze, the system must be drained and dry valves reset.

(14) In case of fire or any indication of smoke, sprinkler system must not, under any circumstances, be shut off until the chief of the city fire department or his representative authorizes it.

(15) After alarms have been responded to and causes ascertained, if there is any fire, report result of investigation to engineer at pump house.

(16) The engineer at pump house will see that system is properly drained when thus requested to do so.

(17) Fire pump must be tested every 24 hours and see that it is working properly.

It is understood that the Consolidated Railway Company is studying the feasibility of running limited express cars between Springfield and Hartford, with the idea of cutting down the running time from the present hour and fifty minutes to an hour and twenty minutes.

FINANCIAL INTELLIGENCE

WALL STREET, June 5, 1907.

The Money Market

Although the developments in the money market were of a generally unfavorable character during the past week, rates for accommodation experienced very little change. Money on call was in abundant supply, at rates ranging from 2½ to 1¾ per cent, the average rate being about 2 per cent. In the time loan department business was practically at a standstill, although a slight increase in the inquiry for money running into January and February was reported. The asking rates for these maturities advanced ¼ per cent to 5¾, but the quotations for the shorter periods ruled absolutely unchanged at 3½ to 3¾ for sixty days, 4 per cent for ninety days, 4¼ per cent for four months, 4¾ for five months and 5 per cent for six months. The demand from Stock Exchange houses was extremely light, owing to the continued liquidation in the securities market. The demand from corporations, however, continued, the most important development in this connection being the decision of the American Telephone & Telegraph Company to issue about $21,000,000 additional stock. The stock will be offered to stockholders of the company at $100 per share, payment to be made one-half on or before July 25, 1907, and the remainder on or before Oct. 25. Several other loans have been negotiated on behalf of railroad companies, but the amounts were comparatively small. A feature of the week has been the heavy absorption of gold by the Bank of France. Within the past ten days foreign exchange rates in the local market have held at a point which, together with the interest allowed by the Bank of France, on the gold in transit, made it more profitable for our bankers to remit in gold than by the purchase of bills of exchange. Up to this time the shipments of gold from New York to Paris aggregate $6,800,000, and within the same time the Bank of France has succeeded in drawing more than $6,000,000 from the London market. At the close of the week the position of the foreign exchange market was such as to permit further shipments of the yellow metal to Europe, and from present indications it is quite probable that a further considerable amount will be sent abroad. Bankers, as a rule, are not inclined to offer money with any degree of freedom, the opinion being generally held that higher rates will prevail in the near future. The Secretary of the Treasury has, as yet, taken no action in the matter of recalling Government deposits, and in well-informed quarters it is doubted if such action will be taken at this time. The depository banks now hold something like $172,000,000 Government money, but as the Treasury surplus is constantly on the increase, it may not be necessary to call in any considerable amount for refunding purposes.

The bank statement published on last Saturday was rather unfavorable. Although cash increased $982,100, there was an increase in the loan item of $13,541,600. Deposits increased $15,554,100, thus increasing the reserve required by $3,888,525. Deducting from this the gain in cash, the surplus was diminished by $2,906,425. The surplus now stands at $12,782,450, compared with $6,616,025 in the corresponding week of last year, $6,050,275 in 1905, $31,760,675 in 1904, $4,775,650 in 1903, $11,285,575 in 1902, $21,523,050 in 1901, and $20,123,275 in 1900.

The Stock Market

The story of stock market movements during the week was limited to periods of urgent liquidation and shifting of position of the speculative members of the Exchange commonly referred to as the trading element. There was heavy enough liquidation on Monday to cause material and disturbing declines all through the list, and all the while that the heavy selling of long stock was in progress, the Wall Street district was flooded with rumors of embarrassment and failure. The names of two houses were freely mentioned in these reports, and those who seemed best posted on the market situation told their friends that unless arrangements were made to tide the houses over their failures would be announced on that day. The day passed though, without any official announcement of trouble and the relief from the tension in itself caused a decided improvement in speculative conditions. The liquidation gave a good opportunity to cover shorts that was availed of by some of the larger bear operators. One of these operators alone covered fully 100,000 shares of short stock, and several others covered lines ranging from 10,000 to 20,000 shares. This covering movement created a false impression of underlying strength, especially as it was of large enough dimensions to force a sharp recovery on Tuesday and was an incentive to an attempt at bullish manipulation by a clique of speculators who thought the market could be easily lifted after the liquidation had been completed. There was one clique that made a demonstration in Union Pacific and American Smelting, buying and bidding up both those stocks and later extending their operations to Reading, and for a short time they were successful in holding prices at a fairly high level and forcing other professional speculators to hurriedly cover some of their shorts. They used for a reason for these bull operations vague intimations that the administration would take no step in the matter of prosecutions because of the disclosures made in the Interstate Commerce investigation. These rumors found no confirmation in the official news from Washington on Wednesday, and those who had joined in the bull movement in Union Pacific, sold that stock in London on Wednesday morning and left it without support in the trading on the New York Stock Exchange from the start. American Smelting was bid up in anticipation of the increase in the dividend rate, and when the news came that the directors had declared a quarterly dividend of 2 per cent, putting the stock on an 8 per cent dividend basis, there was no market response except that the buyers of the day before hurriedly sold and sent the price of the stock back to about where it started from. The outflow of gold continued in about the same volume as last week, bringing the total exports up to date for this movement to $6,850,000, but the foreign demand for gold had no influence as a market factor and was not even discussed by those active in forcing price movements. The net changes for the week were unimportant, advances and reactions just about offsetting each other and leaving values of current Wall Street securities in about the same range that has been established since the reaction following the recovery from the March depression.

The traction stocks were extremely weak, especially those of the Interborough-Metropolitan, both of which made new low records. The weakness in these shares was accompanied by reports that the management may be compelled to discontinue the dividend on the preferred stock. It is stated, however, that the regular 1¼ per cent dividend for this quarter will be declared on the stock this week. It is understood that the management of the company is figuring on a substantial increase in earnings later in the year, and if these expectations are realized the directors will be disposed to continue the dividend payments indefinitely.

Philadelphia

The dulness prevailing in the general securities market was reflected, to a great extent, in the local traction shares during the past week. The demand for these shares was not very large, but in the absence of any pressure to sell, prices remained steady. The only exception to this rule was Philadelphia Company common, which lost a point to 40. Philadelphia Traction fluctuated between 22 and 23½ on transactions aggregating about 6000 shares. Philadelphia Traction sold at prices ranging from 91 to 91½, the final transaction taking place at 91⅛. Union Traction was quiet, with sales at 58 to 58⅛. A semi-annual dividend of 2½ per cent has been declared on the stock of this company, payable on July 1. This is an increase of ½ per cent over the previous payment and places the stock on a 5 per cent basis. Under the terms of the lease to the Philadelphia Rapid Transit Company the stock will receive 5 per cent dividends up to 1909, when the rate will be increased to 6 per cent. Consolidated Traction sold at 72½; United Com-

panies of New Jersey at 246½ to 247, and United Traction of Pittsburg at 47½.

Chicago

The Chicago City Railway Company has declared a quarterly dividend of ½ per cent. This is a reduction of ¾ per cent as compared with the previous payment, thus reducing the rate from a 9 to a 6 per cent annual basis. The reduction is believed to be the initial step to bring the fixed charges of the company within the income which may be expected under the new franchise ordinance requiring a division of the net income with the city. The stock of the Chicago City Railway Company held steady at 180 during the early part of the week, but toward the close the price dropped to 170. Otherwise the market for traction issues was dull and without special feature. Union Traction sold at 3⅜ and the preferred at 14½. South Side Elevated rose from 85 to 85½. Other sales were: Chicago & Oak Park common at 3¾; preferred at 14; Metropolitan Elevated at 65, and Northwestern Elevated at 23.

Other Traction Securities

The market for traction issues at Baltimore was quiet and generally weak. United Railway incomes declined from 53 to 50½, while the new refunding 5s broke from 83½ to 78¼. The 4 per cent bonds held steady at 86¼ to 86. Other sales were: City & Suburban 5s at 109; Baltimore City Passenger 5s at 101¼; Norfolk Railway & Light 5s at 95, and Washington City & Suburban 5s at 101½. The Boston market also was quiet. Prices during the first half of the week held firm, but toward the close there were rather sharp reactions. Boston Elevated dropped from 135 to 134, and Boston & Worcester common declined from 24½ to 23½. Massachusetts Electric ran off from 17 to 16, and the preferred brought 57½.

On the Cleveland Stock Exchange, Cleveland Electric stock reached a new low level within the past few days, the last sale being at 48. Some of the bids were much lower than this, but the asked price for the past day or so has been above 50. Quite a block of Northern Ohio Traction & Light changed hands at 25 and another at 24, but on Tuesday the figures stood 25 bid and 25¼ asked. Aurora, Elgin & Chicago preferred has stood at 76 and 76½, with 77 asked, while the common was marked up 32½ bid and 33½ asked. Washington, Baltimore & Annapolis pooling certificates stood at 10 bid, with 11 asked. Quite a little business has been done in traction securities, but they have not been especially strong in price for the past two weeks. The continued litigation keeps Cleveland Electric down to a low point.

Security Quotations

The following table shows the present bid quotations for the leading traction stocks, and the active bonds, as compared with last week:

	May 29	June 5
American Railways	49¼	48
Boston Elevated	—	133
Brooklyn Rapid Transit	49¼	50¼
Chicago City	180	160
Chicago Union Traction (common)	3¼	3
Chicago Union Traction (preferred)	14	16
Cleveland Electric	—	—
Consolidated Traction of New Jersey	72½	71
Detroit United	67	66
Interborough-Metropolitan	19	15¾
Interborough-Metropolitan (preferred)	51	45½
International Traction (common)	54	50
International Traction (preferred), 4s	50	66½
Manhattan Railway	133	134
Massachusetts Elec. Cos. (common)	16½	16
Massachusetts Elec. Cos. (preferred)	58	56
Metropolitan Elevated, Chicago (common)	24	23
Metropolitan Elevated, Chicago (preferred)	63	63
Metropolitan Street	85	—
North American	67	66½
North Jersey Street Railway	40	40
Philadelphia Company (common)	41	40
Philadelphia Rapid Transit	22	23⅛
Philadelphia Traction	91¼	91
Public Service Corporation certificates	64	64
Public Service Corporation 5 per cent notes	94	92
South Side Elevated (Chicago)	83½	84
Third Avenue	103	105
Twin City, Minneapolis (common)	90¾	91½
Union Traction (Philadelphia)	57½	58½

Metals

The "Iron Age" says that the pig iron markets throughout the country have been very quiet. The furnaces are sold far ahead and show little disposition to press iron for more distant delivery, while many buyers have little confidence in the market, in view of the general business situation and the financial outlook. The feeling is prevalent, however, that the present level of prices will be well maintained until the end of the summer.

Copper metal is reported firm and unchanged at 25¼c. for electrolytic and 25½c. for lake.

NEW HAVEN MERGES WITH CONSOLIDATED

At a special meeting of the stockholders of the New York, New Haven & Hartford Railroad, held at New Haven, May 31, this corporation, according to the terms of the call for the meeting, was merged with the Consolidated Railway Company, a company with $10,000,000 capital stock, which was organized to operate the New Haven's electric lines in Connecticut. Under the terms of the transaction the Consolidated Company will continue to use the name of the New York, New Haven & Hartford but will operate under the charter of the Consolidated Railway Company, which is very liberal.

President Mellen told the stockholders that no danger of skipping a dividend exists. He said that the recent demands of union labor will cost the road $800,000 this year, and that with every demand granted efficiency has decreased.

"The only uncertain, unhappy elements," said Mr. Mellen, "with which the management has to contend are the demands of organized labor, which are very tremendous, and which will cost us this coming year in the vicinity of $800,000 for increases in wages; and the unfortunate situation we are in with regard to the freight car demurrage, which is doubled by the American Railway Association, beginning July 1, which will make another $800,000 increase in our expenses. Therefore, I have to look in the face from July 1, 1907, an increase in the expenses of this company of $1,600,000 from these two items alone, and I regret to say, so far as the organized labor item is concerned, that I am meeting constantly a decreased efficiency with every increase in wages."

In addition to this Mr. Mellen said:

"The amount of money that has been expended, and regarding which there has been expressed to me at times more or less apprehension, doubt, uncertainty as to the wisdom of the policy of the company, has been large, and approximates from July 1, 1903, to May 21, 1907, the enormous sum of $147,000,000. That was for a period beginning four months before the advent of my administration.

"Out of the $157,000,000 that have been raised, $97,750,000 have gone for investments in securities of other companies, which are paying the interest upon the cost of their investment. Out of the balance $37,000,000 has been spent for real estate, new equipment, second, third and fourth tracks, and the electrification of the New York division, and there was no possible way that I can conceive of by which any administration could have avoided those expenditures."

It was learned that the new $30,000,000 of stock for which application has been made for listing on the New York Stock Exchange, mentioned in the STREET RAILWAY JOURNAL of June 1, is immediately connected with the merger. The Consolidated Railway Company recently took over the New England Navigation Company at a valuation of $20,000,000, or exactly the price which C. W. Morse some time ago offered for the property. Against this $20,000,000 of Consolidated Railway Company stock was created, which, added to the previous outstanding $10,000,000 makes $30,000,000 of stock, which in the merger now is represented by the $30,000,000 of stock, share for share, of the steam corporation. It was announced on June 5 that this $30,000,000 of stock will be used to secure control of the Boston & Maine Railroad.

REPORT ON MUNICIPAL OWNERSHIP

The full report of the commission on public ownership and operation of the National Civic Federation, a work upon which for more than eighteen months twenty-five expert accountants, engineers, economists and other specialists have been engaged, is now being sent to press. This report will contain all of the data gathered abroad and in America, and upon which the commission will have based its conclusions.

The investigation embraced the four leading public utilities: gas, water, electric lighting and power, street railways. Examinations were made of twenty-nine private and public plants in America and twenty-four in Great Britain. Among the American cities visited were Cleveland, Chicago, Philadelphia, Wheeling, Detroit, Indianapolis, Richmond, Atlanta, South Norwalk, Syracuse, Allegheny, New Haven and Norfolk. The inquiry abroad included the leading private and public undertakings of Great Britain and Ireland. Examinations were made in the following cities: Glasgow, Newcastle-on-Tyne, London, Liverpool, Norwich, Manchester, Birmingham, Dublin, Leicester and Sheffield.

The keenly analytical character of the work of this investigation only a study of the full report of the commission can indicate. Some idea of the scientific methods employed may be had from the fact that schedules of questions prepared by noted engineers and economists were followed in the case of each plant and system examined. These schedules disposed the questions under several general heads, as follows:

(a) Historical and General.
(b) Supervision of Municipalities.
(c) Public Supervision of Private Companies.
(d) Franchises of Private Companies.
(e) Organization.
(f) Political Conditions.
(g) Labor.
(h) Character of Service and Plan.
(i) Financial Matters.
(j Capital Stock and Bonds.
(k) Assets.
(l) Liabilities.
(m) Receipts.
(n) Expenses.
(o) Profit and Loss.

Several days were personally devoted by the experts upon each plant examined, and in some cases weeks were consumed.

The commission's full report will appear in two main divisions. The first part is intended for popular reading; the second will include the reports of the experts, which will be of especial interest to accountants, engineers, managers of public utility corporations, city officials, members of legislative committees, and all who are interested in municipal ownership and franchises. The second part will also show in the case of each American and foreign plant examined to what extent the experts agreed. Thus will be provided technical information of the correctness and impartiality of which no question can be raised.

The contents of each division of the work will be substantially as follows:

PART 1., VOLUME I.:

General conclusions of commission.
British Municipalities, by Frank J. Goodnow, author of "Municipal Home Rule," "City Government in the United States," etc.
American Municipalities, by Walter L. Fisher, traction counsel to ex-Mayor Dunne and to Mayor Busse, of Chicago, and author of the franchise plan adopted by the voters of that city.
A Critical Review of the Experts' Reports, in two sections by Edward W. Bemis and Milo R. Maltbie and Walton Clark and Charles L. Edgar.
Certain Phases of the Labor Investigation, by John R. Commons and by J. W. Sullivan.
Verbatim Reports of Conferences upon Municipal Trading Held at London with Rt. Hon. Lord Avebury (Sir John Lubbock), Mr. Sydney Morse, president of London Chamber of Commerce; Hon. Robert P. Porter, author of "Dangers of Municipal Ownership;" Hon. T. McKinnon Wood, progressive leader, London County Council; Hon. J. Allen Baker, chairman London Municipal Tramways, and Mr. Robert Donald, editor of the "London Daily Chronicle."

PART 2, VOLUMES I. and II.:

Vol. I., the United States:
Reports of experts on gas lighting:
Alf. E. Forstall, Fred. Burnett, Jno. H. Gray, Jno. R. Commons, J. W. Sullivan, Marwick, Mitchell & Co.
Special report on Philadelphia Gas Works, by Leo. S. Rowe.
Reports of Experts on Electric Lighting and Power:
Theo. Stebbins, Chas. E. Phelps, Jr., John H. Gray, John R. Commons, J. W. Sullivan and Marwick, Mitchell & Co.
Report on the History of Chicago Municipal Electric Lighting, by Marwick, Mitchell & Co.
Report on Water Works Systems, by Dabney H. Maury, John H. Gray, John R. Commons, J. W. Sullivan and Marwick, Mitchell & Co.
Vol. II., Great Britain and Ireland:
Reports of Experts on Gas Lighting:
Milo R. Maltbie, J. B. Klumpp, Wm. Newbigging, Robert C. James, E. H. Turner, Jno. R. Commons and J. W. Sullivan.
Reports of Experts on Electric Lighting and Power:
J. B. Klumpp, A. E. Winchester, Milo R. Maltbie, Robert C. James, E. H. Turner, J. W. Sullivan and Jno. R. Commons.
Reports of Experts on Tramways:
Norman McD. Crawford, Milo R. Maltbie, J. H. Woodward, E. H. Turner, Robert C. James, Jno. R. Commons and J. W. Sullivan.
Report on Taxation of Public Utilities, by Milo R. Maltbie.

The book may be purchased from the secretary of the Federation, 281 Fourth Avenue, New York, N. Y. The price for Part 1, Volume I. (about 500 pages), is paper, $1.00; cloth, $2.00; that for Part 2, Volumes I. and II. (about 1000 pages each), is $8.00.

MEETINGS OF THE MASTER MECHANICS' AND MASTER CAR BUILDERS'

The meetings of the Master Mechanics' and Master Car Builders' Associations of the steam railroads will be held this year at Atlantic City. That of the Master Mechanics' Association occurs June 12-14, and that of the Master Car Builders on June 17-19. In connection with the conventions the Steel Pier will be used for exhibits, which, it is expected, will be more interesting and better arranged than at any previous meeting of the associations. A harmonious scheme of erection and decoration of booths has been adopted, and, it is understood, will afterwards be employed at the meeting of the American Street and Interurban Railway Association next October.

The following manufacturers which are doing a business in the electric railway field, among others, have expressed an intention of making an exhibit at the convention:

Adams & Westlake Company Chicago, Ill.
American Blower Company, Detroit, Mich.
American Brake Shoe & Foundry Company, Mahwah, N. J.
American Locomotive Company, New York City, N. Y.
American Mason Safety Tread Company, Boston, Mass.
American Steam Gauge & Valve Manufacturing Company, Boston, Mass.
American Steel Foundries, Chicago, Ill.
American Water Softener Company, Philadelphia, Pa.
Anglo-American Varnish Company, Newark, N. J.
Armstrong Bros. Tool Company, Chicago, Ill.
Atha Steel Casting Company, Newark, N. J.
Baeder-Adamson Company, Philadelphia, Pa.
Baldwin Steel Company, New York City, N. Y.
Bickford Drill & Tool Company, Cincinnati, O.
F. S. Bowser & Company, Ft. Wayne, Ind.
Brady Brass Company, Jersey City, N. J.
Buda Foundry & Manufacturing Company, Chicago, Ill.
Columbia Nut & Bolt Company, Bridgeport, Conn.
Carborundum Company, Niagara Falls, N. Y.
The Philip Carey Manufacturing Company, Cincinnati, O.
Chicago Pneumatic Tool Company, Chicago, Ill.
Chicago Railway Equipment Company, Chicago, Ill.
Cling Surface Manufacturing Company, Buffalo, N. Y.
Consolidated Car Heating Company, New York City.
Crocker-Wheeler Company, Ampere, N. J.
Curtain Supply Company, Chicago, Ill.
The John Davis Company, Chicago, Ill.
Dearborn Drug & Chemical Company, Chicago, Ill.
Joseph Dixon Crucible Company, Jersey City, N. J.
G. Drouve Company, Bridgeport, Conn.
Dressel Railway Lamp Works, New York City.
Richard Dudgeon, New York City, N. Y.
Duff Manufacturing Company, Allegheny, Pa.
The O. M. Edwards Company, Syracuse, N. Y.
Electric Storage Battery Company, Philadelphia, Pa.
Flexible Compound Company, Philadelphia, Pa.
Fox Machine Company, Grand Rapids, Mich.
Galena Signal Oil Company, Franklin, Pa.
Garvin Machine Company, New York City, N. Y.
General Electric Company, Schenectady, N. Y.
Gold Car Heating Company, New York City, N. Y.
Goldschmidt-Thermit Company, New York City, N. Y.

Grip Nut Company, Chicago, Ill.
Hale & Kilburn Manufacturing Company, Philadelphia, Pa.
Edw. Harrington, Son & Company, Philadelphia, Pa.
Harrison Dust Guard Company, Toledo, O.
Indestructible Fibre Company, Massena, N. Y.
H. W. Johns-Manville Company, New York City, N. Y.
Kalamazoo Railway Supply Company, Kalamazoo, Mich.
Keystone Brake Shoe Company, New York City, N. Y.
Keystone Lubricating Company, Philadelphia, Pa.
Kinnear Manufacturing Company, Columbus, O.
V. O. Lawrence Company, Philadelphia, Pa.
John R. Livezey, Philadelphia, Pa.
Lodge & Shipley Machine Tool Company, Cincinnati, O.
Geo. W. Lord Company, Philadelphia, Pa.
John Lucas & Company, Philadelphia, Pa.
McConway & Torley Company, Pittsburg, Pa.
McGuire-Cummings Manufacturing Company, Chicago, Ill.
McCord & Company, Chicago, Ill.
Modoc Soap Company, Philadelphia, Pa.
National Brake & Electric Company, Milwaukee, Wis.
National Lock Washer Company, Newark, N. J.
A. O. Norton, Boston, Mass.
Norton Company, Worcester, Mass.
Ohio Brass Company, Mansfield, O.
Oil Well Supply Company, Pittsburg, Pa.
Pantasote Company, New York City, N. Y.
Perry Side Bearing Company, Chicago, Ill.
Riverside Metal Company, Riverside, N. J.
Rubberset Brush Company, Newark, N. J.
Sauvage Safety Brake Company, New York City, N. Y.
Schoen Steel Wheel Company, Pittsburg, Pa.
Shelby Steel Tube Company, Chicago, Ill.
Sherwin-Williams Company, Chicago, Cleveland.
Sprague Electric Company, New York City, N. Y.
Standard Paint Company, New York City, N. Y.
Standard Steel Works, Philadelphia, Pa.
Stoever Foundry & Manufacturing Company, New York City, N. Y.
T. H. Symington Company, Baltimore, Md.
H. B. Underwood & Company, Philadelphia, Pa.
U. S. Metal & Manufacturing Company, New York City, N. Y.
Union Spring & Manufacturing Company, Pittsburg, Pa.
Watson-Stillman Company, New York City, N. Y.
Wells Light Manufacturing Company, New York City.
West Disinfecting Company, New York City.
Westinghouse Air Brake Company, Pittsburg, Pa.
Wilmarth & Norman Company, Grand Rapids, Mich.
J. H. Wagenhorst & Company, Youngstown, O.
Wheel Truing Brake Shoe Company, Detroit, Mich.
Yale & Towne Manufacturing Company, New York City, N. Y.

THE CLEVELAND SITUATION

Judge Chapman has granted the Cleveland Electric Railway Company a temporary injunction restraining the Low Fare Railway Company from operating cars on the Euclid Avenue line between the Public Square and East Fourteenth Street, where it was proposed to form a junction with the tracks of the new company that have been extended from the Erie Street Cemetery. The court stated that the order would have been made to cover the Superior Street line from West Twenty-Eighth Street to the Public Square, but consideration for public convenience induced him to leave that portion open until the final decision of the question. No need for such consideration exists as to Euclid Avenue, as there is no particular need of the original line of the Low Fare Railway Company about the cemetery.

Officers of the Low Fare Railway Company stated that they would go to Council for another franchise ordinance enabling them to use Euclid Avenue, and they are quoted as saying that they will be able to get another ordinance much easier than they can get a favorable decision from the courts.

Officials of the American Steel & Wire Company have asked for a street railway line that will accommodate the men who will be employed in their new mills on Harvard Street in the village of Newburg Heights. Mayor Johnson suggested that he would co-operate in securing a line to connect the Cleveland Electric tracks at Harvard Street and Marceline Avenue, through Harvard Street over the flats and across the river on a bridge, with the Denison Avenue line of the Forest City Railway Company. J. J. Stanley has a bid based on 2-cent fare in the village of Newburg Heights. The Mayor's suggestion would compel the Cleveland Electric and the Forest City Railway to co-operate and use tracks jointly. a scheme that is impossible under existing conditions in Cleveland.

Hereafter the board of directors of the Cleveland Electric will hold weekly meetings, at which all phases of the situation will be discussed. The company is progressing well with its campaign for renewal of franchise, and has adopted the phrase, "Speak or write to your Councilman about it," which appears on all the advertising matter that is issued. If a political issue is made of the question the company will probably not appeal to either party.

As expected an ordinance was introduced in the City Council, Monday evening, for the purpose of granting the Low Fare Railway Company the right to use the tracks of the Cleveland Electric jointly with that company on Euclid Avenue, between the Public Square and East Fourteenth Street, the portion of the street the new company was enjoined from using by Judge Chapman. The ordinance also provides for the joint use of the Cleveland Electric tracks on Superior Avenue and Detroit Avenue to West Twenty-Eighth Street. This ordinance is meant to get around the injunctions on all these lines and evade the court orders which contemplate facts and not mere wording of ordinances.

The ordinance granting the Cleveland Electric a five-year franchise on Central Avenue and Quincy Street came up for consideration Monday evening, but was again referred to the committee on railroads pending the filing of consents by the company. It is probable that the company does not care for so short a franchise on the streets and will not use its consents until it feels reasonably sure that its measure will receive the support of the Council.

Opposed by the attorneys for the new companies, Judge Chapman overruled the motion of the Cleveland Electric to advance the financial interest case affecting the East Side and secure a speedy trial. The court wanted to combine this case with one affecting Denison Avenue and other West Side streets in which the same allegations were made, but both companies objected to this. He then refused to advance the case in question, and it will come up in its regular order. It is said the Mayor opposed the advancement of any of the cases, as he wishes no settlement or decision of any kind until after the election this fall, fearing that it would injure his chances of re-election.

On Wednesday, June 5, the Cleveland Council suspended its rules and passed the ordinance granting the Low Fare Company joint use of tracks on Euclid Avenue from the Square to Fourteenth Street, and on Superior Avenue and Detroit Streets to West Twenty-Eighth Street.

ELECTRIC RAILWAY ENGINEERING AT THE WORCESTER POLYTECHNIC INSTITUTE

Progress in electric railway engineering will occupy a conspicuous place in the program of commencement week at the Worcester Polytechnic Institute this year. The commencement ceremonies begin with the baccalaureate sermon in Central Church, on June 9. On June 11 the new Electrical Engineering Building will be opened for inspection, and in the evening the annual commencement lecture will be given in the lecture room of the Electrical Engineering Laboratories, by A. S. Richey, professor of electrical engineering. The subject of the lecture is "The Electric Railway." On Wednesday the hydraulic testing plant at Chaffins will be opened for inspection and an opportunity also given to see a four-stage centrifugal pump, an 80-hp. horizontal turbine, a turbine flow recorder, a pitometer of latest design, a Pelton water-wheel, a current meter, and a water-wheel governor in full operation. On Thursday, June 13, the commencement address will be given by Charles F. Scott, consulting engineer of the Westinghouse Electric & Manufacturing Company. The subject of Mr. Scott's address is "Some Aspects of Electrical Development."

BROOKLYN SUBWAY CONSTRUCTION BIDS

The Board of Estimate held a special meeting Monday, June 3, for the purpose of acting on the request of the Board of Rapid Transit that the Board of Estimate rescind its previous action so as to allow the advertising for bids on the construction alone of the Fourth Avenue Subway in Brooklyn. A resolution to this effect was passed unanimously.

Borough President Haffen, of the Bronx, tried to bring up another matter, but was ruled out of order. Afterward he and Mr. Metz had a slight altercation. Haffen wants subways for the Bronx, and Metz, just at present, is helping Brooklyn get one.

AFFAIRS IN CHICAGO

The protective committee for the West Division and North Chicago City Railway Companies have sent a letter to the stockholders of these companies in which the committee's position is stated as to the deposit of stock in the "blind pool" now being worked out to insure the acceptance by the Union Traction interests of the recently passed street railway ordinance and the reorganization of these interests under the name of the Chicago Railways Company. In brief, it is a demand that the West Division and North Chicago City Railway Companies be recognized in the reorganization plans and that an attorney representing them be joined by C. W. Wickersham, now acting on behalf of the West and North Chicago Street Railway Companies, and L. C. Krauthoff for the Union Traction Company. Quoted in the circular is a letter written by Cyrus H. McCormick to Judge Grosscup in which this same demand is made. The circular, which is signed by Cyrus H. McCormick, Thomas Templeton, Charles W. Ware and John F. Bass, on behalf of the West Division Company, and Leon Mandel, Charles A. Mair, James F. Porter, John A. Chapman for the North Chicago City Company, sets out that there is now deposited the needed amount of stock of the first named company and practically enough of the second one to comply with the terms of the ordinance, but "your committee will not recommend the deposit of the required percentage of the stocks of the underlying companies until they are satisfied that the arbitrators are not going to be hampered in any way in making their award."

"The most important points about which we are not satisfied," the circular continues, "are in regard to the raising of the new money which the company will require for rehabilitation and in regard to the persons who are to prepare in the first place the plan of reorganization for submission to the arbitrators. On the first of these points we ask to have disclosed the names of the bankers and their terms. On the second, we demand that Messrs. Krauthoff and Wickersham, who were originally employed at the instance of the North and West Chicago Street Railway Companies and the Union Traction Company, and who, at the direction of these interests, are at work upon a plan, shall have no more power in the distribution of securities than your attorneys or the attorneys of bondholders. They represent only particular interests. They do not represent you. If any official plan of organization is to be given out you should have a voice in framing it. The fairest would be first to arrange for the financing, next to agree on the kinds of other securities to be issued by the new company, and then to leave the distribution of the latter entirely to the arbitrators."

The employees of the Chicago City Railway Company have voted to accept the offer of the company made prior to the last municipal election. This decision ends all likelihood of labor trouble in Chicago, as the men of the North and West divisions, whose contracts expire on May 31, also have decided to accept the action of the South Side division as a basis for their demand. By the action of the men they will receive back pay dating from April 1, and the contract which the men have approved will date from the first day of August, 1907, and be in force for one year from that date. The 2700 employees will receive back pay amounting to more than $50,000, in addition to their regular salaries. During the year the advance granted by the company will amount to $150,000. The agreement approved by the employees is the same as was repudiated shortly after the notices were posted in the car houses of the company, and a counter demand made upon the company, which was denied in every particular by President Mitten when he resubmitted his original proposition without a single change, and gave the employees until the last day of May to accept, stating that the offer would be withdrawn after that date. Men who received 19 cents an hour will in the future receive 25 cents; those receiving 25 cents an hour will receive 27, and the same working conditions contained in the present agreement are renewed for the period of one year, commencing Aug. 1.

NEW YORK LEGISLATION

The Public Utilities bill has been repassed over Mayor McClellan's veto in the New York Assembly.

The Senate has defeated a motion made by Senator Grady to discharge the railroad committee from further consideration of the Coney Island Five-Cent Fare bill. This means that the bill will die in committee.

The Assembly has passed unanimously the Phillips bill which compels corporations to pay franchise taxes as a condition of their going into court to obtain a review of their assessment by the State Tax Commission.

CONFERENCE ON MILWAUKEE SITUATION

At the conference between the transportation committee of the Merchants & Manufacturers' Association, of Milwaukee, and President John I. Beggs, of the Milwaukee Electric Railway & Light Company, with reference to the matter of a more complete and comprehensive transportation system for the city of Milwaukee, it was stated by members of the committee that the intention and desire is to give President Frost, of the Chicago & Milwaukee Electric Company, who is now building toward Milwaukee from Racine, and Vice-President Walker, of the Milwaukee Northern Electric Railway Company, an opportunity also to present their views. It was thought best, however, to have these conferences at different times, as President Beggs desired to present his ideas and display his plans for extensions to the committee without being subject to questions relative to them before a general meeting of men interested in the move to construct new lines in the city.

LIGHTNING REPORT AND DATA BLANKS DISTRIBUTED

The Central Electric Railway Association is sending to every traction manager in Indiana and Ohio a set of lightning report and data blanks prepared by the chairman of the lightning arrester committee, Geo. Whysall, of Marion, Ohio. It is the desire of the chairman to have the lightning report blanks filled out according to the number of storms occurring during the summer months, and then returned to the committee for compilation prior to the fall meeting in September. The data blanks are to be filled out and returned immediately to the secretary.

The data blank covers the details of the generating station equipment, sub-station equipment, low-tension arresters, high-tension lines, trolley lines, overhead ground wires, track, and rolling stock. The lightning report blank covers such observations of the discharge as the time, whether there was a steady static discharge, whether there was a temporary arc, the location of the discharge and other data, incidental phenomena and damage or interruption.

ANOTHER DIVISION OF THE SPOKANE & INLAND OPENED

General Manager J. B. Ingersoll, of the Spokane & Inland, has announced the inauguration of passenger service south from Oakesdale to Garfield and Palouse, a distance of nearly twenty-five miles. For the present it is probable that trains will reach Garfield by electric power, and then proceed to Palouse by steam, as the overhead construction is still incomplete between those towns. The extension of the train service will require an entire new train schedule. Three through trains will be run between Spokane and Palouse in either direction. Trains will leave Spokane for Palouse at 7:35 a. m., 1:30 p. m. and 4:55 p. m. Trains will leave Palouse at 7:55 a. m., 12:15 p. m. and 4:55 p. m. Trains on the eastern or Palouse division will not make stops between Spring Valley Junction and Spokane, going or coming, but will make all stations below the junction. The running time between Spokane and Palouse will be 3 hours, until the roadbed becomes more settled, when it is probable the time will be reduced. By the new schedule the forty stations between Spokane and Rosalia, on the western division, will be served by four trains each way, as at present. South-bound the trains will leave Spokane at 7:00, 9:40, 1:00 and 5:30, while trains will leave Rosalia for Spokane at 6:00, 9:30, 1:45 and 4:15. With the opening of train service to Palouse the Spokane & Inland will be operating 81 miles of road, 76 from Spokane to Palouse, and 5 on the western division, Spring Valley to Rosalia. This, with the 44 miles now in operation on the Coeur d'Alene division and the 23 miles operated by the Spokane Traction Company, makes an aggregate mileage of 150 for the Inland Empire system.

PROGRAM OF NEW YORK STATE CONVENTION

J. H. Pardee, secretary of the Street Railway Association of the State of New York, expects to issue, in about a week, a circular giving the program to be followed at the meetings of the Association at Hotel Champlain, Bluff Point, N. Y., on June 25-26. This circular will also include a statement of the method of securing the usual convention transportation rates, as well as the summer schedule of trains of the Delaware & Hudson Railroad to Bluff Point. This schedule will go into effect a few days before the date of the meeting.

MR. BAER RETRACTS—ADMITS ELECTRICITY TO BE SOLUTION OF SUBURBAN SITUATION

George F. Baer, president of the Reading Railway, ordered on Tuesday, June 4, what is virtually a restoration of the passenger rates that were enjoyed by the commuters on the Reading Railway out of Philadelphia prior to May 28, when a new and advanced summer schedule went into effect, as noted in the STREET RAILWAY JOURNAL of June 1, with effects other than those Mr. Baer had anticipated. Instead of the old 50-trip tickets at the increased rates that were announced on May 25, 60-trip tickets, representing a rate of about 1 cent a mile, good only for use by one individual during one calendar month, are now on sale at all points in the territory between and including the Reading Terminal, Third and Berks Streets, Chestnut Hill, Glenside, Frankford, Fox Chase, Rydal, North Manayunk and West Manayunk. School tickets containing 46 trips and good between the above-named points are also included in the concessions granted by the company. In announcing the increase Mr. Baer said that the low rate heretofore prevailing was due to the competition of the trolley lines, but that the company felt that the rates must be readjusted in order that a more uniform rate might be adopted. The general passenger agent, Mr. Weeks, was made responsible for the change, the notice being issued over his signature. Mr. Baer has now promised that as soon as practicable the Reading will establish electric lines to all its suburban points and reduce the fares to the lowest possible minimum.

PENNSYLVANIA BILLS SIGNED BY THE GOVERNOR

Governor Stuart has signed both the Dunsmore State Railroad Commission bill and the Hoshmer trolley eminent domain bill.

The State Railroad Commission will consist of three commissioners, who shall take office the first Monday in January, 1908. They will be appointed by the Governor for three, four and five years, respectively, and each succeeding appointment will be for five years. Headquarters of the commission, which will have jurisdiction over the electric, as well as steam railroads, of the State, will be at the State Capitol. Among other appointments which the commission will have authority to make is that of an inspector, who shall be an expert in electrical affairs. The commission is empowered to recommend the manner, under existing laws, in which one electric railway may cross another electric railway, and also to compel the giving by steam or electric roads of any information requested by the commission, which shall also have power to administer oaths in all matters relating to its duties; to inquire into the management and business of all common carriers, including freight and passenger tariffs and rates, equitable distribution of cars, granting of sidings and regulation of crossings, location of freight and passenger stations, adequacy of facilities for transportation purposes.

If the commission finds that any of the "rates or charges established or demanded by any railroad are excessive or unreasonable, or that improvements to a railroad's property are reasonable and expedient to promote the security and convenience of the public," it shall give notice to the company. If, after a hearing, the carrier neglects to carry out the recommendation, the facts are to be certified to the Attorney-General and the next Legislature.

The Hoshmer bill grants to trolley companies the right of eminent domain, provided they secure the consent of 51 per cent of the property holders along the proposed new line or extension. The bill was opposed by the steam roads and also by residents of suburban towns outside of Philadelphia who feared it would permit the cutting up of many fine residential sections. Trolley men expect the bill will give a tremendous impetus to the building of electric roads all over the State.

The bill introduced by Representative Fahey, of Philadelphia, amending the act of 1895 governing street railway companies, was also signed. It provides that the consent of the local authorities of all the cities, boroughs and townships of the first class and the Board of Road Supervisors of townships of the second class be obtained before the granting of any such charters.

Another measure approved is that forbidding those officers, employees or agents of any railroad company operating within the State, who have charge directly or indirectly of the distribution of cars to shippers, to own or have any interest whatsoever in any operated coal property or the stock of any mining or manufacturing company along the line of such railroad.

The bill is intended to prevent the gifts of coal and other stocks to railroad men, such as were brought out in the Pennsylvania Railroad scandal.

The bill to prohibit trolley companies from purchasing or guaranteeing the stock or bonds of other securities or the lease or purchase of the works or franchises of any competing street railway or any company having under its control a parallel line was also signed.

PROGRESS ON THE NORTHERN ELECTRIC COMPANY'S LINES

The Northern Electric Company has decided to commence at once the construction of the Chico-Hamilton City line. It is understood that work on the road will be prosecuted on both sides of the Sacramento River simultaneously in order to connect Chico and Hamilton City at the earliest possible time. The company will soon convert its property at 1020 Eighth Street, in Sacramento, into a baggage room and ticket office for the accommodation of the passengers when the company has its interurban line running into Sacramento from Marysville, Chico and Oroville. The company is rushing work on its lines to this city, and expects to be operating cars to Sacramento about Aug. 1.

Henry A. Butters, Eugene de Sabla, John Martin and Sloss & Lilienthal, who own the Northern Electric Company, are said to be the real parties interested in the Vallejo & Northern Electric Railroad, and it is asserted that in the near future they will have an electric railroad system from Vallejo via Sacramento as far north as Red Bluff. In fact, if present tentative deals are perfected they are likely to extend the electric railway system on to Napa City, San Rafael and a point near Belvedere, and have a ferry system into San Francisco in addition to a connecting boat line between this city and Vallejo. The Northern Electric, or Butters Syndicate, is now completing a system which takes in Chico, Oroville, Marysville, Red Bluff, Sacramento, Hamilton and Colusa. Richard Hotaling, W. M. Rank and their associates project an electric railway from Belvedere via San Rafael to Napa and thence to Lakeport.

CAPITAL TRACTION DEED FILED FOR RECORD

The Capital Traction Company, of Washington, has filed for record the deed of trust upon its property recently given to the Union Trust Company, to secure an authorized issue of $6,000,000 in bonds, dated June 1, 1907, and maturing June 1, 1947. The issue is to be known as forty-year 5 per cent gold coupon bonds, and is made under the provision of an act of Congress of March 3, 1891, in which it was provided that bonds might be issued by the company not to exceed in the aggregate amount of their face value one-half of the capital stock of the company, which is $12,000,000.

It is recited in the paper filed for record that April 2, 1900, the company authorized the issue of bonds to the extent of $1,500,000, the proceeds of which have been entirely used to aid in paying for the construction and equipment of its railroads. Other sums, it is stated, are now required by the company for further necessary construction and equipment, which, it is believed, with the preceding issue, will not exceed the sum of $4,000,000 to be expended in the near future. In order to provide for probable future needs it was thought expedient to make the authorized issue $6,000,000. Only $4,000,000 worth of bonds are to be issued at present.

Of the $4,000,000 issue, bonds to the amount of $2,520,000 are to be first offered to the stockholders of the company pro rata at par, and so many of the bonds as shall not be so taken by the stockholders, together with the remaining $1,480,000 of the issue are to be held by the company, to be negotiated by the directors when and as they shall deem best.

The proceeds of the sale of the $2,520,000 of the issue are to be applied first to the payment of the outstanding bonds, amounting to $1,080,000, then to the payment of the company's floating indebtedness of $600,000, and the balance used for further necessary construction and equipment of the company's railroads and extensions now authorized, including new power stations, new car houses, changing grades and purchasing new cars and other equipment. When the $4,000,000 issue has been exhausted, it is provided that the remaining authorized $2,000,000 may issue in the discretion of the board of directors.

STRIKE IN BIRMINGHAM DECLARED OFF

The strike on the lines of the Birmingham Railway, Light & Power Company, of Birmingham, Ala., which has been continued in a very small way ever since it started on May 20, was formally declared off June 11. As a final desperate effort to revive interest in it the leaders attempted on June 10 to start a sympathetic strike by calling out the barbers and carpenters of the city. Most of them, however, refused to leave their work, and 24 hours later the sympathetic strike was declared a failure. The former street railway employees are now making applications for reinstatement and the leader has left the city in disgust. The railway strike occasioned inconvenience for only about three days, or from May 20-23, but since that time all the cars have been kept running on schedule time.

STREET RAILWAY PATENTS

[This department is conducted by Rosenbaum & Stockbridge, patent attorneys, 140 Nassau Street, New York.]

UNITED STATES PATENTS ISSUED MAY 21, 1907

854,066. Clock Mechanism for Signals; Frank O. Warner, Baltimore, Md. App. filed Feb. 25, 1907. Clock mechanism for signals including an indicator arranged to be actuated by the closing of an electric circuit and adapted to indicate the exact time of the happening of an event, such as the passage of a train past a given point.

854,124. Train Pipe Coupling; Clarence W. Taylor, Oak Park, Ill. App. filed Jan. 7, 1907. Comprises a pile coupling member having an aperture therethrough and a locking bar slidably seated therein, and adapted to be pushed through into an aperture in an opposing pipe coupling member by the recession of the members in the act of coupling.

854,148. Fluid Pressure Brake; Francis L. Clark, Pittsburg, and Walter V. Turner, Wilkinsburg, Pa. App. filed Aug. 11, 1904. An apparatus adapted to be adjusted to a light braking position or to a heavy braking position, and means operated by the train pipe pressure of the system for automatically setting the apparatus to its light braking position.

854,185. Trolley Amusement; Harry G. Traver, East Orange, N. J. App. filed Jan. 17, 1906. A pleasure railway in which the car is pulled to the top of a spiral trackway down which it travels by gravity.

854,328. Rail-Bond Protector; Leonard B. Buchanan, Woburn, Mass. App. filed March 18, 1907. A cover or guard for rail-bonds to prevent their removal by thieves.

854,330. Passenger and Like Car; Andrew Christiansen, Butler, Pa. App. filed Aug. 25, 1906. A metallic vestibule construction for cars comprising vestibule end posts having webs substantially longitudinal of the car, and metallic filling pieces between the posts of flanged shape and having integral flanges at their ends secured to the webs of the posts.

854,344. Electrical Signaling Apparatus for Engines; George J. Exterkamp, Covington, Ky. App. filed Feb. 25, 1907. An auxiliary rail between the traction rails, and specially constructed wheel axles whereby the rails are not short circuited by a passing train.

854,349. Metallic Car-Underframe; John M. Hansen, Pittsburg, Pa. App. filed Sept. 6, 1906. Details of construction.

854,403. Underframe for Passenger and Like Cars; Andrew Christianson, Butler, Pa. App. filed Aug. 25, 1906. Comprises a center sill, a transom extending outwardly therefrom and a connection plate having its body arranged vertically and secured to the end of the transom and having a top flange resting on the transom.

854,404. Frame for Passenger and Like Cars; Andrew Christianson, Butler, Pa. App. filed Aug. 25, 1906. A metallic post for railway cars having a web and flanges on the inner and outer edges, the outer flange being wider than the inner flange and having its upper portion bulged outwardly.

854,405. Passenger and Like Car; Andrew Christianson, Butler, Pa. App. filed Sept. 7, 1906. Relates to the interior finish of metallic cars.

854,406. Metallic Compartment Construction for Passenger and Like Cars; Andrew Christianson, Butler, Pa. App. filed Sept. 7, 1906. Relates to details of construction for applying a compartment at the end or in the corner of the car and which is entirely or mostly composed of metal.

854,435. Rail Anti-Creeper; Neil E. Salsich, Hartland, Wis. App. filed Jan. 2, 1907. Comprises an anchor fulcrumed on the rail, a yoke embracing the anchor and rail, and means for spiking the anchor to a tie.

854,442. Electric Motor Truck; Benjamin R. Van Kirk, Philadelphia, Pa. App. filed Nov. 30, 1906. Relates to that type of electric motor trucks in which the motors are carried by the trucks and extend beyond the wheel base of the truck. The outer portion of the motors is attached to equalizing beams which rest upon the axle boxes.

854,449. Brake Mechanism for Pivoted Car Trucks; William L. Austin, Philadelphia, Pa. App. filed Jan. 7, 1907. The brake chain extends first to the center of rotation of the truck and then around a sheave to the brake rod, so that the truck is free to swing without affecting the brake mechanism.

854,475. Key for Brake-Shoes; David H. Fairbanks, Nashville, Tenn. App. filed Oct. 23, 1906. Comprises a key having lugs or barbs on opposite faces thereof to engage abutments on the brake head and shoe to thereby lock the key in place.

854,668. Ball Cleaner; Hilary Quertier, Dunedin, New Zealand. App. filed Feb. 13, 1906. Means for mounting a plow and revolving brush for cleaning the grooves of rails.

854,687. Convertible Car; John A. Brill, Philadelphia, Pa. App. filed June 26, 1906. A car having angle-metal side sills which have a lower horizontal web, a plate secured upon the web and forming side steps and stanchions secured to the step and sill web.

854,688. Controller Operating Means; Arthur J. Brown, Norwood, Ohio. App. filed Aug. 27, 1906. Has a quick break mechanism. The controller drum has a spring or resilient connection with the handle shaft. A detent device is provided by which it follows the movement thereof abruptly.

PERSONAL MENTION

MR. E. L. SCHMOCK has been appointed purchasing agent of the Cleveland, Painesville & Eastern Railroad Company, of Cleveland, Ohio. Mr. Schmock will have his headquarters at Willoughby, Ohio.

MR. JOHN HANF, who recently resigned as master mechanic of the International Traction Company, of Buffalo, N. Y., was presented with a handsome silver loving cup by the foremen and the office force under him, a few days ago, as a token of their esteem.

MR. L. H. KIDDER, formerly of the Westinghouse Electric Manufacturing Company, has severed his connection with that company and has been appointed superintendent of motive power of the Pittsburg & Butler Street Railway and the Butler Passenger Railway.

MR. DANIEL FRANCISCUS has been appointed to succeed Mr. C. Faller as superintendent of the Carlisle & Mt. Holly Traction Company. Mr. Faller is now superintendent of the Carlisle Gas & Water Company, and Mr. S. P. Goodyear has been chosen auditor of both companies.

MR. GEORGE SYDNEY BINKLEY, late chief engineer and manager of construction of the Monterey Water & Sewer Company and the Monterey Railway, Light & Power Company, of Monterey, N. L., Mexico, has become manager of the mining properties and smelter of the Douglas Copper Company, State of Sonora, Mexico.

MR. E. F. DAVIS has resigned from the Brooklyn Rapid Transit Company as district superintendent of the southern district, and expects to leave Brooklyn shortly for Minneapolis,

Minn., for the purpose of attending to personal interests located there. Mr. Davis has been connected with the Brooklyn Rapid Transit Company since October, 1903. During this time he has held positions as assistant superintendent and division superintendent, and, finally, on Jan. 1, 1906, was made district superintendent of the southern district, which embraces all the surface lines in South Brooklyn, including the Coney Island lines, the system being divided into two districts. Mr. Davis has been railroading continuously since 1893, except for three years, which were occupied in gold mining in the Northwest.

MR. G. J. ANDERSON, who has been assistant to Mr. P. F. Sullivan, general manager Massachusetts Electric Companies for the past eight years, has resigned from the company to become private secretary to Mr. S. Z. Mitchell, vice-president of the Electric Bond & Share Company, of New York.

MR. J. M. BRAMLETTE, general superintendent of the Michigan United Railways Company's lines, has been appointed to the position of general manager of the company. Mr. Bramlette succeeds Mr. J. R. Elliott, who will retain the office of vice-president, and will have active charge of the construction of the Lansing & Jackson line, on which work will begin immediately.

MR. R. C. TAYLOR, superintendent of motive power of the Indiana Union Traction Company, of Anderson, Ind., has been appointed chairman of the standardization committee of the Central Electric Railway Association, to fill the vacancy caused by the resignation of Mr. W. H. Evans, who, as noted elsewhere in this issue, has been appointed master mechanic of the International Railway Company, of Buffalo.

MR. JOHN POWERS, superintendent and electrical engineer of the Sterling, Dixon & Eastern Electric Railway Company, of Sterling, Ill., has resigned from the company to enter the employ of the Milwaukee Electric Railway & Light Company, of Milwaukee, Wis., owned by the same interests as control the Sterling, Dixon & Eastern Company. Mr. Powers on leaving Sterling was presented by his associates in the company with a handsome Masonic watch charm as a token of esteem.

MR. CHARLES KENMOUTH STEARNS, an electrical engineer, who was identified as an assistant engineer with the electric equipment of the Nantasket Beach branch of the New York, New Haven & Hartford Railroad, is dead. Of late Mr. Stearns had acted in a consulting capacity for a number of street railways. He was a member of the American Institute of Electrical Engineers and of the American Society of Mechanical Engineers. He was born at Newton Center, Mass., in 1864, and was a graduate of the Massachusetts Institute of Technology.

MR. L. F. LOREE, president, and MR. C. S. SIMS, general manager of the Delaware & Hudson Railroad, were elected on June 1 as president and vice-president, respectively, of the United Traction and Hudson Valley Railway Companies, Mr. I. A. Culver formally retiring as president and general manager of the Delaware & Hudson Company. Messrs. Loree and Sims also were recently elected president and general manager, respectively, of the Schenectady Railway Company, another Delaware & Hudson interest.

MR. T. FRAME THOMSON, of Buenos-Aires and London, and director of La Capital Company, of Buenos-Aires, is on a short trip to this country. Under the plans of the new organization which will control the tramways of Buenos-Aires, described in the last issue, Mr. Thomson is to be one of the directors of the new company and also a member of the executive committee, which will consist of Messrs. V. Fris, D. Heinemann, Ch. Cicogna and Leon Janssen, of Brussels; O. Oliven, of Berlin; Thomson and Lazarus, of London.

MR. J. H. BRENNAND, superintendent of the Sydney division of the New South Wales Government Tramways, at Sydney, Australia, is making an extended visit in this country. Mr. Brennand arrived at Vancouver some two months ago, and has been inspecting the electric railway systems of the country on his trip East. He expects to sail for Australia during July, and on his return trip will visit Los Angeles, San Francisco and some of the other cities on the Pacific Coast. Mr. Brennand is making this trip in company with Mr. John Mitchell, architect of the Educational Board, of Auckland, New Zealand. Mr. Mitchell is making a special study of reinforced concrete construction as exemplified in this country.

MR. G. U. G. HOLMAN has been appointed manager of the electrical department of the Boston branch of the H. W. Johns-Manville Company and has already entered upon his new work. Mr. Holman is well known in electrical and railway circles. After graduating from the Massachusetts Institute of Technology, he was for several years with the Thomson-Houston and General Electric Companies, in Lynn, Mass., New York City and Minnesota. He left the General Electric Company in 1892 to become railway engineer with the Mather Electric Company, of Manchester, Conn., and later was engaged in the lighting field in Philadelphia for five years. During the last few years he has been connected with the construction and operation of electrical enterprises in New York, Philadelphia and Canada. He has also been a contributor to this and other technical papers on engineering and financial subjects.

MR. W. H. EVANS has been appointed master mechanic of the International Railway Company, of Buffalo, N. Y., to succeed Mr. John Hanf, resigned, who retired from the company on June 1, as noted in the STREET RAILWAY JOURNAL of May 25. Mr. Evans formerly was master mechanic of the Indianapolis Traction & Terminal Company, of Indianapolis. He first entered street railway work several years ago at Minneapolis with the Twin City Rapid Transit Company. Subsequently he was connected for a short time with the Chicago City Railway Company. Mr. Evans has been very active in the affairs of the Central Electric Railway Association, and has taken a considerable interest in the American Street & Interurban Railway Association, serving for the former as chairman of its standardization committee and for the latter as a member of the standardization committee.

MR. C. V. WOOD has been appointed general freight and passenger agent of the New England Investment & Security Company, of Worcester, Mass., which operates the electric railways in Massachusetts controlled by the New York, New Haven & Hartford Railroad. Mr. Wood, who will co-operate with Mr. A. B. Smith, general traffic manager of the company, is to take charge of the excursion business and the through passenger and parcel express business of the company, and will supervise and advise in regard to the development and management of all lines that come under his jurisdiction. Mr. Wood formerly was superintendent of the Pittsburg and Cleveland divisions of the Wheeling & Lake Erie Railroad, the Wabash-Pittsburg Terminal Railway and the West Side Belt Railway at Canton. Mr. Wood's steam railroad experience, however, dates from his connection in 1881 as telegraph operator with the Grand Trunk Railway.

MR. T. F. GROVER has been appointed general manager of the Terre Haute division of the Terre Haute, Indianapolis & Eastern Traction Company, which owns the properties of the Terre Haute Traction & Light Company, including the local railway and lighting plants in Terre Haute and Brazil and the interurban railways from Haute to Brazil, Clinton, Sullivan, St. Mary's and Paris, and entered upon his duties June 1. Mr. Grover, who since 1905 has been employed in consolidating the street railway, electric and gas properties in and about Trinidad, Col., has been identified with electrical interests since the electric current was first introduced on a commercial scale. He was born and brought up in New Jersey and the East, but has been in the Northwest since 1892. He was the superintendent of the former Milwaukee & Wauwatosa Electric Company, which he left in 1896 to go to Fond du Lac, Wis., where he acquired an interest in and was vice-president and superintendent of the then Fond du Lac Electric Company. Having secured a new electric light, street railway and gas franchise, he then formed the Fond du Lac Railway & Light Company, which later acquired the property of the Gas Light Company. In 1899 he built the street railway system in Fond du Lac, which in the following year was extended to North Fond du Lac. In 1902 the Fond du Lac & Oshkosh Electric Railway Company was incorporated, of which he was the general manager and later its president. This company was subsequently absorbed by the Eastern Wisconsin Railway & Light Company, from which Mr. Grover retired in 1905.

T. F. GROVER

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Changes of advertising copy should reach this office by 10 a. m. Monday preceding the date of publication, except the first issue of the month, for which changes of copy should be received two weeks prior to publication date. New advertisements for any issue will be accepted up to noon of Tuesday for the paper dated the following Saturday.

Of this issue of the Street Railway Journal 8000 *copies are printed. Total circulation for* 1907 *to date,* 198,050 *copies, an average of* 8252 *copies per week.*

Controlling the Scrap Heap

The disposal of scrap in power plants and repair shops is a matter of great importance, not only on account of the waste which often occurs in even well-organized stations and maintenance departments, but because of the demoralizing effect on the men of lack of care in the handling of all materials. Experience shows that men are often more wasteful of large quantities than of small bits of scrap, and for this reason it has been found wise in some instances to keep an open receptacle of moderate size for daily accumulation, and a larger bin, provided with a locked cover, into which the smaller boxes can be emptied from time to time.

Few roads are so improvident as to throw away copper wire or single pieces of equipment which can be melted over or used a second time without repairs, but there is often a tendency to throw into the scrap pile to be sold as junk parts of apparatus which lack only some one or two pieces, put in place on a rainy day, to make them good for at least a limited service. If a company maintains a brass foundry, a considerable amount of scrap can be remelted to good advantage. Trolley wheels which are worn out, broken or chipped controller contacts and fingers, parts of circuit breakers and various brass fittings used on the cars can be remelted, along with partly ruined wire stripped from burned-out armatures or fields. Even the dirt of the foundry beneath the brass furnace can be sold at a good price. It is, of course, a mistake to store obsolete equipment on the premises, for the room it requires is not worth the trouble as a rule. The problem of looking after the scrap, including burned-out incandescent lamps, wornout commutator brushes, broken rheostat grids, cracked bearing shells, etc., may well be taken in charge by the shop employee who keeps the storeroom in shops. What the situation generally requires is systematic treatment in place of the neglect so often seen.

The Under Side of the Car Again

That cars have been built with practically no thought to the wiring and to the hanging of the apparatus underneath the bodies is at once evidenced by an inspection of the under sides of many cars. The designers of some, it may be added, have arranged the bottom framing just as though wiring resistance boxes, air pumps and brake rigging were never to be required. Such procedure can only result in the apparatus being installed in an unsatisfactory manner. Moreover, the labor cost of installing the wiring and apparatus is greatly increased when no provisions for them have been made and the workmen are compelled to spend half their time in doing carpenter or machine work.

In the last few years, however, more consideration has been given to this feature of car construction. On another page of this issue an article will be found on the installation of the wiring and control apparatus of fifty Metropolitan West Side Elevated cars, Chicago, and reference to the cost data in connection with the installation will emphasize the statement that time spent in making provision for the wiring and the hanging of the apparatus when the body is designed is a good investment. These figures show that the apparatus was installed at an unusually low cost. In this case, a careful consideration of the location of the apparatus resulted in short connection conduits between the different parts of the control system. The lessened material of

course resulted in a decreased cost of labor as well as of material.

In the Metropolitan job, however, the aim was not to cheapen the cost of installation. It was rather to put the apparatus and conduit up in a manner that would assure of its not giving future trouble. The appearance was also considered. Lessened cost, substantiality and appearance seem to have gone hand in hand in this instance, and we believe it is safe to say that this will usually be found the case.

It must not be inferred that making provisions for wiring in the design of the car and giving attention to the installation of the wiring and the apparatus give good returns only with steel framings and conduit construction. We feel certain that like results will be obtained with timber framing and with wiring that is not run in conduit.

In locating the apparatus a very important point to be kept in mind is so to place it that a minimum amount of wire will be required. The less the wiring the less usually will be future trouble, the better will be the appearance and the less will be the cost entailed.

Superheated Steam

The numerous papers on superheat read at the recent Indianapolis meeting of the Society of Mechanical Engineers are, no doubt, some indication of the interest that is felt in the question of superheated steam. Historically, superheating is by no means new. Patents for a superheater were taken out over one hundred years ago. Trevithick or some other Cornish engineer discovered the merit of the principle when he built a furnace under the great cylinder, and later Penns, of Greenwich, fully proved the economy of superheat, but at the same time discovered the superior decomposing effect upon tallow of superheated as compared with saturated steam. Trevithick indeed patented a superheater in the year 1811, and Hirn wrote about them in 1857. But want of a permanent oil killed them, and meantime higher pressures and compound working came into being and superheating lapsed into desuetude until revived a dozen years or so ago after engineers had begun to grasp what the mineral oils now rendered possible, namely, higher temperatures. There are numerous superheaters now made, but they may be all classed in two divisions, controllable and uncontrollable. The former have the temperature of the steam controlled within narrow limits of variation by means of hot water circulated through pipes threaded through the pipes of the superheater. These latter pipes are large and heavy so as to give some inertia control by means of the mass effect of the heavy pipes and to give the finer control by means of variation of the quantity of water which is made to flow through the internal control pipes. This quantity is automatically increased or diminished by the use in the length of the circulatory system of a steam inspirator worked by superheated steam, and, therefore, more or less active as a propelling agent according as its temperature is higher or lower.

The uncontrolled type is always built up of small tubes and the temperature fluctuation is liable to be considerable. But in a battery of boilers, each with its superheater, the temperature of the superheat in the main steam pipe is the mean of that of all the contributing supplies from the several superheaters. Thus the engine will probably always receive a fairly average quality of steam. We think that power station engineers should pay attention to the question which is now being so much ventilated. In the use of steam there can be no doubt as to the economy to be derived from superheat in the matter of coal consumption. From the gross economy we have to subtract the interest and depreciation charges and various other expenses in order to arrive at a fair estimate of the commercial economy possible. With proper care and choice of apparatus, it ought not to be difficult to show an economy on the commercial side.

The Analysis of New Routes

In the regular growth of a large city street railway system the analysis of conditions bearing upon the selection of new car routes is a problem of far-reaching consequence. Hasty action in planning such alterations or extensions is likely to cut into the profits of the company as the system expands, and nothing but a detailed study of the relations of the new route to the rest of the company's territory is a safe guide to decisions. Small as is each change in routeing, it is of immense importance as a tendency in the service which creates or discourages traffic, and which enables the company to handle its business with greater economy or results in increased cost per passenger carried.

In general, the longer ahead an actual route change can be foreseen, the more probable it is that a sound decision can be reached in regard to it. On even small systems an endless study of the traffic and service must be conducted by operating officials if the data are to be secured which can some day be effectively utilized in settling broad and detailed questions of expansion. Conferences with real estate interests, observations of the prices of land and building tendencies in different districts, studies of tax records, proceedings of improvement associations, suggestions of the public as heard by conductors, inspectors and higher officers of the company, and as expressed in the press, must all be brought together in the study of the service and anticipation of future needs.

When a divisional organization obtains, the superintendent of each division should be able to present many valuable suggestions bearing upon present and prospective routes. An active superintendent will constantly study the traffic and characteristics of his territory with reference to the present service, growth and future prospects, keeping in close touch with the pulse of the public's desires through observation and conferences with his subordinate inspectors, whose duties of keeping the traffic in motion at the congested points keep them in almost hourly touch with the tides and whims of travel. The conclusions and suggestions of the division superintendent should form an essential part of the data which determines the wisdom of opening new routes to bring passengers to the business district more directly, thereby reducing the number of transfers previously necessary or decreasing crowding upon certain other lines, or of establishing a connecting line which will link together outlying suburbs previously separated and tend to build up sparsely settled intermediate territory. The es-

tablishment of faster service is almost certain to increase the population of a given section, and the prospects in this direction are profitable subjects for the study of the company. There is room for the closer fitting together of real estate, population and transportation developments and experience in the analysis of traffic on large systems.

A broad consideration of the relations of a new route to the system as a whole should supplement memoranda from local operating officials as to the needs of their special territory. Estimates of construction cost based upon experience on similar streets in building lines of single and double track, figures representing the probable traffic and earnings of a given schedule, and the anticipated reduction or increase of travel on associated lines, the number of passengers probable at different hours, number of cars that should be continued on the older lines in view of the effect at certain places of new facilities in order to meet the needs of passengers who use them at other parts of the route without reference to the point of starting, time table rearrangements and power requirements should all be finally considered in a careful determination of the need of new or revised routes.

The Advantages of Large Cars

An interesting commentary upon the increasing use of longer cars for city roads is shown by recent reports of the Massachusetts Railroad Commission. According to the statistics in that volume, the four largest electric railway systems of Massachusetts have added very few cars net to the total number owned by each in the past five years, although the traffic, and in three cases the track mileage, have increased by substantial percentages.

In 1902 the Boston Elevated Railway Company owned 3281 passenger cars; in 1903, 3280; in 1904, 3365; in 1905, 3325, and in 1906, 3338. At the end of the five years the increase was but 1.7 per cent, the total being actually lower than the number of cars owned in 1904. During this half-decade the track mileage of the system increased from 360 to 403, or 12 per cent, and the total number of passengers carried increased from 222,484,000 to 262,267,000, making a traffic gain of about 18 per cent. The Boston & Northern Street Railway Company owned 1162 cars in 1902 and but 1112 in 1906. The latter figure represents the minimum of the five years, but in this time the track mileage increased from 423 to 513. The number of cars thus fell off 4.3 per cent, while the trackage gained 21 per cent. Here there was also a substantial gain in traffic, from 69,299,000 in 1902 to 88,849,000 in 1906, or 28 per cent increase.

The Old Colony system reduced its cars from 746 to 721, and the mileage operated also decreased from 362 to 352. But the traffic increased from 46,321,000 to 53,713,000 during the five years. The Worcester Consolidated system gained a single car in 1906 over 1902, the figures being 315 and 316. In 1903 this company owned 347 passenger cars. The track mileage of the Worcester Company increased 23 per cent, or from 129 to 159 miles operated, in the period, and the number of passengers carried increased from 24,522,000 to 30,456,000, or 24 per cent.

Each car owned by these four companies handled, on the average, a much larger amount of work in 1906 as compared with 1902. The Boston Elevated carried 67,600 passengers per car owned in the latter case and 77,500 in the year 1906, or an increase of 15 per cent. The Boston & Northern raised the figure from 59,000 to 80,000, or over 35 per cent, and the Old Colony's patronage per car owned rose from 62,000 to 74,500, making a gain of 20 per cent. Worcester increased 23 per cent, from 78,000 to 96,000 yearly passengers per car owned.

On all four of the systems the total car mileage increased during the period under consideration. The Boston Elevated cars ran 45,770,000 in 1902 and 50,000,000 in 1906, a gain of 9.6 per cent. The Boston & Northern car mileage rose from 14,139,000 to 16,460,000, or 16.5 per cent, and the Old Colony's from 9,296,000 to 9,971,000, or 7.2 per cent. The Worcester Consolidated gained 16.3 per cent, from 4,679,000 to 5,459,000 car-miles. The mileage per car also increased with each company. In Boston each car's average gain in total yearly mileage was 1100 miles, from 13,900 to 15,000. The Boston & Northern increased from 12,100 miles per car in 1902 to 14,800 in 1906; the Old Colony raised its record from 12,500 to 13,800, and the Worcester system from 15,100 to 17,300.

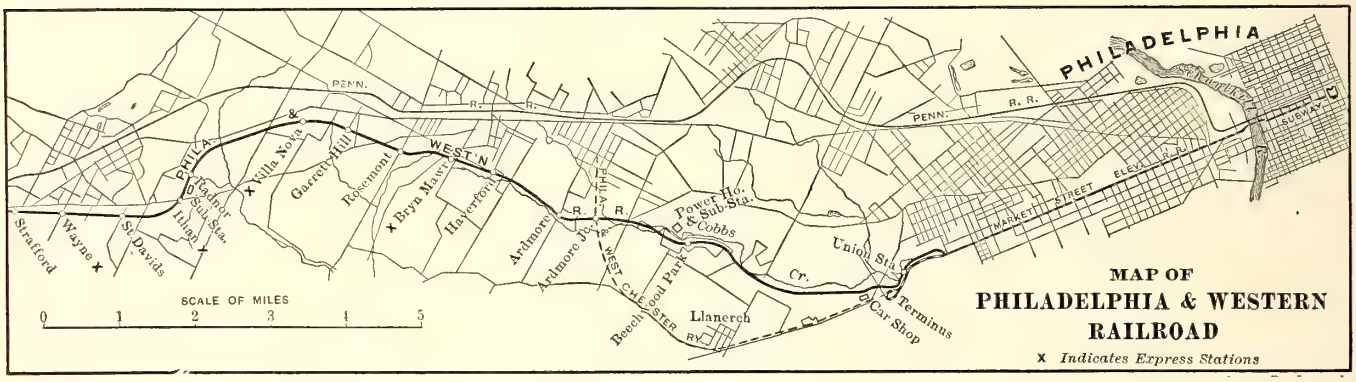
While it is impossible to determine to what extent the use of larger cars is responsible for these greater transportation outputs per car, there is no question that the tendency toward higher speeds of operation and the increase of traffic density offered each car in the populous territory served are insufficient to account for all this gain in work per car. It is well known that as the four systems considered have expanded during the past five years, the companies have purchased many large and improved cars capable of handling more passengers per trip than was ever possible with the short, single-truck and the moderate length double-trucked cars which were standard a few years ago. These later cars have almost invariably been equipped with four motors each, and have, therefore, been able to make faster time than their slower predecessors, particularly on interurban and suburban runs. Thus far the total percentage of large modern cars, notably of the semi-convertible type, is probably not large in comparison with all the cars owned by the companies, but the adaptability of these cars to all seasons and hours undoubtedly makes their influence strongly felt in relation to the total number of cars in operation at any one time. In fact, the semi-convertible car has become so popular on some routes that other cars have been poorly patronized and in some cases have had to be withdrawn.

The only disadvantages of note characteristic of large cars are their higher first cost, their enlarged power consumption and probably increased maintenance expenses. These are minor considerations where the volume of traffic is sufficient to create good loading. The increased carrying capacity easily offsets with a liberal profit the extra power cost, and the greater comfort of riding, higher speed possibilities and superior attractiveness to the public are strong reasons why large systems should continue to supersede the older rolling stock by larger and more powerful units. Certainly the results in Massachusetts bear out the wisdom of such a policy.

THE PHILADELPHIA & WESTERN RAILROAD

The Philadelphia & Western Railroad, which was opened for service between Philadelphia and Strafford, Pa., on May 22, marks another noteworthy step in the development of heavy electric traction for high-speed transportation of the suburbs of our large cities. Unlike other instances of heavy electric traction, this installation is not an old steam railroad electrified because of undesirable operating conditions, but one built from the first to give an electric train service along the most liberal lines and in competition with a long-established steam railroad. The operating results of the new line, therefore, may well be expected to demonstrate anew the superiority of electricity for suburban service.

It would be difficult in any description to do justice to the splendid district west of Philadelphia chosen for exploitation by the Philadelphia & Western Railroad, yet even a brief glance at the accompanying map reveals that the territory must be one of attractive character. Within the 11½ miles between Strafford and West Philadelphia are the noted colleges of Haverford, Bryn Mawr and Villa Nova, as well as numerous smaller academies and schools, many sectarian institutions of charitable character, and a large number of golf, polo and cricket grounds. It is evident that aside from the prosperous class of permanent residents in this section, there must be a great deal of pleasure travel whenever the more important colleges have athletic meets and on holidays favorable for general outings and visits to the many points of interest.



THE PRESENT ROUTE OF THE PHILADELPHIA & WESTERN RAILROAD, FROM WEST PHILADELPHIA TO STRAFFORD

As at present constituted, the Philadelphia & Western Railroad is a two-track line extending from Sixty-Third and Market Streets, in West Philadelphia, through the towns of Ardmore, Haverford, Bryn Mawr, Rosemont, Villa Nova, Radnor, St. Davids, Wayne and Strafford. The length of this route is 11½ miles, but the total in single track is 24 miles, this including the freight and storage sidings, etc. Eventually the line to Strafford will be four-tracked to permit an express service, and two local tracks will be continued to the town of Parkesburg, 32 miles further. All of the tracks are laid on the company's right of way, and, in accordance with the State law governing the grant of perpetual franchises, there are no grade crossings. The perpetual franchise also includes the obligation to carry freight, which accounts for the freight sidings mentioned.

A VIEW OF THE BIG FILL AT ROSEMONT, SHOWING ALSO THE ARCH FOR OLD CONESTOGA ROAD. NOTE THE COMPARATIVE HEIGHTS OF THE AUTOMOBILE, ARCH AND FILL

Since the section now operated will be four-tracked in the future, the company secured a 230-ft. right of way as far as Strafford. Surveys have also been made through to Parkesburg. The right of way includes several large parcels of land purchased to avoid litigation. One of these tracts

amounts to about 180 acres, and, together with other property on the line, is being developed by a subsidiary real estate corporation.

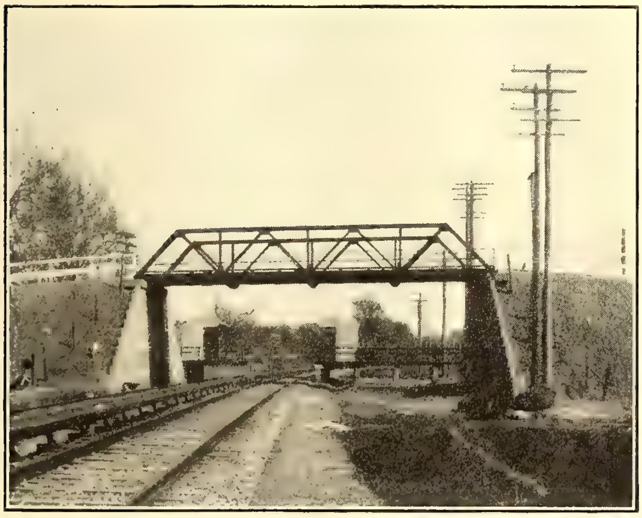
ROADWORK

The rolling character of the territory traversed by the Philadelphia & Western Railroad would have required a large number of fills, cuts and culverts in any event, but compliance with the law prohibiting grade crossings with other railroads and public highways necessitated also an extraordinary number of bridges, arches and culverts. Besides the foot bridges, there are in the 11½ miles of route fully thirty-four over and under grade crossings, made up as follows: Eleven overhead bridges for public highways; four overhead bridges for private crossings; two arches, one of 33 ft. diameter under the big fill at old Conestoga Road, Rosemont, and the other at the power house, and seventeen railroad bridges. There is also a 33-ft. span concrete arch at Cobbs Creek west of the power house.

The foot bridges are of steel with wooden steps and floors, and are found at stations, at certain points connecting private property, and at the company's Ithan quarry. The road bridges are of heavily reinforced concrete designed in accordance with the standard loading specifications of the Pennsylvania Railroad. The abutments are set back for four tracks, so when the road is ready for express service the expense and time for changes required will be very little.

All of the arches are of concrete reinforced with plain round bars of high carbon tensile steel capable of withstanding a stress of 15,000 lbs. per square inch. Plain reinforcement was chosen in preference to special shapes because of its greater economy and ease in securing the material. The most important arch on the line is the one carrying part of the Conestoga fill at Rosemont, mentioned later, and which had to be made to provide for a roadway. Owing to the presence of a stream at this point, this road is built over a culvert.

The cut and fill work was of a peculiarly difficult character, due to the heavy rock work and to the slippery soil,

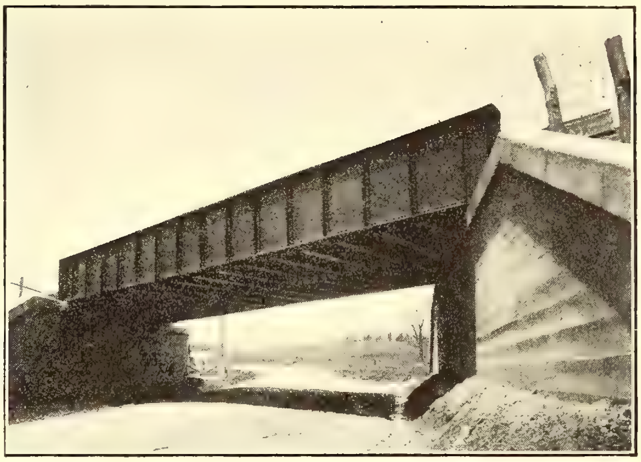


HIGHWAY BRIDGE AT ARDMORE AVENUE, SHOWING ALSO THE DOUBLE-POLE CONSTRUCTION AT CROSSINGS WITH FOREIGN WIRES

of which a considerable proportion is disintegrating mica. The company is sowing alfalfa on all of its fills to secure a good binder and enhance the appearance of the right of way, in favorable contrast to the cinder-covered roadway of steam railroads.

The largest cut is 500 ft. west of the power station. It is 600 ft. long and has a maximum depth of 40 ft., and required the removal of 20,000 cu. yds. of granite. The biggest fill is located over the old Conestoga road. It is 1850 ft. long, has a maximum height of 65 ft., a slope of 1½ : 1, is 33 ft. wide at the top and 230 ft. wide at the bottom.

In all, the total excavation amounted to about 1,000,000

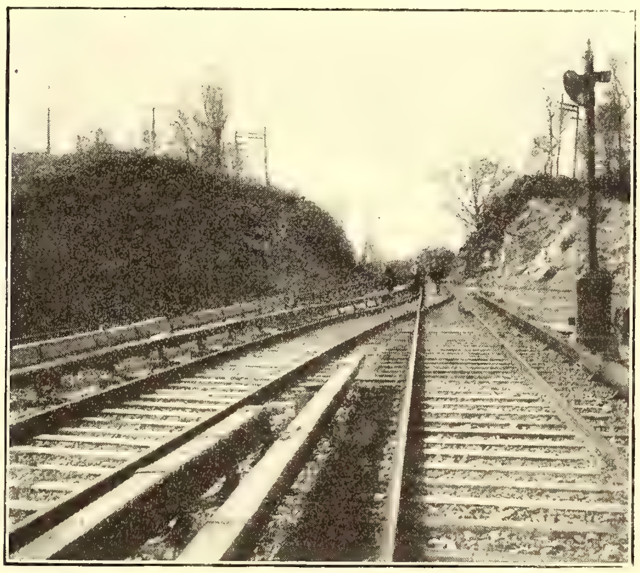


A TYPICAL STEEL BRIDGE WITH REINFORCED CONCRETE FLOOR ARCHES

cu. yds., and this practically was balanced by the material needed for the fills. The result of this work has been to limit the maximum grade to 2½ per cent, and the maximum curve, except at the Strafford loop, to 5 degs. The 5-deg. curve is practically no hindrance to the service, since it is very near the Bryn Mawr station, where trains must slow down as a matter of course.

TRACK AND THIRD-RAIL CONSTRUCTION

As already noted, the service tracks at present are double, but there are extra loading tracks and platforms at the



LOOKING WEST AT THE GREAT ROCK CUT NEAR THE POWER HOUSE, WITH SIGNAL POST AT THE RIGHT

terminals, the Bryn Mawr station and other places where picnics or college games involve the handling of large numbers of people in short periods. At Strafford, for example, there is an extra track to allow room for eight to ten cars. Throughout the entire system the track consists of 85-lb. T-rails laid on wood ties spaced 21½ ins. center to center in rock ballast taken from the company's quarries along

the line. The rails have Continuous joints and are bonded with two 400,000 circ. mil Protected bonds per joint.

The striking feature of the power-collection system is the use of the Farnham inverted U-shape third rail. This conductor is of soft steel, its low proportion of carbon giving it a conductivity equal to an 800,000 circ. mil copper cable, while its bearing surface is equivalent to a 70-lb. T-rail. The U-shape of the rail offers another advantage in that the extra conductivity possibly needed by traffic increase can be obtained easily by placing the desired size of bare copper cable inside the rail, contact being secured in such cases by a compound plastic bond at all rail joints. The upper part of the rail section is provided with lips or side flanges for fastening to the bracket structure, which also carries the three protective planks, insulator, bushing, etc., as shown in one of the accompanying illustrations. The latter also illustrates the method for making feeder connections to the rail. Further particulars regarding this system as applied on the Philadelphia & Western Railroad will be found in the STREET RAILWAY JOURNAL of Jan. 6, 1906, on page 45.

To mark the boundary of the right of way and as a precaution against trespassing, the company has put up stout wire fences over 5 ft. high on both sides of the track. Warning signs regarding interference with the third rail are placed at frequent intervals on the fence posts, station platforms, etc.

HIGH-TENSION TRANSMISSION AND OTHER WIRING

All of the wiring is carried on chestnut poles 40 ft. high, spaced 100 ft. on tangents. These poles were heavily tarred to about 8 ft. above the butt, and to prevent ground rot were placed in concrete to a depth of 7 ft. After the concrete had set, the space left by shrinkage between it and the pole was filled with hot tar.

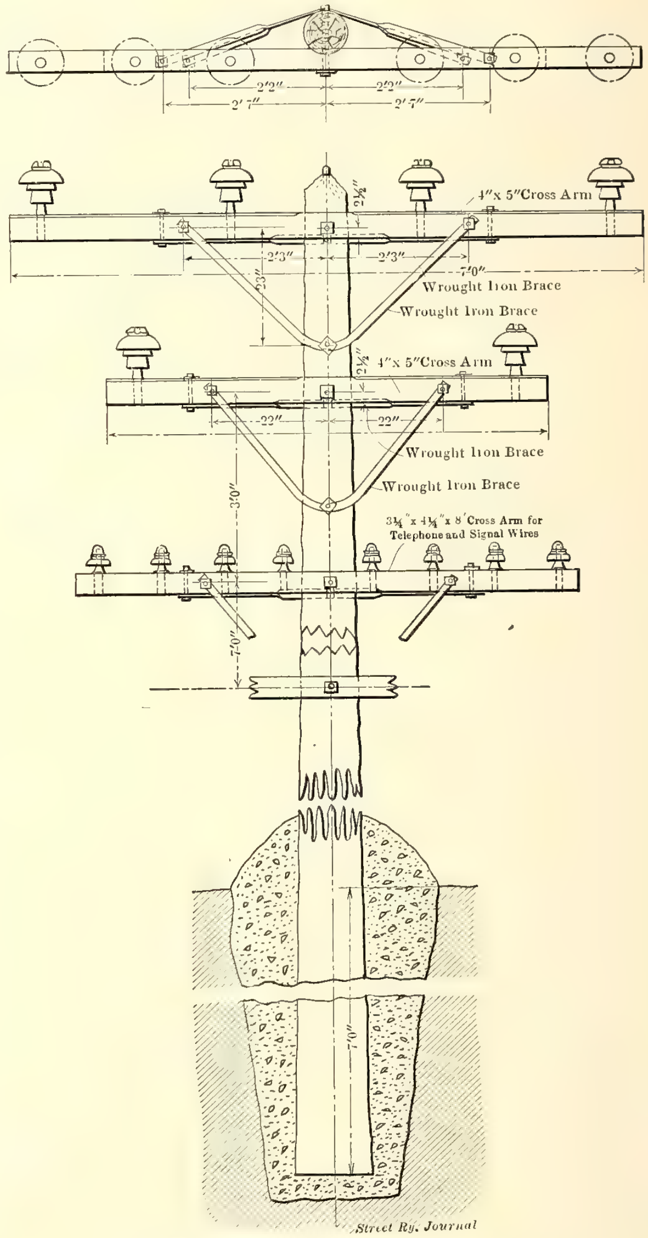
The 19,000-volt, three-phase transmission system extends at present only as far as the Ithan sub-station. The wires are carried on Thomas triple petticoat insulators set on wood pins. The feeders are of 600,000 circ. mils section. There is no feeder between the West Philadelphia terminal and the power station, as two rotary converters in the latter feed current directly into the rails.

An interesting feature of the overhead construction is that the company has installed a private telephone system, the wires of which are carried on the same poles as the high-tension wires on a separate cross-arm 3 ft. below. This cross-arm also carries the signal wires. To avoid the effects of induction the telephone circuit consists of a twisted pair of insulated wires, while the high-tension conductors are transposed every mile.

An important problem that arose in connection with the high-tension transmission was to devise some sure method of avoiding short-circuits possible through a broken high-tension wire falling on foreign wires at the crossing of pole lines. An effective yet simple preventative has been secured by running a ¼-in. stranded steel cable alongside each transmission wire and tieing in every 6 ft. for 100 ft. on both sides of the crossing. Should either wire break, therefore, the one paired with it will keep more than a 6-ft. length from falling, and thus the high-tension wires can never come dangerously near foreign wires. The same insulators carry both the steel cable and copper wires in the protective section and the steel cable is looped around the last insulator. A crossing of this kind is shown in a view taken near Ardmore Avenue, and illustrates also that at such places the poles are doubled up to carry the extra wire.

POWER STATION

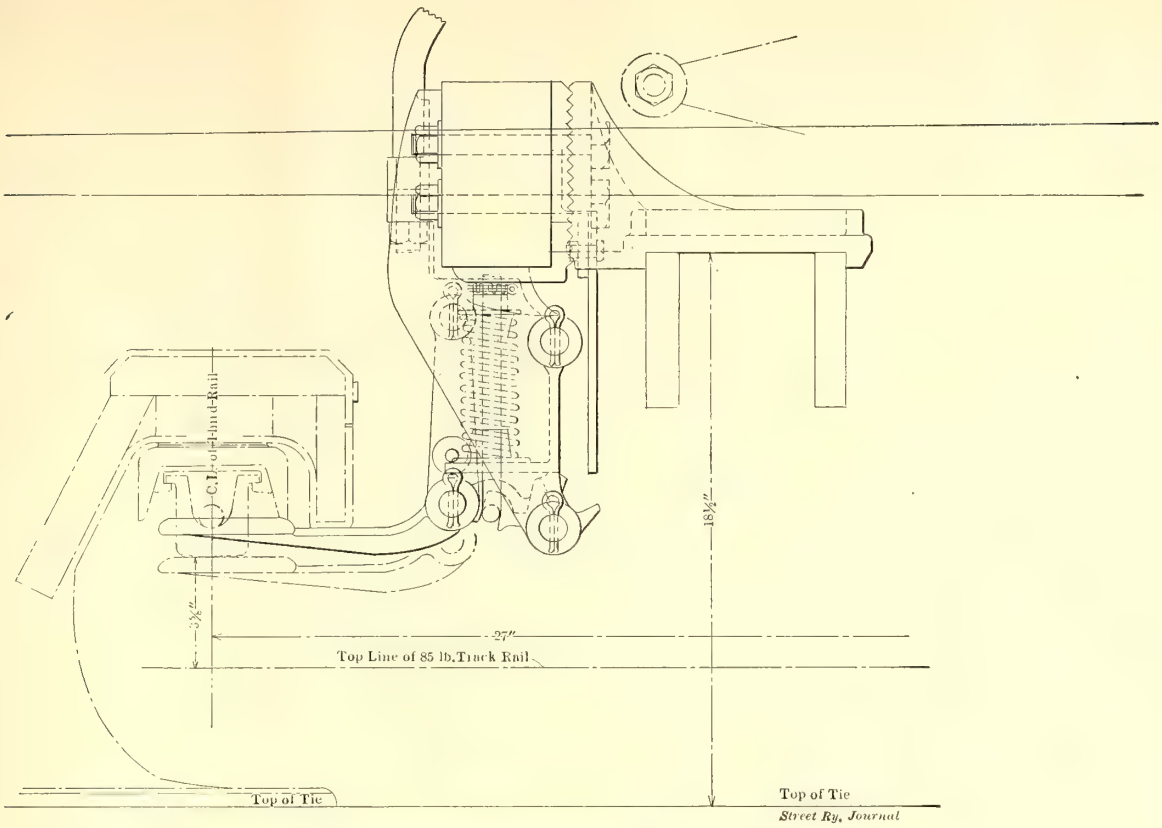
The power house is located on Cobb's Creek 2½ miles from the West Philadelphia terminal. As shown in the section and plan on pages 1056 and 1057, the building is divided into two parts, one for the boilers and superheaters and the other section with a mezzanine floor for carrying the transformers, exciter sets, rotary converter and other electrical equipment, while the main floor accommodates the turbines, with condensers and other steam auxiliaries.



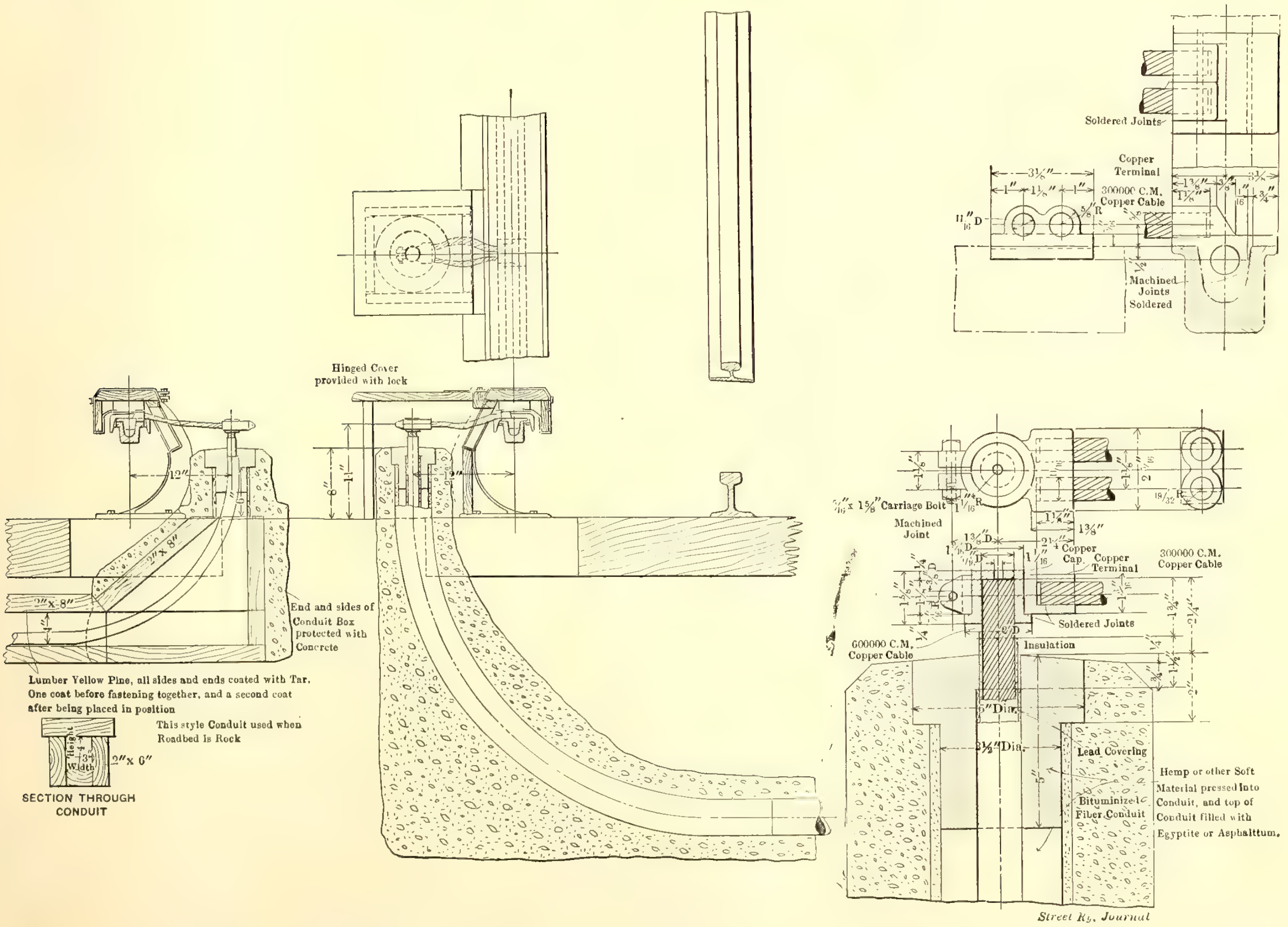
DETAIL OF POLE FITTINGS AND SETTING

To permit easy extension, the station is very simply constructed, the footings being of concrete, the walls of corrugated sheet steel fastened to steel columns, and the roof, which rests on angle-iron framing, of concrete with a slag finish. The gallery floor, like that of the lower one, is of concrete, but is carried on channel beams.

The position of the station alongside the company's tracks greatly simplified the coal handling problem. All fuel is brought in standard cars which are run up a concrete-supported trestle alongside the outer boiler room wall. The cars may dump either through chutes directly in front of the boilers or to the outside storage under the trestle.



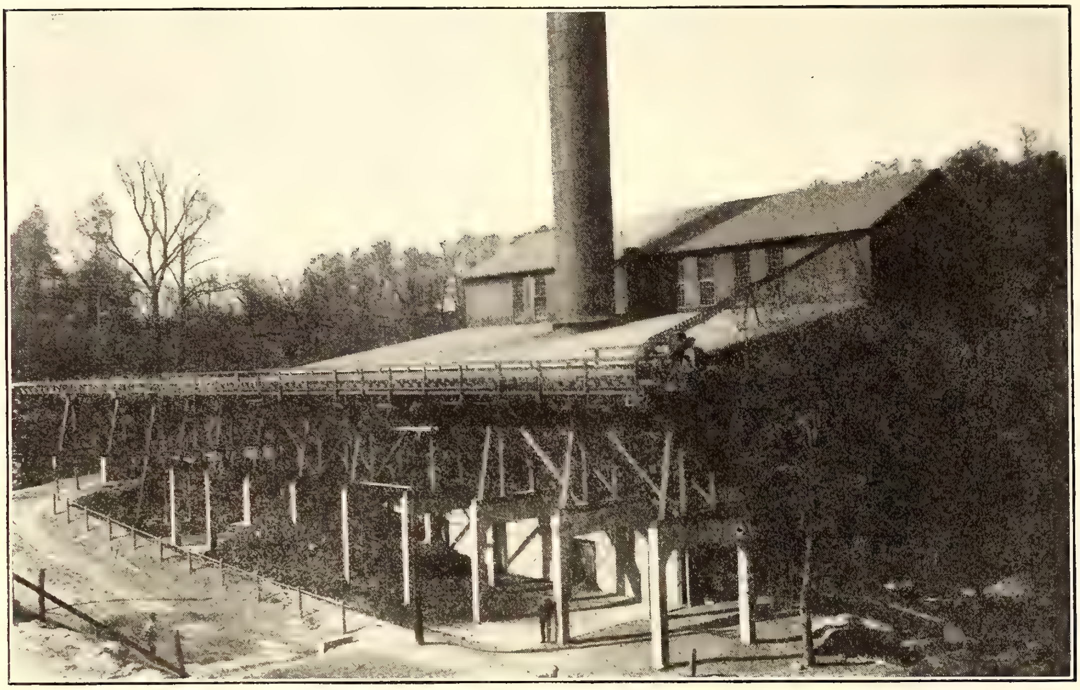
CONSTRUCTION DETAILS OF THIRD-RAIL SHOE



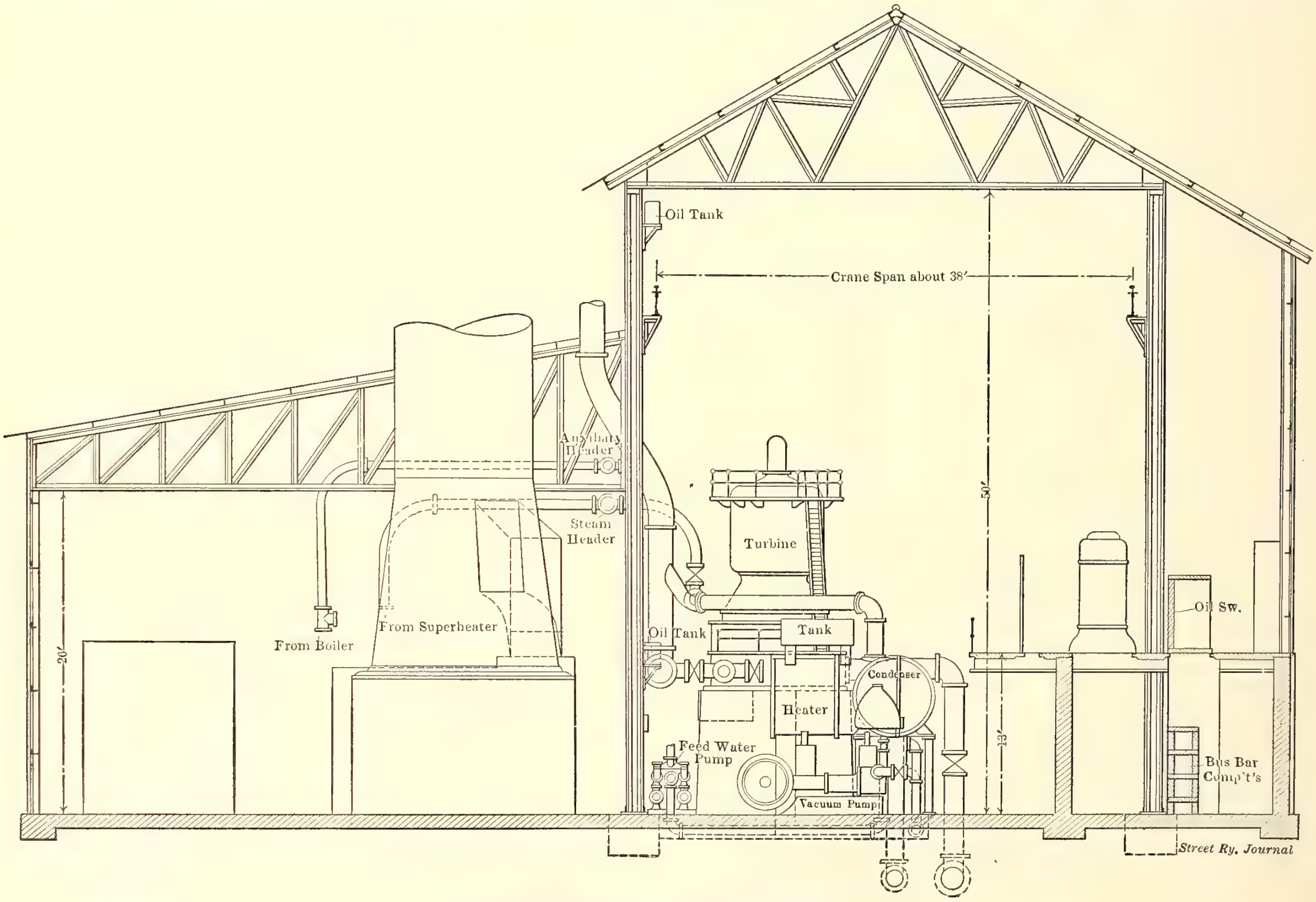
DETAILS OF CABLE TERMINAL, CONDUIT CONNECTIONS, ETC., FOR THIRD-RAIL OPENING

Ashes are taken out in side-dump cars on a narrow gage track running alongside the boilers.

The operating equipment of boilers now consists of five



COALING TRESTLE ALONGSIDE THE POWER STATION



CROSS-SECTION OF POWER STATION

500-hp Heine units. These boilers each have 5000 sq. ft. of heating surface and are built for 200 lbs. working pressure. They are made up of two sections, each having 138 3½-in. x 18-ft. tubes and one 48-in. shell 21 ft. 9 ins. long. The grate surface is 15 ft. 3 ins. wide and 7 ft. deep. The fifth boiler has been installed primarily for the summer lighting and power load at Beachwood Park, but it can also be used as a spare. There is but one stack, which is of steel 13 ft. in diameter and 160 ft. high.

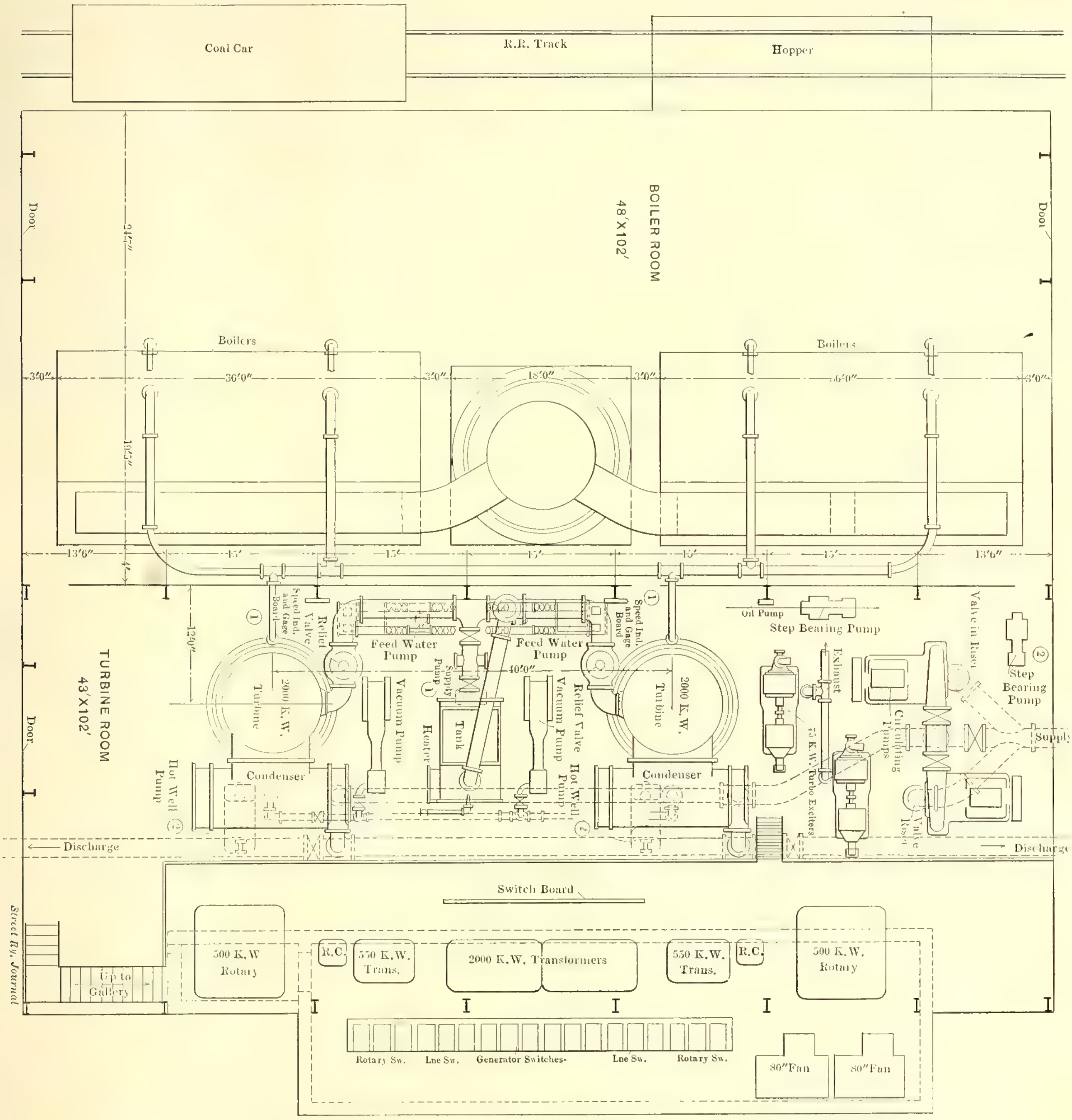
The power generating equipment consists of two four-stage, 2000-kw, 2300-bolt, three-phase, 25-cycle Curtis turbines, running at 750 r. p. m. These turbines are now being changed over from water to oil step bearings. It will be noted that either turbine is capable of taking the output of the five boilers, so that under general operating conditions one turbine will be ready for emergencies or to carry loads that are too heavy for one machine.

The steam auxiliaries comprise a Foster superheater, Cochrane open-type feed-water heaters and Worthington condensers. Gravity feed lubrication is employed.

The superheater is placed in the upper part of the boiler setting in chambers provided alongside of the drums. The superheater consists of a nest of horizontally disposed straight tubes surrounded by cast-iron rings and joined at their ends by connecting headers and return headers, so that the steam is passed back and forth three times. By means of a damper in the superheater flue, the heat may be diverted entirely or the degree of superheat regulated. The superheater increases the temperature of the steam 150 degs. F. at 200 lbs. pressure.

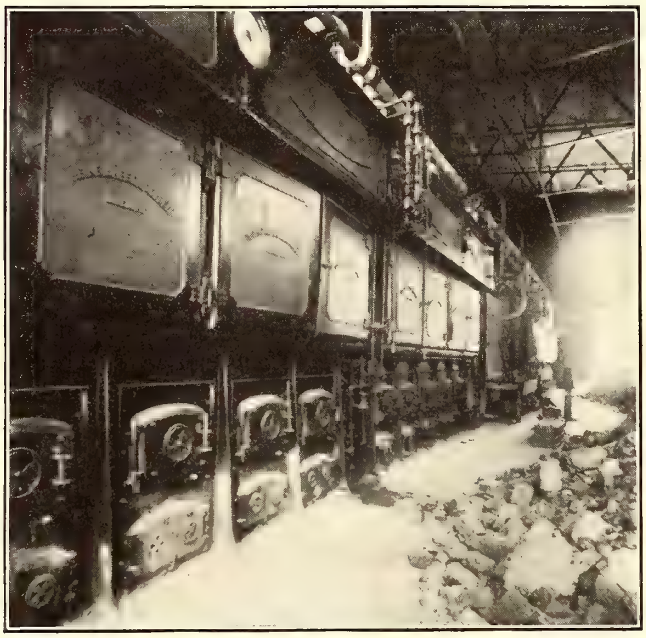
The feed-water heater and purifier is of horizontal cylindrical construction, rated to take care of 4000 hp. A second heater can be added at any time after a three-way transfer valve has been installed in the exhaust main to permit cutting off either heater at will or using both together. The steam enters the heater through an oil separator, the drips of which are piped to waste. The body of the heater is of cast-iron plates reinforced by ribs and bolted together at the corners where the joints are calked from the inside with a "rust" joint. Cast iron is preferred for heater construction, as that material is less susceptible to corrosion than sheet iron or steel plate; for the same reason, the fittings are of copper or brass.

The condensing apparatus consists of two units, each capable of taking care of one of the 2000-kw turbines. The condensers are of the surface type built for what is known as the wet and dry vacuum system. Each unit condenses 40,000 lbs. of steam per hour with 70 degs. F. water, maintaining a condenser pressure of 2 ins. absolute, which is equivalent to a 28-in. vacuum based on a 30-in. barometer. The condensing units consist of the following parts: One 6750-sq. ft. surface condenser; one 10-in. x 22-in. x 18-in. horizontal, single rotative dry vacuum pump; one 20-in. horizontal volute centrifugal circulating pump direct connected to a 12-in. x 12-in. vertical engine mounted on the same bed plate, and one 3-in. horizontal two-stage turbine



PLAN OF THE PHILADELPHIA & WESTERN RAILROAD COMPANY'S POWER STATION

centrifugal hot-well pump electrically driven at 1200 r. p. m. The same manufacturer also supplied two 14-in. x 8½-in. x 15-in. pressure type boiler feed pumps, each capable of taking care of 3500 boiler hp. These pumps are of the out-

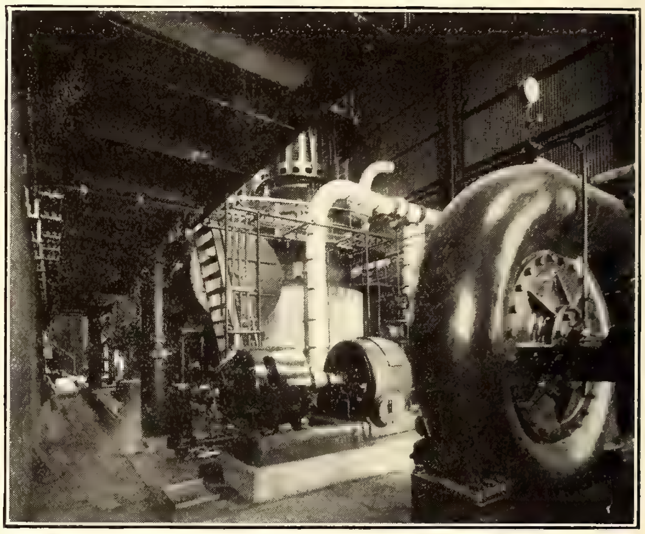


IN THE BOILER ROOM

side end packed plunger type with pressure pattern water ends, the water valves being of the brass winged type working in brass seats. Among the special features of the installation are the equipment of each surface condenser with a special air cooler, which is very efficient to move the non-condensable vapors from the condenser chamber at the point of greatest density; the vacuum pump, which is of the crank and flywheel pattern and special high vacuum design, all air valves being mechanically operated; the volute pumps, which, combined with the engines, form self-contained units operating at approximately a speed of 300 r. p. m., and the hot-well pumps, which are specially noteworthy in that they are automatic in their action and require no special floats and valves for their operation, and consequently there is less liability to cause trouble. These hot-well pumps are designed to carry overloads of 100 per cent and deliver the water of condensation into an open tank against a slight discharge head.

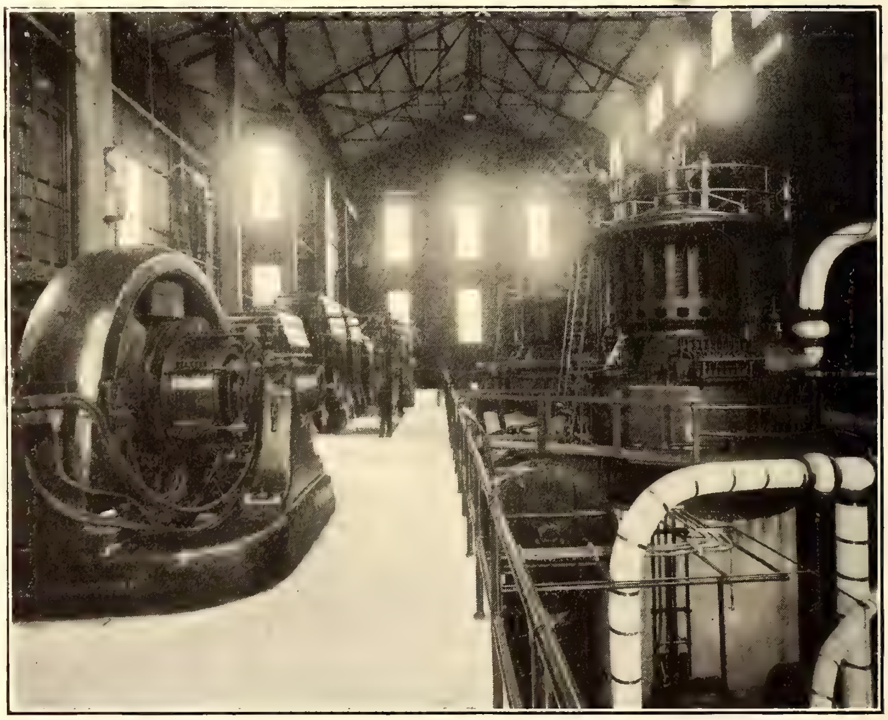
All of the heavy piping of the condensing system is under the floor; the condensing water is taken from Cobbs Creek, where a dam was built for that purpose. When the water is low the return pipe discharges into a flood box into the center of the pond, the surplus going down stream. Aside from this supply, the company has a connection with the mains of the Springfield Water Company 2300 ft. distant, which can be used when the creek water is muddy.

All of the purely electrical apparatus, which includes a regular sub-station equipment, is mounted on the concrete platform in the section containing the turbines and auxiliaries. This comprises the following: Two four-stage, 75-kw, 2400-r. p. m., 120-volt Curtis turbo-generators for exciting the large turbines; two 25-cycle, 2000-kw air-blast transformers now arranged for 2300 volts primary and 19,100 volts secondary; two 25-cycle, 550-kw air-blast transformers to step-down from 19,100 volts primary to 430 volts



CONDENSING AND FEED-WATER APPARATUS SECTION

secondary; two 80-in. Buffalo blowers; two six-phase, 600-volt, 500-kw, 500-r. p. m. rotaries, and two 75-kva reactive coils. This equipment is controlled from a black slate switchboard in the same gallery. The high-tension switches are electrically operated. It may be added that the transformers are wound for an eventual maximum potential of 33,000 volts.



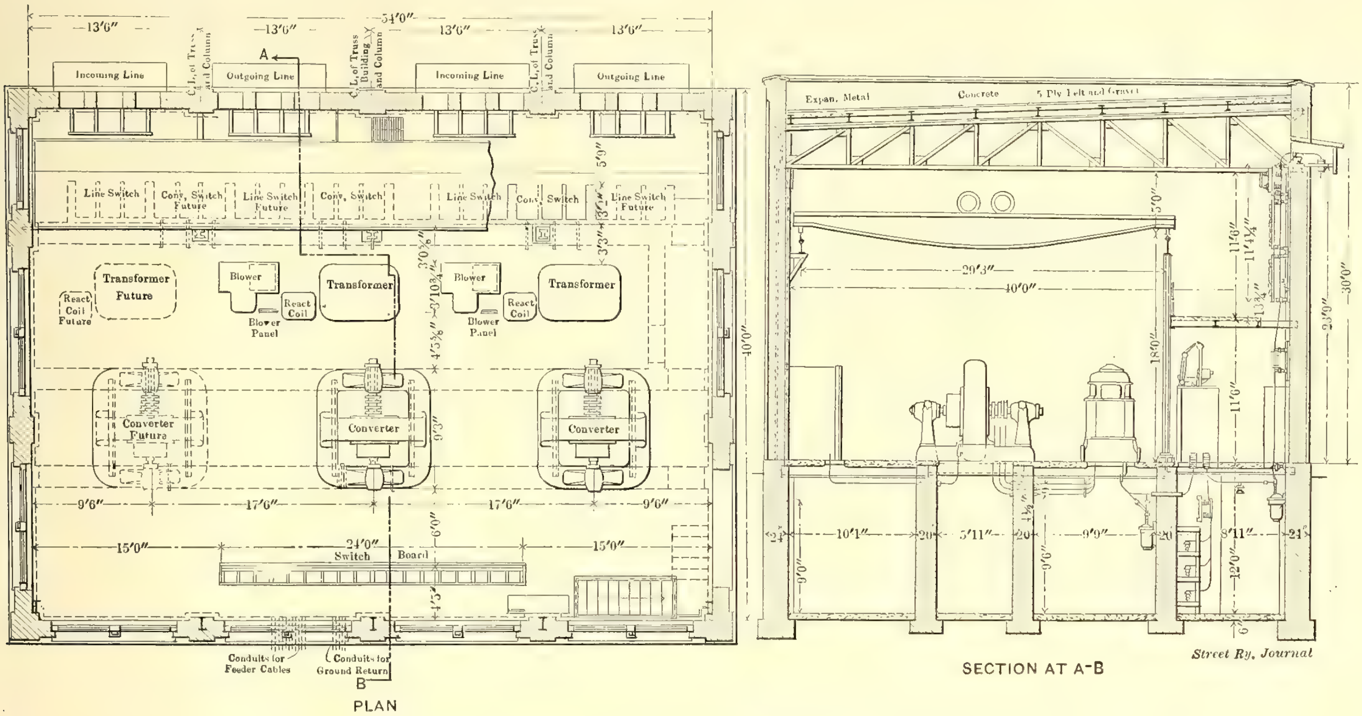
THE GALLERY IN THE POWER HOUSE ON WHICH ALL OF THE ELECTRICAL EQUIPMENT EXCEPT THE TURBINES IS CARRIED

THE ITHAN SUB-STATION

The only sub-station on the line is at Ithan, 2 miles from Strafford and 6 miles from the main power station.

It is a neat brick structure with concrete footings, and is 40 ft. wide by 54 ft. length. The roof is of concrete reinforced with expanded metal resting on I-beams over the roof framing. The concrete is covered with a five-ply felt and gravel. The windows are made up of small panes, which, with the arch construction and white copings, give the station a pleasing appearance. The interior of other apparatus that the attendant can move about without hindrance or danger.

The present converter outfit consists of two G. E. six-phase, 25-cycle, 500-r. p. m., 600-volt, 500-kw rotaries. The two 550-kw transformers are of the air-cooled type with two Buffalo 40-in. blowers. The transformers are placed in front of the oil switches, which are in compartments

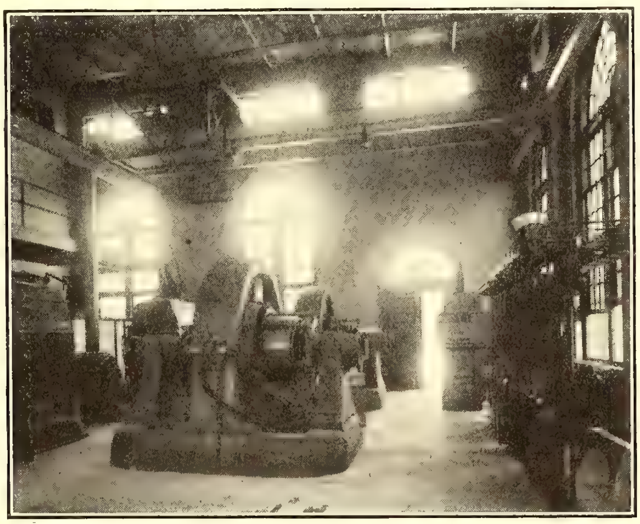


PLAN AND SECTION OF THE ITHAN SUB-STATION

the station is trimmed with enameled brick; red is used for about 1 ft. from the floor, then about 5 ft. of white and the rest in buff. faced with white brick. The oil switch compartments are directly beneath the high-tension switchboard gallery. There are also two 75-kva reactance-coils and the usual protective apparatus. The station is spanned by a 10-ton

The relative location of all the equipment is plainly shown

EXTERIOR OF THE ITHAN SUB-STATION



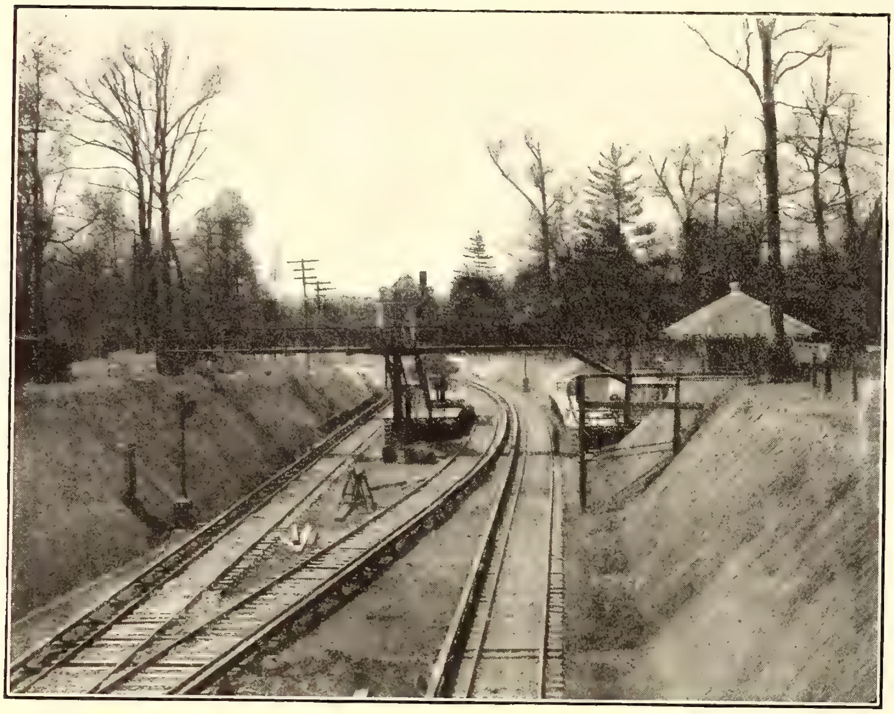
ITHAN SUB-STATION, SHOWING RELATIVE LOCATION OF SWITCHBOARD, ROTARIES AND TRANSFORMERS

in the plan, but it might be well to add that as this station represents the terminal of the present high-tension system, provision for the future lines toward Strafford has been made as indicated. It will be noted also that the station now has but two-thirds of its ultimate equipment. Even with three rotaries it will not be too crowded for convenient working. The switchboard, for example, is set back 4 ft. 5 ins. from the wall, and is so placed with reference to the Maris crane. The building is heated by steam radiators from a separate steam plant in the cellar.

STATIONS AND SHELTERS

Including the terminals, there are fourteen regular stations and two flag stops (at Radnor and Ardmore) on the present trackage of the Philadelphia & Western Railroad. All of the station buildings are of wood with corrugated

iron roofs. The platform sheds also have the same type of roof and rest on steel posts built up of Ls. The flag stops are regular platforms 32 ft. long furnished with corrugated metal shelters. In general, the stations and shelters are constructed for easy removal, since some of them may be transferred to other points, according to traffic developments.

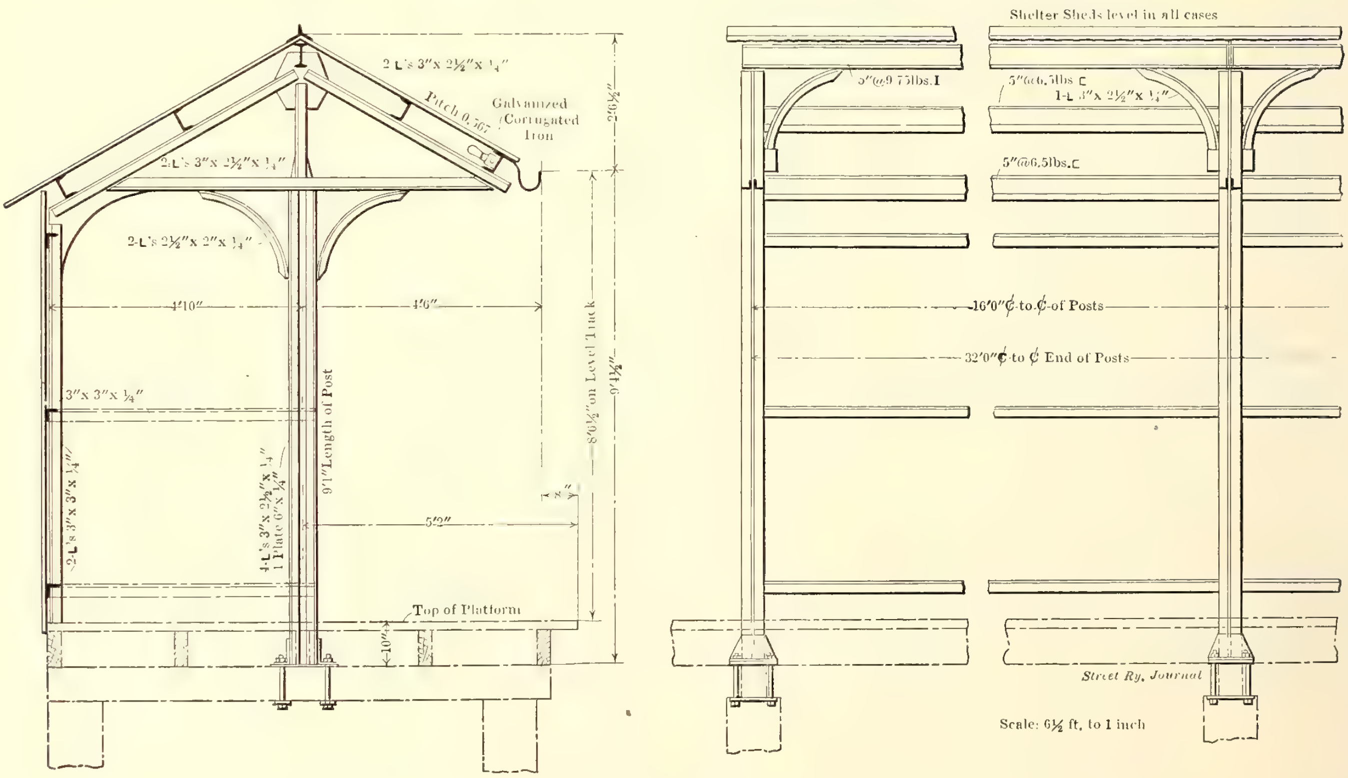

THE EXTRA LOADING TRACK AND PLATFORM AT BRYN MAWR

A notable feature is that all of the platforms, which are of wood on concrete piers, are built flush with the car floor, thus following regular elevated railway practice. This variation from steam road methods is a very sensible one, as there is no excuse for making passengers climb up and down steps except on roads where passengers are picked up anywhere on signal. All stations are furnished with enameled metal signs having 5-in. letters on a green background. There are at least three of these per station, so passengers will have little difficulty in learning their whereabouts.

The West Philadelphia terminal of the company was described in the Street Railway Journal of Feb. 15, 1907, in connection with the Philadelphia Rapid Transit Company's terminal at the same point. At the Strafford terminal the old stone building shown in the view on page 1061 has been converted to a waiting room. Probably the most important station along the line is the one at Bryn Mawr. At this point there has been installed a freight siding and an extra loading track with platform. The platforms are joined by the cross-over illustrated.

THE CAR HOUSE AND SHOP

The car house and shop is located a few hundred feet west of the West Philadelphia terminal. As shown on the final plan, the building will be divided into three sections, two for the cars and one for shop and general purposes. The present building, however, comprises but one car section. It has a frontage of 120 ft. and a maximum length of 330 ft. 9 ins., the car section being now 110 ft. 3 ins. beyond the present shop division to secure storage capacity for thirty-two cars 51 ft. 4 ins. long.



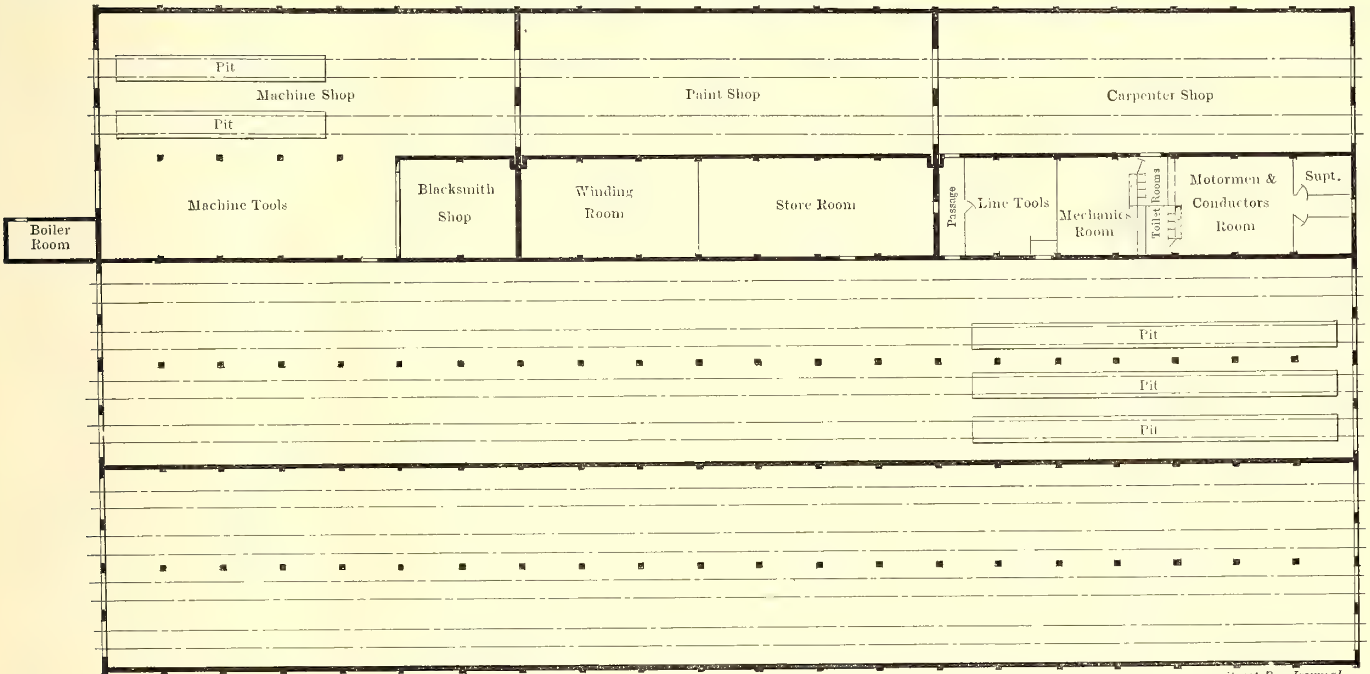
CONSTRUCTION DETAILS OF STATION AND SHELTER PLATFORMS AND ROOFS

Concrete is used throughout in the construction of the walls, floors and roof. The roof varies in thickness from 5 ins. to 6 ins. It is longitudinally reinforced with ½-in. diameter rods 20 ft. long spaced 5-in. centers and transversely reinforced by ¼-in bars of the same length and spaced 12 ins. centers. The concrete and reinforcement are turned up several inches at the skylights. The latter are 8 ft. wide and are regulated from the floor by chains.

The intermediate roof beams are carried on two sets of 12-in. columns. They are 4 ft. deep throughout, but in the shop or overhauling section are 15 ins. wide, or 3 ins. more than the beams in the office and car sections, to enable them to carry weights as high as 42 tons imposed through the rails of the crane runway. All of the intermediate beams are reinforced at the bottom, four 1½-in. bars being used for the 12-in. and six 1½-in. bars for the 15-in. This reinforcement is not tensional throughout, as a stirrup-effect is secured by turning one of the bars up at the ends or point of greatest unresisted shear. Pairs of beams for each bay are tied by prolonging the rods. As the building probably will be extended at an early date, the roof beams were built to project several inches and end with a plane of weakness so when extensions are made the abutting beams of the new section can be quickly placed by chipping off the concrete at the ends of the installed beams.

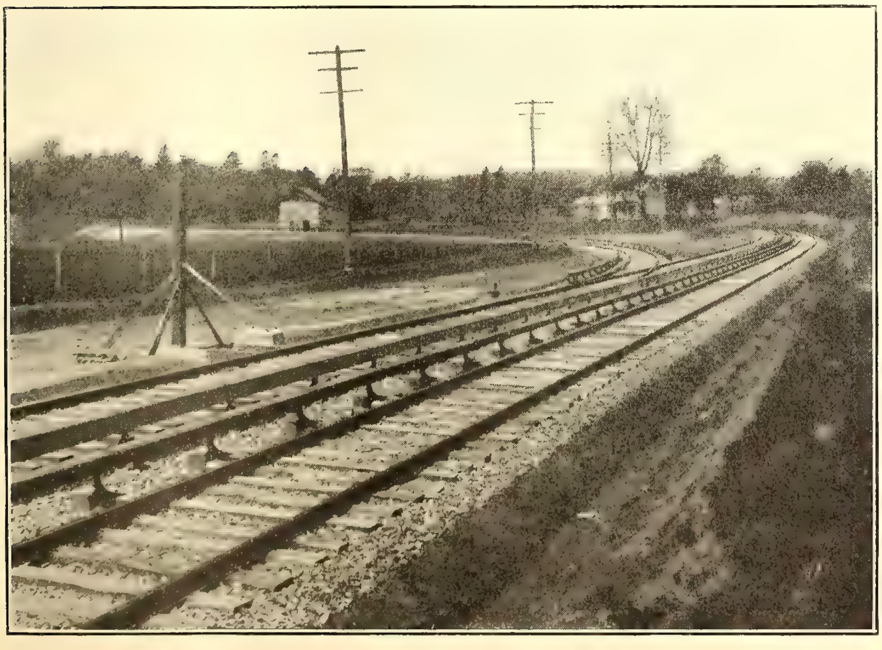
The front wall is also reinforced both longitudinally and transversely. For securing framing, 2-in. x 2-in. wooden strips about 8 ins. long were set in the concrete around the doors and the windows.

THE VILLA NOVA STATION, WITH TYPICAL FOOT-BRIDGE



Scale. 50 ft. to 1 inch
Street Ry. Journal

FINAL LAYOUT OF THE PHILADELPHIA & WESTERN RAILROAD COMPANY'S CAR HOUSE AND SHOPS



THE LOADING LOOP AT THE STRAFFORD TERMINAL

The car section contains four tracks, three of which are furnished with pits. The cars enter the building through openings 10 ft. 2 ins. wide, with a head room of 17 ft. 3 ins.

INTERIOR OF THE CAR HOUSE, SHOWING THE CONCRETE ROOF BEAMS, HEATING DUCTS, PITS, ETC.

These openings are closed by swinging wood and glass doors. The tracks are carried clear through the building to the running tracks to avoid dead-ends.

piers which carry the columns between the second and third tracks. The devil strip drains toward the pits on both sides.

Between the car section and shop proper is a group of rooms enclosed by an 8-in. concrete wall with openings controlled by fire doors. These rooms are used respectively for offices, employees' quarters containing toilets and Darby lockers, a tool room, storeroom and winding department. The space beyond this is now a blacksmith and machine shop.

One of the accompanying illustrations gives a good idea of the present appearance of the overhauling section. It will be seen that the machine shop is placed on an elevated section alongside the tracks, while the portion in front is used for blacksmith and miscellaneous work. This section contains one pit and a 20-ton Maris crane. The other track is for carpentry and painting.

The machine tools installed were furnished by the Bement-Niles Works, of the Niles-Bement-Pond Company, and consist of the following: One 24-in. engine lathe, one 18-in. engine lathe, one 16-in. Stockbridge shaper, one Sigourney single-spindle drill, one No. 2 Bridgeport combination wet and dry grinder, and one Washburn twist drill grinder. All of these tools, except the lathe, are driven from one countershaft.

The building is heated from the small steam plant, which contains a Buffalo blower outfit and Erie boilers. The offices and employees' rooms have steam radiators, but the car house and overhauling shop are heated by the indirect system through an

VIEW OF CAR HOUSE TAKEN FROM THE REAR TO SHOW HOW THE BUILDING WILL BE EXTENDED WHERE THE PROJECTING ROOF BEAMS ARE SHOWN

The pits are of rather novel construction, as the rails are carried on the projecting ends of 10-in. concrete-encased I-beams set under the concrete devil strip. The pits are of the open type, the only obstruction being the concrete

overhead duct carried from the roof beams, as shown in the interior illustrations.

The car house and shop are lighted by arc lamps, but incandescent lamps are used elsewhere. The pit lamps are

staggered every 5 ft., and each pit is separately controlled from a switch box set on the columns.

As to the fire protection, the usual precaution has been taken of closing all inside openings by fire doors. There are thirteen fire plugs throughout the building ready to distribute water at the supplied city main pressure of 80 lbs., and a number of Patrol chemical fire extinguishers made by the LaFrance Fire Engine Company, of Elmira, N. Y.

ROLLING STOCK

The company's passenger equipment now numbers twenty-two four-motor baggage cars and one four-motor work car. The general features of the passenger car body and truck construction were described in the STREET RAILWAY JOURNAL of May 4, 1907; but it may be worth while to summarize the most important points and include further details of the equipment.

The cars, which were furnished by the St. Louis Car Company, are 51 ft. 4 ins. long over the bumpers and 40 ft. over the corner posts; width over all, 9 ft. 3 ins. The body is mounted on the car builder's No. 161 truck, each of which carries two G. E. No. 73 75-hp motors adapted for the type M multiple-unit control. Train operation is also facilitated by the use of automatic couplers, spring buffers and Westinghouse automatic air brakes. Despite the fact that the station platforms are flush with the car floors, it will be noted that the usual steps have been provided for emergencies.

The interiors are furnished in mahogany with marquetry inlay design. The seating in both the regular and the smoking compartments is of the reversible type with high back and head roll, all upholstered in green leather. The side windows, which are double, are furnished with the Curtain Supply Company's Forsyth roller-top fixtures attached to Pantasote curtains on the regular spring roller. Round bar metal basket racks are installed throughout.

Although fourteen 16-cp lamps were provided on each side, equivalent to spacing them 3-ft. centers, additional interior illumination is derived from three arc lamps. The heating is supplied by the Consolidated Car Heating Company's apparatus. Each equipment consists of twenty truss plank heaters, No. 203 S, arranged for three points of heat. These are controlled by a double-knife switch. The switch cover bears the monogram of the Philadelphia & Western Railroad. Each vestibule contains one 192 M. S. heater controlled by a quick-break knife switch. These cab heaters are furnished with locks and the motormen keep the keys. This heater is very compact, as appears from the following dimensions: Length, 16⅜ ins.; width, 7 ins., and thickness, 5⅜ in.

IN THE MACHINE SHOP AND OVERHAULING SECTION. THE STRUCTURE IS HEATED FROM THE DUCT SUSPENDED FROM THE ROOF BEAMS

A TRAIN OF CARS IN SERVICE ON THE PHILADELPHIA & WESTERN RAILROAD. THE SLIDING BOWS ARE USED ONLY FOR CAR MOVEMENT IN THE CAR HOUSE

For convenience in moving cars in and about the car house, every car carries two copper sliding bows.

SCHEDULES AND OPERATING FEATURES

The company will operate cars in trains from the union terminal at Sixty-Ninth and Market Streets to Strafford in about twenty-eight minutes. Adding the nineteen minutes required to make the run from the business center on

and secondary relays with a tap for certain low-voltage relays employed, and two windings for feeding track cirthe Market Street elevated line of the Philadelphia Rapid Transit Company, the total time will be forty-seven minutes, as against the forty-five minutes on the Pennsylvania Railroad from the Broad Street station. This slight difference will be more than counterbalanced by the greater number of trains and lower fares offered by the Philadelphia & Western Railroad. As against the approximately half-hour service of the Pennsylvania Railroad the electric line will run cars every fifteen minutes from 5:15 a. m. to 1 a. m., all trains starting on the even quarters of the hour in both directions. The following table shows the great difference in fares in favor of the electric line, even though the Philadelphia & Western figures include the 5-cent fare on the Market Street elevated:

	P. & W.	P. R. R.	P. & W.	P. R. R.
	One Way		Excursion	
To Bryn Mawr	16c.	26c.	29c.	41c.
To Villanova	19c.	30c.	35c.	48c.
To Wayne	25c.	37c.	45c.	58c.
To Strafford	27c.	39c.	47c.	62c.

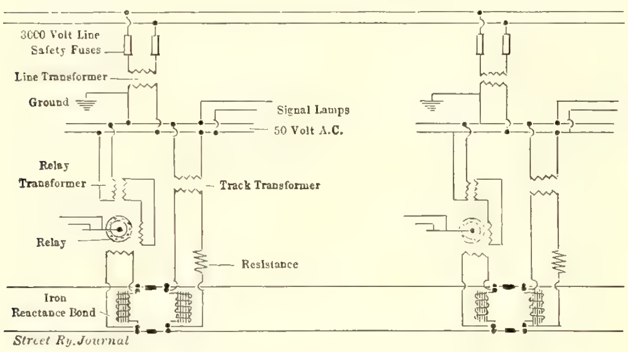
For ten-trip tickets to Strafford the Pennsylvania Railroad charges $2.61. Ten rides on the Philadelphia & Western and elevated lines, covering the same distance, are to cost $2.

Although a double-track line, the Philadelphia & Western has a complete dispatching system. Cars are dispatched by telephone from the West Philadelphia terminal. The telephones are also used for other company business, for which purpose they are installed in all company buildings. The instruments are sixteen in number, and were furnished by the Stromberg-Carlson Company, of Rochester, N. Y.

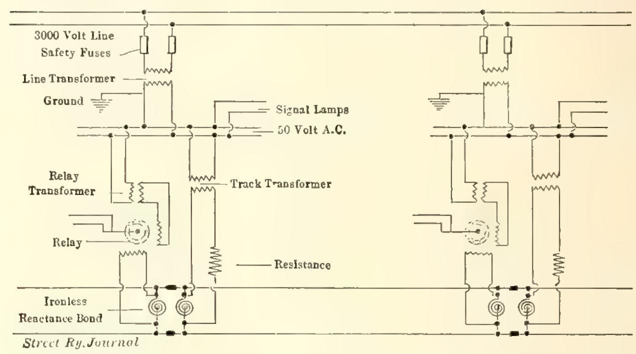
SIGNAL SYSTEM

The management of the Philadelphia & Western Railroad early recognized the necessity of an absolute block signal protection on a high-speed line parallel to the perfectly signaled Pennsylvania Railroad main line carrying exclusively human freight in comparatively frail cars. A contract was made, therefore, with the General Railway Signal Company, controlling the two-rail Young system, for the complete signaling of the line. This installation will be completed during the coming month. The system is in many respects identical with the installation made by the same company on the electric zone of the New York Central & Hudson River Railroad (described in the STREET RAILWAY JOURNAL of June 9, 1906), although the blocks are necessarily longer, and the design and arrangement of the reactance bonds is dependent upon the length of the road and the necessity of cross bonding between the tracks.

On the New York Central above Mott Haven where the traffic divides into the Hudson and Harlem divisions and the speed is increased, the blocks lengthen from 1600 ft. to 3500 ft., and the necessity for cross bonding requires a change in the arrangement of reactance bonds in blocks



TYPICAL A. C. TRACK SIGNAL CIRCUIT, TWO-RAIL RETURN, USING IRON BONDS



TYPICAL A. C. TRACK SIGNAL CIRCUIT, TWO-RAIL RETURN, USING IRONLESS REACTANCE BONDS

longer than 1600 ft. For short sections the scheme in the left-hand diagram shown above admits cross bonding only at the ends of sections. For longer sections the scheme shown in the right-hand diagram has been adopted, as it admits cross bonding between the undivided rails as often as desired, and thereby supplies a most highly conductive return for the propulsion current. As the Philadelphia & Western Railroad blocks are some 1½ miles long, the latter scheme is used, as cross bonding with the former method at such long intervals would not be practicable.

The operation and control of all functions is obtained by 25-cycle, single-phase current drawn directly from the railway's 2300-volt busses. It is transmitted at that voltage

THE SHELTER AT WYNNEWOOD AVENUE

after having passed through a switchboard which controls the two feeder circuits for the signal system, one running in each direction from the power house.

At each signal location the 2300-volt current is stepped-down by a single transformer to the various operating voltages required. This transformer has three secondary windings—one 50 volts for the operation of signal motors, lamps

cuits, one of which is used for each track, when the sections on these tracks end opposite each other. The track windings are furnished with taps to permit adjustment of the current to secure satisfactory operation of the track relays. The adjustment required depends upon the length of the section.

The transformer is located on a stub pole which also supports a grid box containing an adjustable resistance connected in series with the track winding of the transformer to prevent excessive flow of direct current through this winding, with its resulting saturating effect, and also to secure the proper phase relation between the currents and the two windings of the track relay, which is of the polyphase induction-motor type. A track box containing controlling relays and a terminal board, to which all wires are led, is also located on this pole. This localizes all apparatus, thereby making it easy to maintain, and also to locate troubles should they occur.

The reactive bonds used for track circuit work are of the ironless type; these consist of coils of strip copper with a sufficient number of turns insulated from each other to give the requisite reactance, and of sufficient cross section to carry the propulsion current without undue heating. These bonds are oil-cooled, and are placed in an iron case located on extended ties at the end of each section.

The signals are of the one-arm, home, automatic block type, and are overlapped, the average length of overlap being about 3200 ft. East of Beechwood Park, where traffic will be very dense, short blocks with a full block overlap are employed, both the block and overlap averaging 3200 ft. West of the Park the blocks average about 8000 ft. in length.

The average length of track sections is 3500 ft.; the longest is 8800 ft. The ability to operate long track sections with alternating current is, in fact, one of the important advantages of this type of control.

This company is the first high-speed interurban railway, in contradistinction to an electrified steam railroad, to provide such an elaborate and scientific system of block signals. Without question, it has set an example which must be followed on future roads of similar class where high speed must be maintained with absolute safety, and where one rear-end collision might well equal in cost of damages a large part of the road's capitalization.

EMPLOYEES

Recognizing that the reputation of a railway depends largely upon the character of its trainmen, the Philadelphia & Western not only is exercising great care in selecting such employees, but also is offering liberal wages for this class of work. In all cases, the company requires experienced motormen, but conductors and brakemen need have no previous training in railway work. Motormen and conductors will receive 25 cents an hour, and brakemen 20 cents an hour. Ten hours will constitute a day's work. The regular crews will work from early in the morning to 3 and 4 o'clock, when they will be relieved by other crews continuing service until 1 and 2 o'clock the following morning.

BEECHWOOD PARK

The Philadelphia & Western Railroad anticipates heavy amusement traffic between the West Philadelphia terminal and Beechwood Park, which enters on its first season. This resort is directly opposite the power station of the railroad company and is within a through-run, 5-cent zone. The passengers visiting the park will be accommodated by an extra track and the large platforms shown under construction, and will reach the park entrance safely over a bridge carried on concrete towers. The railroad company also has erected on the park grounds a 600-kw sub-station for lighting and power.

The park is divided in two sections, one of which will be enclosed and devoted wholly to amusements of the highest order. The other will be used for picnic parties, and ample tables and seating facilities will be provided for public and Sunday school parties that are already engaging dates for outings during the summer. The amusement section, which is enclosed, consists of about 10 acres properly laid out and devoted exclusively to the best attractions and high-class music, while an additional 10 acres of prettily shaded woodland comprise the picnic grove. The park attractions will be placed on the sides of a hollow square and be accessible by a board walk 40 ft. wide. The capacity of the grounds is estimated at 15,000 to 20,000. It is hoped to make this a great family resort, inasmuch as the policy announced by the management prohibits the sale of liquors, and special attention will be given to women and children.

A VIEW OF BEECHWOOD PARK, SHOWING SOME OF THE PRINCIPAL ATTRACTIONS AND THE SPECIAL PASSENGER PLATFORM UNDER CONSTRUCTION

GENERAL

The Philadelphia & Western Railroad Company is owned by a syndicate headed by Mackay & Company and William C. Sheldon & Company, both banking firms of New York. The officers of the company are the following: President, George R. Sheldon; vice-president, Thomas Newhall; secretary and treasurer, Davies Murdoch; chief engineer, W. R. Molinard, and general superintendent, W. H. Simms.

SOME COMMON FIRE HAZARDS OF CAR HOUSES

BY W. J. CANADA
Electrical Inspector of Ohio Inspection Bureau

The larger electric railway companies are now paying considerable attention to the installation of fire preventive measures in their car houses and repair shops as well as to fire-fighting facilities,—a natural step in view of the recent disastrous fires in this class of buildings. As a result the car house itself is becoming more nearly fireproof in construction and some of the fire hazards have been lessened, although there are still many comparatively inexpensive protective features which the experience of the next few years will demonstrate to be necessary. It is among the smaller systems, however, that protection has been most neglected, and with whom even the most ordinary precautions are often omitted. Apparently many of them are in blissful ignorance of what constitutes a fire hazard and what it really means to the continuity of their service to have the safety and availability of their rolling stock assured.

A number of serious potential causes of fire inception and spread are prevalent in the buildings of these companies. Some of these are almost universal, and most of them are very general. When one considers that those responsible for their existence are trained engineers, the surprise is increased that more forethought has not been employed in their prevention.

Every one recognizes the danger of a live trolley wire in a burning car house or in one not actively used except for storage. But in very few of the storage houses are the tracks inclined so that with dead trolley, cars may be cleared from burning buildings by simply releasing the brakes. In a majority of cases, too, the switches within the car house are solid-throw instead of the spring type, and so will occasion additional delay to the quick removal of cars.

Most car houses and shops have very unsafe trolley wire protection. Comparatively few have the running trough for wheels which leave the wire, and many employ so few hangers that a break near one will allow wire to fall to the track or to grounded parts of cars. Both these defects are frequently the causes of incipient fires. Within the past year a fire has been started by a trolley wheel leaving the wire, and the pole grounding the trolley wire against a sprinkler pipe. This might also put the sprinkler system out of commission at the time of its greatest necessity. Two fires have occurred within six months, caused by the trolley wire falling and making contact with grounded parts of cars in car houses. In one case, the car body was almost destroyed. Broken or missing bond connections are another prolific source of arcs which become especially hazardous over pits or in painting and cleaning sheds. Wooden pits which have communicating tunnels or are partially used for storage are contributing causes. Electric wiring for light and power is often of the frailest construction and productive of frequent local troubles. The location of rheostats is generally apparent by scorched woodwork. Wires are so overloaded that the insulation soon becomes useless, and these wires are frequently so placed that they arc against adjacent combustibles. Out of twelve car houses in one district, seven fires from these causes occurred within a year. Open forges, stoves, storage of oils in repair shops, drying ovens of asbestos-lined wood, and the like, add to the list of usual hazards about these buildings.

In many cases it has been only through the strenuous efforts of the insurance companies that some protective apparatus, such as sand buckets, water barrels, hose, standpipe, tanks, and occasionally a sprinkler system, has been installed. With these in place there is often a perpetual war between insurance companies and operating force over their proper maintenance. It is a strange fact that "fooling the inspector" is regarded more highly by some foremen than safeguarding the building. Waste cans have been frequently discovered open and full of oily waste, while an accumulation of greasy rags of the past week is found on benches, shelving, or in pits. Sand buckets will be used to supply track sanders. Barrels become dry and leaky. Standpipes are disconnected and left in that condition. The sprinkler system leaks and is cut off. An especially aggravated case was recently observed where a main supply pipe was utilized as a ground return for an armature testing and heating stand, the track return not being easily accessible. A smaller air supply pipe, paralleling this water pipe, had only a few months before broken down on account of electrolytic corrosion, so that this case could hardly be ascribed to ignorance alone.

The attitude of the management, which must finally determine the degree of safeguarding to be maintained, is often a complicated one. It vacillates between a desire to secure a vaguely understood condition of safety, and an uncertain idea, frequently fostered by a foreman's report, that the insurance interests are more rigorous in their demands than the occasion requires. That insurance rates are a result of fire loss experience and are reduced by better protective and preventive construction is a fact which does not properly appeal to the managements. Careful inspection by a competent employee will keep the fire hazard within the lowest possible limits. This should be supplemented by periodic inspection from a disinterested source. Construction necessary to assure a high degree of safety to shops and rolling stock should be installed. All this will result from a careful study of the question by the management, but this study cannot be made from the office. A personal inspection into every detail which enters into the question will bring most managers to a different viewpoint, and their attention to the matter will be reflected in the maintenance of safer conditions by the operating force.

The so-called Public Utilities bill, signed by Governor Hughes of New York last week, puts under direct State control every public service corporation in the State of New York, with the exception of the telephone and the telegraph. Under the new law four of the most important State commissions will pass out of existence. In their place will be two boards of five members each, all of whom are to be appointed by the Governor, and these boards will have complete control of the regulations governing the transportation and lighting facilities of the State. One of the commissions will have jurisdiction in the four counties composing New York City, and the other will have under its direction all the other counties of the State. These two bodies will have complete and free-handed control, and will be held to enforce the regulations provided for in the measure. The State Railroad Commissioners legislated out of office by the new law on July 1 are Frank M. Baker, of Owego; Joseph M. Dickey, of Newburg; George W. Aldridge, of Rochester, and Henry N. Rockwell, of Yonkers. George W. Dunn, of Binghamton, resigned a few weeks ago. The State Commissioners of Gas and Electricity, who also go out, are Lucian L. Sheddon, of Plattsburg; John C. Davies, of Camden, and Frederic E. Gunnison, of Brooklyn. The State Inspector of Gas Meters also is legislated out of office.

CAR WIRING AND PIPING PRACTICE OF THE METROPOLITAN WEST SIDE ELEVATED RAILROAD, CHICAGO

Too frequently the wiring of cars and the disposition of the apparatus under the car receives very little attention, and for this reason the practice of the Metropolitan West Side Elevated Railroad, Chicago, in the equipment of fifty cars recently put in service, is of especial interest. The company has given particular attention to this phase of car construction for several years, and frequent orders for cars have enabled the officials to work out methods which are believed to be superior to those usually followed. The problems connected with the wiring and piping of the cars have been worked out by E. T. Munger, master mechanic of the system, under the supervision of Benj. H. Glover, superintendent of motive power.

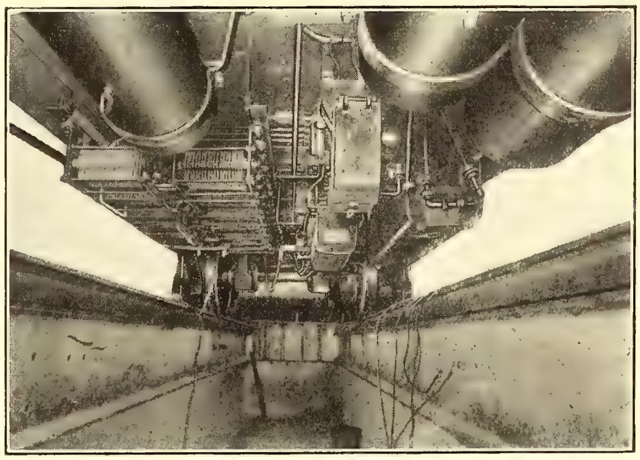
In general design and dimensions the new cars are similar to those described in the STREET RAILWAY JOURNAL, April 22, 1905. However, the design of the bottom framings of the two types of cars are radically different. The bottom framing of the former car consisted of built-up side girders of the fish-belly type with cross channel bars at the ends and intermediate bridging of I-beams. The wood floors rested directly on this framing. The bottom framing of the new cars consists of two parts, a steel sub-framing of I-beams covered over entirely with a 3-16-in. steel floor and a wood framing over this consisting of wood side sills and stringers carrying a wood floor. Between the wood floor and the steel plates there is a space of about 1¾ ins.

The fish-belly type of side girder was abandoned partly because of its depth, which prevented proper ventilation of the apparatus under the car. With it, to obtain sufficeint cooling of the compressed air, radiating coils were hung on the outer side of the girders. In the new car the decreased depth of the side I-beams permitted these radiating coils to be hung under the car, and their location is well shown in one of the accompanying reproductions from a photograph.

An increased cooling effect on the air in the tanks was obtained by hanging the tanks below the side I-beams. In fact they were placed so low that it was not advisable to put the customary drain cocks underneath, so to permit drainage the tanks were hung with one end about 3 ins. lower than the other and a drain pipe provided with a globe valve was fitted in the lower end.

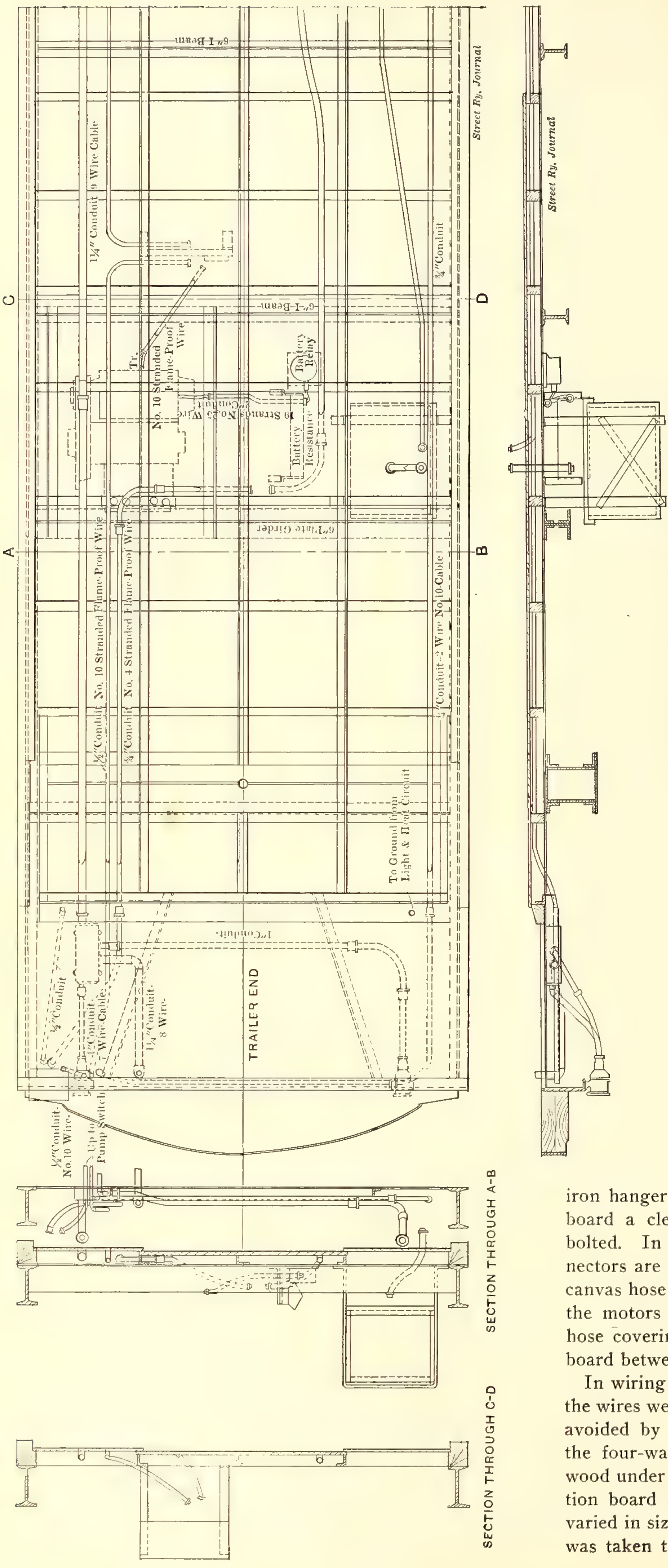
All of the air apparatus was located at one end of the car so as to eliminate as much piping as possible. By placing the apparatus of the Westinghouse electro-pneumatic control system at the No. 1 end of the car, the connections between the motors and the reverser and switch group were kept short and in addition the weight of these heavy parts was thrown on the motor truck.

All of the wiring of the controller under the car with the exception of two or three cables about 1 ft. long is in loricated conduit. Probably the most unusual feature in connection with the wiring is the fact that all the conduits except the short ones are run in the space over the steel plates and underneath the wood floor. The conduits were built in this space during the construction of the car and are held in position in such a manner that vibration is impossible. Those terminating in the jumper receptacles on the end of the car and those leading to the master controller drop down through the steel plate just behind the end sills, while those leading to the pump and controller parts are carried through the plate immediately over the apparatus to which they connect. In the accompanying engraving the conduits shown by full lines are those above the steel



VIEW FROM TRAIL END, SHOWING FREEDOM FROM CONDUITS AND WIRES OF UNDER SIDE OF CAR FLOOR

CAR OF THE METROPOLITAN WEST SIDE ELEVATED RAILWAY READY FOR SERVICE



HALF PLAN AND SECTIONS FROM TRAILER END

floor. Those underneath are shown by broken lines. One advantage gained by carrying the conduits in this space above the steel floor was that no brake apparatus and other parts were to be avoided; in addition, they could be run straight with increased economy both in labor of installation and in material. An idea of the relative location of the switch group reverser, grids and main switch may be obtained from one of the illustrations. By assembling these, all connecting cables were materially shortened. The loricated conduits between the controller apparatus are held in by wrought-iron straps bolted to the steel floor above.

Although assembled compactly, the controller apparatus is so placed that any part of it may be easily reached for inspection or repair. The limit switches are mounted near the ends of the reverser, where they are readily accessible. All of the control apparatus, and in fact all the apparatus under the car, is suspended from the steel floor by wrought-iron supports. The rheostats are carried by angle-iron frames, and the supporting bolts for each grid are provided with lock nuts; provision is made also for the insertion of a cotter key underneath the nuts.

One of the illustrations shows the motor connection board used by the company on all of its cars. Instead of carrying the motor leads up against the car floor to a point near the bolster, as is usually done, the leads are clamped so that they rest on the top of No. 2 motor and drop down under the truck end frame and up to the connection board shown. This method of bringing out the motor leads, which has been used by the company for two years, avoids making short bends in the cables and also permits the two way-connectors to be placed at a point where they can be gotten at without difficulty. The connection board referred to consists of a 2-in. oak block about 14 ins. square suspended from the steel flooring above by wrought-iron hangers. At both the forward and rear edges of the board a cleat containing U slots for the seven wires is bolted. In connecting up the motors the two-way connectors are first clamped together and then short pieces of canvas hose are drawn over them. When that cleat nearest the motors has been bolted up the connectors with their hose coverings are held up rigidly against the connection board between the two cleats.

In wiring the cars, no cables were soldered except where the wires were held rigidly. In several places soldering was avoided by using Dossert connectors, both of the T and the four-way type. Special effort was made to eliminate wood under the car, none being used except for the connection board and in the battery boxes. The conduits used varied in size from 1¼ ins. to ½ in. In bending them care was taken to see that the bends were not too short or of

such a character as to make it difficult to draw the cables in them. All of the cables drawn in the conduits, with the exception of the control circuit cables, are of G. E. standard rubber-covered flame-proof wire.

In locating the apparatus under the car particular attention was given to distributing the weight with reference to the center of the car, and as placed the foot-pounds on each side of the car balance, or in other words, the sum of the weight of each piece of apparatus on one side of the car multiplied by its distance from the center line of the car in feet balances a similar sum of apparatus weight and distance on the other side of the car.

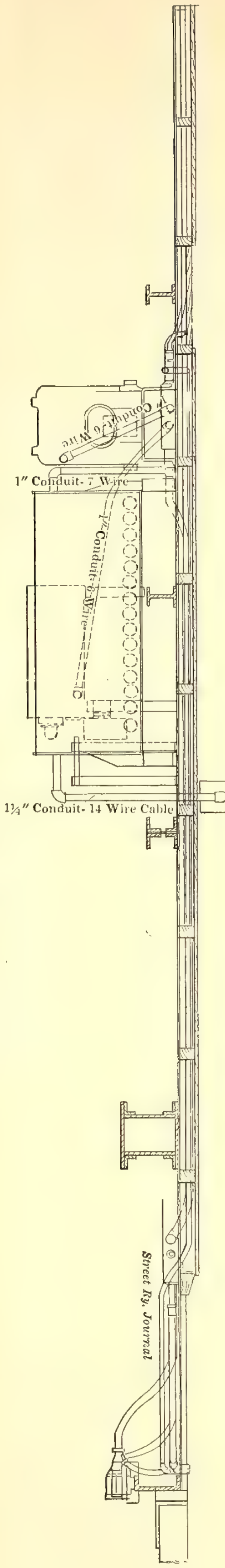
All the positions for the apparatus and conduits and the details as to hangings and supports were worked out before the construction of the car. This enabled the holes and openings in the steel work to be made during construction, and as a consequence the installation of the apparatus together with the piping and wiring was very much facilitated and cheapened.

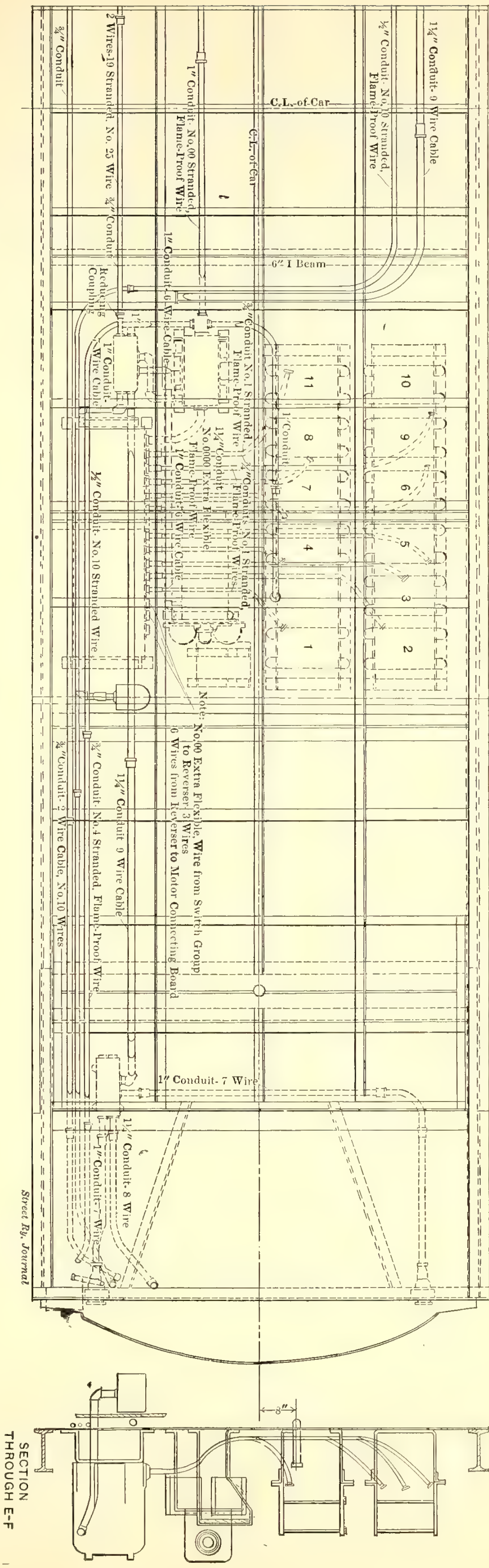
The careful manner in which everything was worked out previous to the installation of the apparatus had a very decided effect on both the cost of the material required to wire the cars and of the labor necessary to install the apparatus and wiring. The average cost on fifty cars was: Material, per car, $85.14; labor, wireman and helpers, $46.77; labor, bending, placing and hanging conduit, $26.75, making a total per car of $158.66.

The costs given for material include all wires of the car body and trucks except those in the light and heat circuits above the car floor and the small cables of the battery control circuits which were purchased as part of the control apparatus. It includes all of the conduits, hangers for apparatus and conduits, all conduit fittings and wire connectors.

The amount and sizes of conduits used were: 1¼-in., 60 ft.; 1-in., 104 ft.; ¾-in., 110 ft., and ½-in., 20 ft.

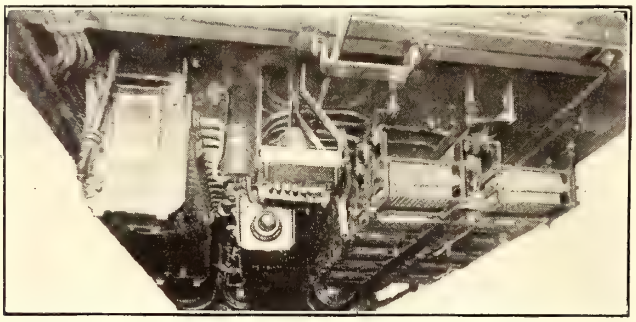
The amount and sizes of wire required were: No. 00 stranded flame-proof, 69 ft.; No. 00 extra flexible flame-proof, 17 ft.; No. 0000 extra flexible flame-proof, 5 ft.; No. 1 stranded flame-proof, 96 ft.; No. 4 stranded flame-proof, 38 ft.; No. 8 stranded flame-proof, 12 ft., and No. 10 stranded flame-proof, 15 ft..





HALF PLAN AND SECTIONS, SHOWING CAR WIRING DETAILS

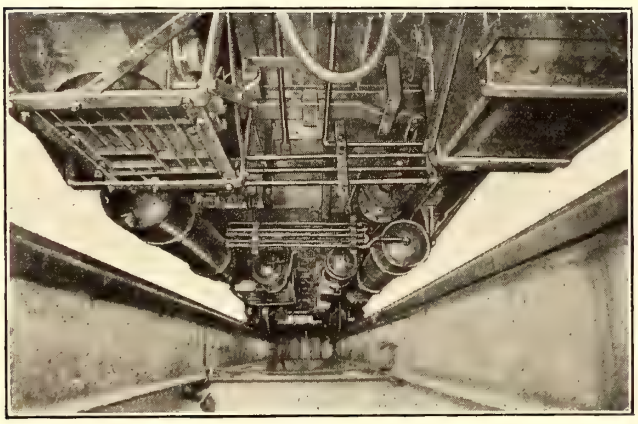
The No. 00 stranded flame-proof wire was used between the trolley shoes and the junction near the line switch where the trolleys from each end of the car are brought together, except where flexibility required the use of the No. 00 extra



VIEW FROM MOTOR END OF CAR, SHOWING THE RELATIVE LOCATION OF CONTROL APPARATUS AND CONNECTION BOARD

flexible flame-proof. The No. 0000 wire was used between the line switch and the junction referred to and between the line switch and the switch group.

The resistance leads are made of No. 1 stranded flame-



TRAIL END OF CAR, SHOWING AIR-BRAKE APPARATUS

proof and the trolley connection of the light and heat circuits and to the light and heat terminals on the ends of the cars are No. 4 stranded flame-proof wire.

ELECTRIC RAILWAY STATISTICS OF CANADA SHOW HEALTHY GROWTH OF THE BUSINESS

According to the annual report of the Department of Railways and Canals of Canada, there were in operation at the close of the fiscal year ended June 30, 1906, 814 miles of electric railway, 195 miles being double-tracked. The paid-up capital amounted to $63,857,070. The gross earnings aggregated $10,966,872, an increase of $1,609,747, and the working expenses $6,675,038, an increase of $756,844, leaving the net earnings $4,291,834, an increase of $852,903. The number of passengers carried was 237,655,074, an increase of 34,187,757, and the freight carried amounted to 506,024 tons, a decrease of 4326 tons. The car mileage was 56,618,836, an increase of 4,659,735 miles. The accident returns show a total of 47 persons killed during the year, and 1653 persons injured. Power was supplied in 15 cases by water, and in 41 cases by steam. Ontario has 441 miles, Quebec, 198; New Brunswick, 16; Nova Scotia, 54; Manitoba, 32, and British Columbia, 72 miles. Returns were received from 47 companies.

REPORT ON THE CAMBRIDGE SUBWAY STATIONS

William Barclay Parsons, of New York, consulting engineer for the city of Cambridge, Mass., in connection with the Boston-Cambridge subway, has submitted an exhaustive report to Mayor Wardwell upon the question of station locations. A rather full abstract of the report is given herewith:

The total length of subway from Park Street to Harvard Square is 3.2 miles, of which 2.3 miles are in Cambridge west of the Charles River, following Main Street and Massachusetts Avenue. The arrangement of stations suggested by the Boston Elevated Railway Company, no formal plan having been filed, calls for two in Cambridge, one at the terminus at Harvard Square and one at Central Square, free transfers to and from the surface lines to be given at both points.

At Harvard Square the surface tracks coming from the west are to be depressed beneath the surface, so as to give on the same level, as near as possible, a convenient transfer between the western trolley cars and the subway trains, while at Central Square the company would provide a transfer station so that passengers can go from one conveyance to the other under cover. The following items are important as bearing upon the problem:

(A) The character of the various districts regarding their population, occupations and traffic values, with possibilities of development and the probable effect upon them of subway station location.

(B) Actual information as to the origin and destination of passenger traffic as it exists at present in Cambridge.

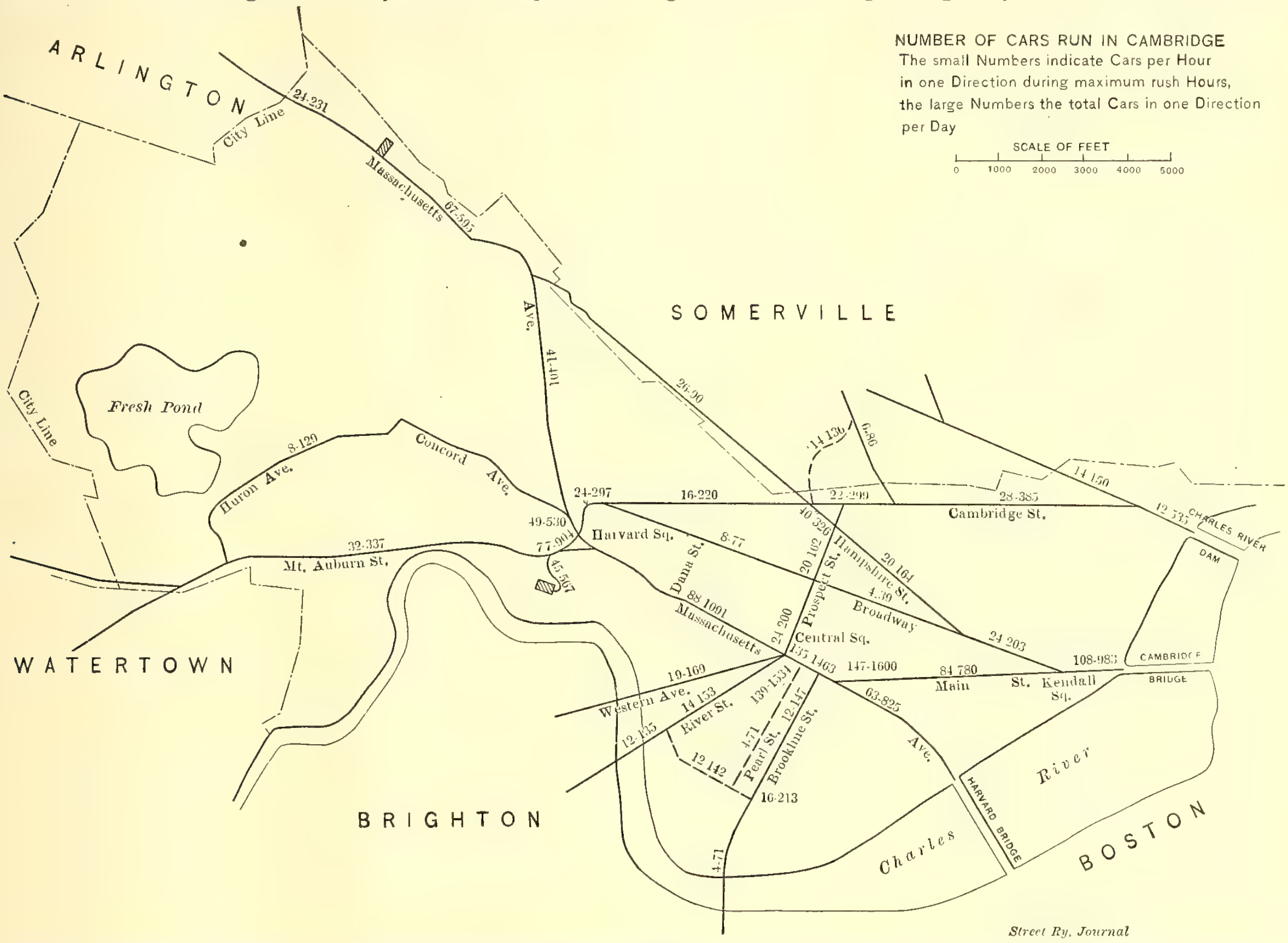
Within the limits traversed by the proposed subway, Cambridge may be considered as divided into four districts, the university on the west, the commercial near Central Square in the center, with a residential area between them, and a district of manufacturing industries and tenements to the east. The Harvard Square district being largely dependent on the university, will grow in population directly as Harvard grows. The commercial area next to Central Square will probably extend as a business district, and the actual increase in population may consequently be small, as is true of business districts in other cities, in some of which indeed the population in the business districts is actually decreasing.

Growth in population and growth in traffic are thus seen to be not necessarily related. Further increase in workmen population does not bring comparative increase in car travel. Such people, being of moderate means, endeavor to live near their work, so as to economize on car fares. On the other hand, a strictly residential district creates car travel that is above the average of car travel per population, as it furnishes travel not only to and from business morning and evening, but shopping and school travel during the day and to amusements during the evening. These basal principles must be kept in mind in discussing facilities to be furnished through stations. Given the facilities, a district well located and susceptible of dense growth, either in private houses or a good class of apartments, is certain to respond in traffic returns, and special allowance must be made for such demands.

In the lower district of Cambridge, called the "Port," it is probably certain that there will be more factories and tenements, a condition not conducive to rapid increase in car traffic. That section of Cambridge immediately tributary to the subway, where there may be expected a great increase in what is known as "residential" population, is in

the district in the neighborhood of Dana Street. In order to analyze the movement of passenger travel, and particularly the travel to be handled by the proposed subway, the origin of the present street car traffic must be determined. The information available consisted of passenger records in gross and some special counts made by the Boston Elevated and the City Engineer of Cambridge, but none of sufficient detail to answer the purposes of this inquiry. From the company was ascertained the number of cars run on the various routes in Cambridge, including the maximum number of cars per hour during the period of greatest traffic in one direction, and the total number of cars run in one direction during twenty-four hours.

To determine the distribution of car travel in Cambridge in detail, Mr. Parsons organized a system of inspection, whereby the passengers boarding and alighting from the cars at all points on both Main Street and Massachusetts Avenue between Harvard Square and the Charles River were counted, and there were also counted the passengers arriving at Central and Harvard Squares and other transfer points from other parts of the city of Cambridge or outlying districts, or who either remained in the cars and went toward Boston or transferred to other cars in the same direction. This count of passengers extended from 6 a. m. to 9 p. m., and covered 95 per cent of the total travel. As a matter of convenience, passengers were counted on and off east (Boston) bound cars only, it being known that the traffic in the reverse direction is substantially equal in amount. The counts were made on four different days, on which complete returns were secured for two whole days. Individual observations were also made on the traffic lines over a period of about two weeks, under varying weather conditions. In taking these figures, not only was the number of passengers secured, but they were taken in point of time and according to car routes, so that the distribution of travel can be computed both by time and direction. A table was prepared showing the traffic by streets, and this gave the number of passengers getting on and off east-bound cars at each stop on or tributary to the proposed subway route. On April 22 at Harvard Square 9740 passengers were counted in the cars and 5075 got on at this point, making a total of 14,215. The passengers on the cars at Harvard Bridge were 21,935, and at the West Boston Bridge 17,588, or a total of 39,525. The figures for April 24 paralleled these quite closely. At the various street stops the inbound traffic represented by passengers boarding eastward moving cars greatly exceeded the number of



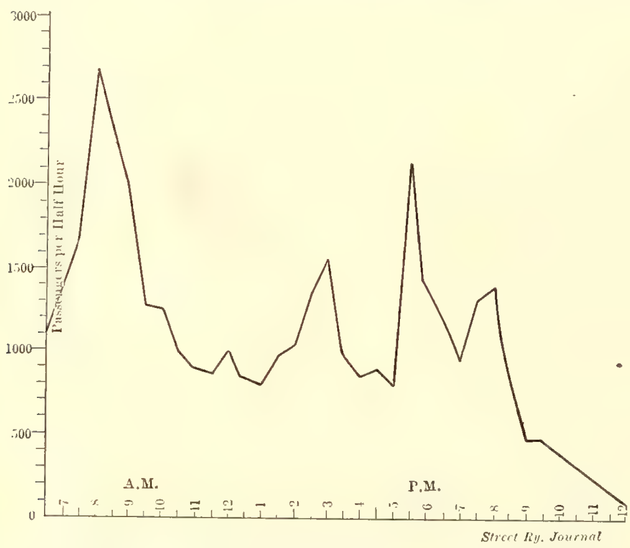
MAP OF DISTRICT AFFECTED BY THE BOSTON-CAMBRIDGE SUBWAY, EACH LINE SHOWING CARS PER RUSH HOUR AND PER DIEM

passengers alighting. Detailed figures for each street were given in the report. The figures gave the number of passengers on the days in question, but an unusually constant set of travel conditions was noted under wide changes in weather, with local variations, increases and decreases, easily explainable by well-known traffic laws. While on the one hand the figures included many people who were going to parts of Boston distinctly removed from Park Street and its vicinity, on the other hand they did not include the increase in traffic that a fast service will incidentally stimulate. The figures represent proportions in which the traffic, whatever is its amount, is divided among the various localities.

The effect of locality and of climate on the daily traffic, according to the hour, was very evident from the detailed figures. In the counts from the residential area of Dana Street there is fairly evenly distributed traffic throughout

the day, with increase in the morning of passengers going to Boston on business, with a maximum peak at 8:30 a. m.; with the Boston shopping traffic in the afternoon and amusement load in the evening. The travel from Dana Street area is heavier on Mondays, due largely to the increase in the shopping trade, and is more affected by inclement weather than any other area in Cambridge. In the neighborhood of the Port, the manufacturing district, one in the morning towards Boston, with the peak of the load at 7 a. m., being working people living in Cambridge and employed in Boston, and the other in the afternoon, with the peak of this load at 5 p. m., indicating the movement of operatives living in Boston but working in Cambridge. The travel to this area, conversely to the Dana Street travel, is increased by inclement weather, as the wage-earners who ordinarily walk are driven to the cars.

The traffic that will be tributary to the subway is partly transfer and partly local. The former arrives at Harvard



DISTRIBUTION OF TOTAL TRAVEL BY TIME FROM CAMBRIDGE TO BOSTON

Square by the Arlington, Belmont and Watertown cars, and at Central Square by River Street, Western Avenue and Prospect Street cars, and at Kendall Square by Broadway and Hampshire Street cars.

Two stations do not, therefore, take cognizance of all the surface lines of Cambridgs. The Broadway and Hampshire Street lines, carrying across the river about 5000 passengers in each direction, are important connections, and would be left without connection. In order to furnish facilities for this traffic a station at Kendall Square has been proposed, and, in addition, to furnish intermediate stations for local traffic and to reduce some longitudinal transferring, stops have been suggested in the neighborhood of Dana Street and Portland Street. It is axiomatic that high speed and frequent stops are antagonistic if only two tracks are used. With four tracks, as in the New York subway, the double service is maintained, and the public served by a change at the express stations. It is to be regretted that the traffic in sight does not justify immediate four-track construction in the Cambridge subway. When the details of construction are under consideration, it will be well to arrange the Harvard Square station so as to permit the building there of two more tracks for an express service running easterly by such route as may in some future year be chosen. The use of longitudinal surface tracks, as local feeders for the subway track below, is a temporary compromise for a four-track railway, on which it may be necessary to decide as to the advisability of the number of what may be called the express stations, with the extreme of two only (including the terminals at Harvard Square) as proposed by the Boston Elevated to three, four and five as proposed by different citizens.

The time occupied by a train under the various conditions can be taken substantially as follows:

	Min.	Sec.
Harvard Square to Park Street with one intermediate station	7	0
Harvard Square to Park Street with two intermediate stations	8	30
Harvard Square to Park Street with three intermediate stations	10	0
Harvard Square to Park Street with four intermediate stations	11	30

This time schedule is somewhat slower than some figures which have been published. It is certain to be found impossible to work up to a theoretical schedule during the rush hours, when delays by passengers and close train intervals are bound to occur. Such delays are here taken into account.

To determine the proportion of travel that may be considered as tributary to any station, it is necessary

1. To deduct from Harvard Square count passengers alighting from east-bound cars at Harvard Square and at streets east of Harvard Square to and including Trowbridge Street, as such passengers would obviously not use the subway.

2. To add to stations east of Harvard Square the passengers alighting, as such passengers would purchase tickets in the subway west-bound later in the day.

3. To add to Dana Street, Portland Street and Kendall Square a portion of passengers boarding cars on Broadway and Massachusetts Avenue, as probably tributary to the subway if built. This allowance is in favor of the small and at the expense of the large stations.

4. To add to Kendall Square the passengers going to Boston on the Broadway and Hampshire Street cars.

5. To group the traffic at the various streets according as such streets appear to be tributary to one or the other station.

Making these corrections and combinations, we have the following percentage of traffic probably tributary to the various stations, taking the liberal allowance of five stations as the basis:

	Per Cent
Harvard Square	35.85
Dana Street	8.12
Central Square	32.95
Portland Street	6.48
Kendall Square	16.6

The tables of travel showed the total travel at all points, regardless of whether the passengers came from Cambridge or from points beyond Cambridge. To make this separation, passengers entering the limits of Cambridge were counted, and those alighting before reaching Harvard Square and Central Square or at those points without taking transfers were deducted. It was found by this means that through passengers at Harvard Square would account for nearly one-half the passengers credited to that station, and more than one-third of the Central Square total.

The great preponderance of Harvard and Central Squares and the importance of Kendall Square is immediately evident. The placing of a station at Kendall Square is, however, very objectionable from an engineering and practical standpoint. Descending from the crown of the Cambridge bridge is a 3 per cent grade, continuing until the railway is underground, a total distance of about 2000 ft. Near the

foot of this incline would be the station. To permit a fast-moving train to descend the incline, unless the preceding train had cleared the station, would be highly dangerous. Mr. Parsons states that he is aware that this is done elsewhere, but it is dangerous practice and either restricts the speed of the trains or the capacity of the subway, or both. If the location of the station were moved westerly to Sixth Street, the same ends would be served. The station would still be among the large factories, in fact, rather nearer the center, while the transfer to the Broadway and Hampshire Street cars could be equally conveniently effected. This station would be far enough away from the incline on the bridge approach to permit the use of ordinary train block lengths irrespective of the station. Should a station be located at Sixth Street, and this is the proper point as determined by operating conditions, it would seem to be advisable to place another at Portland Street, or, in fact, between Sixth Street and Central Square. In this distance, about 4500 ft., there is no transfer traffic, and the longitudinal traffic, which is small in amount, in fact, less than 5 per cent of the total travel, can be accommodated by transfers from the surface cars.

The territory between Harvard Square and Central Square is the one section of Cambridge directly contiguous to the route of the subway, which is susceptible of great development for compactly built residences and apartment houses. Such development will undoubtedly be greatly stimulated by a subway station conveniently located. This has been the experience in similar districts in New York, apartment houses being built up in the immediate vicinity of the "up-town" stations, with a corresponding rapid increase in the subway travel, an experience which will doubtless be repeated in Cambridge.

The stations in New York at 135th Street and Lenox Avenue on the East Side subway, and at 137th Street and Broadway on the West Side subway, are good illustrations of how apartment house traffic increases. The travel at these two stations for the first six months and for the corresponding six months two years later are as follows:

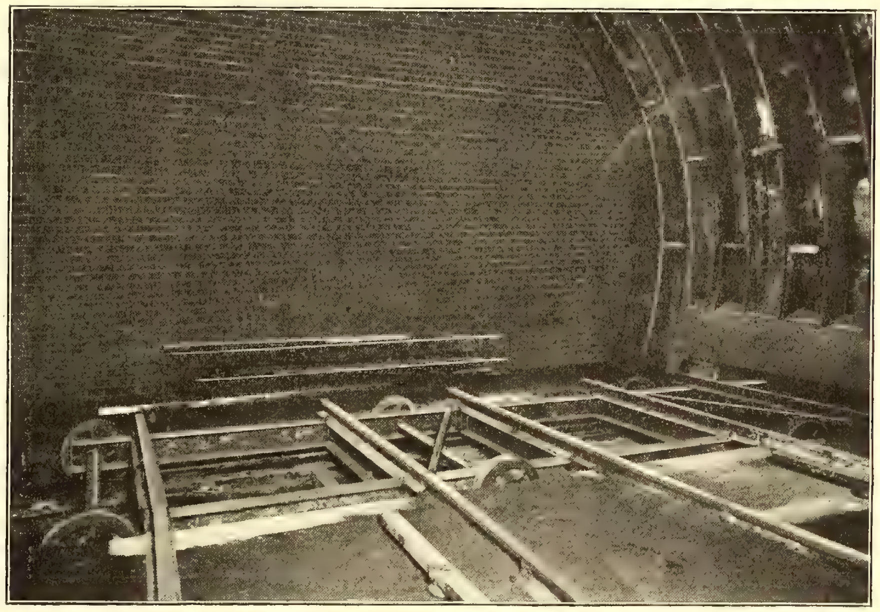
135th Street and Lenox Avenue, six months, ending April 30, 1905	1,419,519
135th Street and Lenox Avenue, six months, ending April 30, 1907	2,272,660
Increase	853,141
137th Street and Broadway, six months, ending April 30, 1905	1,419,519
137th Street and Broadway, six months, ending April 30, 1907	2,272,660
Increase	853,714

If no station could be located between Harvard and Central Squares the effect would be to concentrate development, with congested conditions, about these squares, while if a station was located midway between, development could be more evenly spread, and there would undoubtedly be a quickening of the apparent existing tendency toward apartment house construction in the district in question, with a corresponding increase in the travel derived from the district. Mr. Parsons recommends a station at Dana Street and criticises curved platforms as intolerable unless absolutely necessary. Should a four-station arrangement be adopted, the proportionate total distribution of traffic is:

Harvard Square 35.85 per cent (18.75 local, Cambridge).
Dana Street 8.12 per cent.
Central Square 32.95 per cent (20.75 local, Cambridge).
Sixth Street 23.08 per cent (13.62 local, Cambridge).

EXTENSION TO THE CITY & SOUTH LONDON TUBE

An account was given in the London Letter in the issue of June 1 of the opening of the extension of the City & Southern London Underground Tube Railway from the Angel to Euston station, but additional particulars of the equipment of the railway are now available. It will be remembered that the City & South London was the earliest of the electric tubes in London, and few changes, if any, have been made in the type of equipment used. Electric locomotives are still used and the normal length of train is five cars. The third rail is laid between the running rails,



TRAVERSER FOR LOCOMOTIVES AT EUSTON

but not directly in the center of the track. The railway is operated on the three-wire system with 1000 volts pressure across the outside wires. Including the distribution system, however, an ingenious five-wire system is employed with 2000 volts between the outside conductors, as motor-generators operate boosters at the sub-stations on the outside of the system. In this way the amount of current returned on the neutrals is very small. A diagram illustrating the system of distribution used is contained in the paper by P. V. McMahon published in the STREET RAILWAY JOURNAL for Aug. 16, 1902.

The extension which has just been completed is built with two twin tunnels like the rest of the system, but at Euston station these two tubes are united in a tube 30 ft. in diameter. This is said to be the largest tube ever driven on the Greathead system, and has two tracks carried on each side of an island platform. In the view of Euston station herewith three tunnels are shown, but that at the right is simply a siding. The engraving on this page shows a transfer table employed at the Euston terminal for shifting the locomotives on to the return track.

A telephone signal system has been installed, in which

a telephone is carried on the locomotive and can be connected to two telephone wires, carried through the tunnel, by which the motorman can communicate with the nearest signal booth. In addition, the tubes are supplied with electric lamps, which are not normally in use, but each signalman has instructions that when a train has been in a section for a longer period than two minutes the tunnel lamps are to be switched into circuit. Electric block signals are also employed.

The company has recently added steel cars to its equipment. These cars were supplied by the Brush Electrical

EUSTON CROSS-OVER AND SIDINGS

Engineering Company, and their principal dimensions follow: Length over car body, 26 ft.; width over car body, 6 ft. 10 ins.; height inside car, 6 ft. 8½ ins.; total height from rail to top of car, 8 ft. 4¾ ins.; wheel-base of truck, 5 ft.; truck centers, 16 ft. 9 ins.; total length of five-car train, without locomotive, 160 ft.; weight of train, 37½ tons; number of seats per car, 32; weight of car per seat, 0.224 tons; weight of train per running foot, 0.284 tons.

The company has recently introduced geared motors on its locomotives instead of the direct drive originally employed. Westinghouse brakes are used throughout, and the train line and other pipes are carried on the roof.

PROGRAM OF NEW YORK STATE CONVENTION

As already announced in this paper, the annual convention of the Street Railway Association of the State of New York will be held at the Hotel Champlain, Lake Champlain, New York, on June 25 and 26. Hotel Champlain is on the Delaware & Hudson Railroad, and can also be reached by Lake Champlain boats. Reduced railroad rates will be granted to those attending the convention. The program follows:

TUESDAY, JUNE 25

Roll call.
Address by president.
Report of executive committee.
Report of treasurer.
Report of secretary.
Reports of committees.
Paper—"Some Phases of Electric Railway Accounting," by J. C. Collins, secretary, Rochester Railway Company.
Paper—"Existing Shop Practice in Central New York," by W. H. Collins, M. M., Fonda, Johnstown & Gloversville Railroad Company.

WEDNESDAY, JUNE 26

MORNING SESSION, 10 O'CLOCK

Paper— "Recent Improvements in Motors and Control," by G. H. Hill, Railway Engineer, General Electric Company, and Clarence Renshaw, Railway Engineer, Westinghouse Electric & Manufacturing Company.
Paper—"Relation Between Maintenance of Way and Equipment," by W. R. Griffin, Superintendent, Rochester & Eastern Rapid Railway Company.
Paper—"Power," by S. B. Storer, Niagara, Lockport & Ontario Power Company.

AFTERNOON SESSION.

Unfinished business.
Election of officers.

The entertainment decided upon is as follows: On Tuesday afternoon an excursion will be made to the far-famed Ausable Chasm; on Wednesday afternoon there will be a ball game between the railway and supply men present. Many short trips can also be made to points of interest on Lake Champlain.

The banquet will be held in the evening of Tuesday. Hon. W. Caryl Ely has consented to act as toastmaster. Banquet tickets will be provided to members, associate members, guests and the ladies. Each allied member will receive one banquet ticket. Extra banquet tickets will be sold at $5 each.

The secretary requests that those who have badges should bring them to the convention, and extra bars will be provided free. A charge of $1 each will be made for extra badges.

E. S. Fassett, of Albany, N. Y., chairman of entertainment committee, will arrange for hotel accommodations upon request. The hotel is conducted on the American plan only. The rates per person are $4 per day for room without bath and $5 per day per person for room with bath.

No provisions have been made for a general exhibit of appliances and apparatus by allied members, but any exhibit will be welcomed, and arrangements for space can be made directly with Hotel Champlain or E. L. Brown, manager, 1354 Broadway, New York.

The Empire State Gas & Electric Association has arranged for a meeting at Hotel Champlain on Thursday, June 27, and has extended to the attendants at the New York Street Railway Association a cordial invitation to be present.

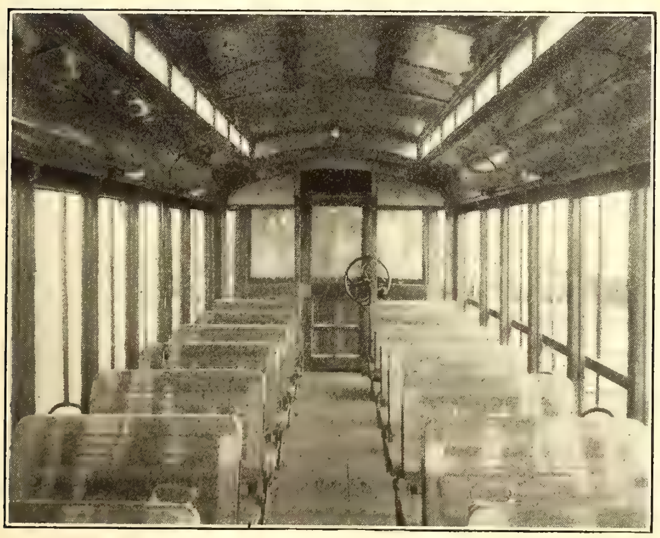
Reduced railroad fares of a fare and a third will be granted upon the usual certificate plan, provided one hundred or more persons secure certificates. These certificates must be vised by special agent of the Trunk Line Association at Hotel Champlain, June 26, 1907; for this there is a fee of 25 cents. Going tickets will be on sale from June 21 to 25. Return tickets are good until June 29, 1907. The reduction is from Trunk Line territory, namely, from Buffalo, Niagara Falls, Suspension Bridge, Dunkirk and Salamanca, N. Y; Erie and Pittsburg, Pa.; Bellaire, Ohio; Wheeling, Parkersburg and Huntington, W. Va., and points east thereof, except in New England.

A handsome interurban private car has just been built by the Cincinnati Car Company for A. F. Schoepf, superintendent of the Cincinnati division of the Schoepf properties, and other officials of the system. The car has an observation end with concave glass windows extending almost to the floor, and a library compartment, toilet, kitchen and dining room in the front end. It is highly finished throughout and upholstered in leather. The car is 60 ft. over all, and is equipped for train operation.

CENTER-AISLE VESTIBULED OPEN CARS FOR SPRINGFIELD, ILL.

The Springfield Consolidated Railway Company, of Springfield, Ill., has received from the American Car Company five eleven-bench open cars which contain some features a little out of the ordinary. The cars are vestibuled at both ends, each vestibule accommodating four passengers; the total seating capacity of each car is forty-four passengers. The seats do not extend entirely across the car, as is the more common practice, the company preferring a center-aisle car. The metal arm pivoted to the back of the seat, although primarily intended to strengthen the back of the seat, may be used as a grab handle by alighting passengers. The truck used is the No. 21-E with 8-ft. wheel-base; two motors of 25 hp capacity each were installed on each car. The cars are finished in ash with ceilings of three-ply birch. The chief dimensions are as follows: Length over crown pieces, 30 ft. $6\frac{3}{8}$ ins.; over sills, including sheathing, 7 ft. 3 ins.; over posts at seat ends, 8 ft. $\frac{1}{2}$ in.; height from floor to ceiling, 8 ft.; from track to under side of sills, 26 3/16 ins.; side sills, $4\frac{3}{4}$ ins. x $7\frac{3}{4}$ ins.; sill plates, 8 ins. x $\frac{5}{8}$ in. The company at present operates thirty-one cars over 31 miles of track on regular schedule. During the winter 22-ft. closed cars with longitudinal seats are operated. These cars are also of the American Car Company's make, the last to go forward being a lot of five shipped about six months ago. In the summer a complete equipment of open cars is operated, excepting four grooveless post, semi-convertible cars, which are used during the entire twelve months.

EXTERIOR OF CENTER AISLE OPEN CAR

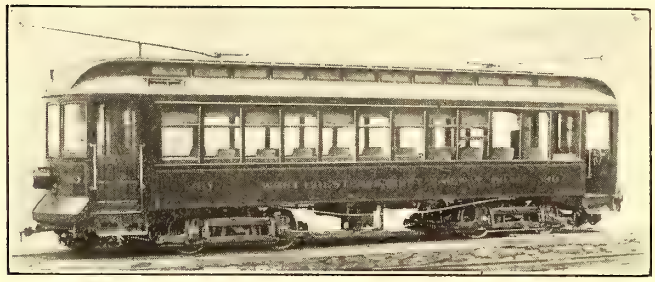


INTERIOR OF CENTER-AISLE OPEN CAR

NEW CARS FOR WESTCHESTER STREET RAILWAY CO.

A number of combination passenger and smoking cars of the grooveless post, semi-convertible type recently were supplied by the J. G. Brill Company, of Philadelphia, to the West Chester Street Railway Company, of West Chester, Pa., to be placed in service on the company's line between West Chester and Coatesville, passing through Downington. Kennett Square may also be reached from West Chester over the company's southerly branch, a distance of about 13 miles. The total trackage of the system is 28 miles. The rolling stock now comprises eighteen semi-convertible cars, the standard car measuring 28 ft. over the body.

The vestibule window rail in the new cars is a continuation of the side window rail, which gives a well-finished appearance to the car ends. The accompanying illustration shows a heavy molding running alongside the car to which the canvas of the roof is fastened; this feature also is a new departure for interurban cars of this type. The smoking compartment occupies the space of three windows. The seats in both compartments are of Brill make. The interior finish is of cherry, with ceilings of birch. The trucks are the No. 27-E1 type with 6-ft. wheel-base; four motors, of 40 hp capacity each, were installed on each car. The weight of car, including trucks and full electrical equipment, is 46,900 lbs. The chief dimensions are as follows: Length over end panels, 33 ft. 4 ins.; over crown pieces and vestibules, 42 ft. 9 ins.; width over sills, including sheathing, 8 ft. 2 ins.; size of side sills, 4 ins. x $7\frac{3}{4}$ ins.; end sills, $5\frac{1}{4}$ ins. x 6 ins.; sill plates, $\frac{3}{8}$ in. x 12 ins.



EXTERIOR OF SEMI-CONVERTIBLE CAR FOR WEST CHESTER

INTERIOR OF SEMI-CONVERTIBLE CAR FOR WEST CHESTER

A FOUNTAIN BRUSH FOR GENERAL CLEANSING

The advantage in cleansing operations of any kind where the cleanser is a liquid of a system which insures a continuous and fresh supply of the cleansing agent are well known. In street railway work generally, and in car cleaning especially, does a system of this kind make for speed and thoroughness, which are the great essentials. With the considerations in mind just mentioned, the Baumruk fountain cleaning brush, manufactured by the Fountain Cleaning Brush Company, of Chicago, was designed. This brush is made in a variety of sizes and shapes, to meet all requirements, and needs only to be attached to the source of supply by means of a hose to be ready for use, the water being delivered through the hollow chamber of the brush to the bristles. In this way the brush is available for hand use or can be mounted on the end of a long pole to reach a considerable height, and is very handy for exterior car cleaning, it being possible to scour and wash down the exterior of a car very rapidly. Where a hydrant is not available as a source of supply, a pail of water or liquid cleanser properly hung will afford the desired pressure, but the company has a small portable pressure tank for special service. The brush permits the flushing of curves and special work, after which they can be readily cleansed.

FOUNTAIN BRUSHES OF VARIOUS STYLES

The City Council of Columbus, Ohio, has passed an ordinance prohibiting the use of T-rails by any street or interurban railway company with lines entering the city over improved streets. The interurban companies opposed the passage of the measure, because of the difficulties that attend the operation of their cars over girder rails.

PLANS FOR THE BROOKLYN TUNNEL

On Tuesday, June 11, Chief Engineer Rice, of the New York Rapid Transit Commission, announced that he will have the plans and specifications of the Fourth Avenue and Coney Island subway ready for the last meeting of the commission, which will be held June 28, three days before the public utilities law goes into effect. Mr. Rice says the contract will probably be advertised in thirteen sections. The last function of the present commission in this matter will be to set a date for a public hearing which will be held by the new utilities commission. That body then will approve the plans and specifications and form of contract.

SOME NEW CARS FOR CHICAGO

A few months ago a variegated assortment of cars was in use in Chicago. Some of them dated back almost to the horse-car days, and between the most ancient ones and those of modern type were several intermediate types, each typifying an epoch in street car construction. However, many of these antedated cars have given place to cars of modern design and the remaining ones are fast disappearing. Of the cars replaced some recently constructed for the Chicago Union Traction Company by the St. Louis Car Company are intended for operation in either direction and embody a number of interesting features. They measure 28 ft. over corner posts and 41 ft. over bumpers, and are 7 ft. 10 ins. wide over sills and 8 ft. 4 ins. wide over all. The height from the track to the trolley board is 11 ft. 3½ ins. The side sills, of 4-in. x 7¾ in. yellow pine, are reinforced with a ⅜-in. x 15-in. steel plate, and the white oak end sills, which measure 5 ins. x 9⅞ ins., are stiffened with a ¾-in. x 6-in. steel plate. The interior is finished in mahogany. The seats are of the St. Louis Car Company's reversible type. The double side sashes are glazed with D. S. A. plate glass, and wire glass is employed in the ventilator windows. The cars are provided with headlights, drawbars and signs on each end. The vestibule doors are provided with an automatic folding device. The steps are of a folding spring type, so designed that when the step on one side of the car is down the opposite one is folded. The car is mounted on No. 47 trucks having a 4-ft. 6-in. wheel-base. The wheels are 33 ins. in diameter and have a ⅛-in. tread and ¾-in. flange. They are mounted on 4½-in. axles. The car is provided with four G. E. No. 80 A motors.

A NEW CHICAGO TYPE INTENDED FOR OPERATION IN EITHER DIRECTION

RADIAL SNOW PLOW

An account was published in the STREET RAILWAY JOURNAL of Sept. 2, 1905, of a novel type of snow plow invented by W. E. Wilder and put in service during the previous winter by the Worcester Consolidated Railway Company. In this plow the plow portion, instead of being mounted, as usual, on the car body, is carried on and forms a part of the truck, while the body portion extends only to the truck bolster. This construction permits the plow portion to turn with the trucks and follow exactly the curvature of the track, even in curves of 25-ft. radius. The plow, which was built by the Wilder Snow Plow & Manufacturing Company, of Boston, has been in use in Worcester ever since that time, or for the last three winters. During the first two the snow fall was so light as practically to offer no test of the working qualities of the plow, but last year the fall of snow was the heaviest in ten years. As this is the time of year during which plans are being perfected by electric railway companies for snow-fighting equipment, an account of the performances of this plow last winter will be of interest.

RADIAL PLOW ON 45-FT. RADIUS

A DRIFT MORE THAN 1000 FT. LONG AND FROM 5 FT. TO 6 FT. HIGH, CLEARED BY PLOW

The plow was assigned to division No. 3, or the Leominster section of the Consolidated System in Worcester, where during the heavy storms it took care of 22 miles of interurban track. On Feb. 5, 1907, it ran 156 miles in 13 hours, an average of 12 miles an hour, through drifts from 3 ft. to 6 ft. deep and several hundred feet long. On Feb. 25 the plow had much harder work to do, yet took every drift and winged out both sides, making a 12-ft. wide cut at all times. In cuts not over 10 ft. deep the plow would throw the snow to the top of the cut. On this date the plow ran 172 miles in twelve and one-half hours (an average of over 14 miles an hour), through drifts from 3 ft. to 6 ft. deep and from 200 to over 1000 ft. long.

As will be seen from the engraving, a shovel-nosed plow is used as in steam railroad work, a point which is considered of great advantage. The upper curved flanges of the plow throw the snow clear of the track on each side. On a double-track road these flanges would be shaped so as to direct the snow to one side. Owing to this form of construction there is no tendency to pack the snow, and the greater the drift the less the chances of derailment and the better the traction. The toe of the plow has a slight vertical movement to clear any obstruction which there may be on the track, and side wings are used; but as both these parts are moved pneumatically they can be operated by the motorman, who is thus the only operator really required. The plow in Worcester is equipped with four 50-hp motors, but for very severe work a heavier equipment would undoubtedly be desirable.

NOTIFYING PASSENGERS OF TEMPORARY CHANGES IN ROUTES*

Failure to notify passengers of temporary changes in car routes is an operating defect which should receive attention on more than one system. It is not an easy matter to correct this difficulty on a large road handling a heavy traffic, but there is no reason why some sort of modification should not be made as soon as the conductor and motorman are informed that their car will proceed to its destination over other than the usual tracks. Such cases often occur owing to blockades of various kinds, and where a connection has to be made at the other end considerable inconvenience may result from a delay. No car can be diverted from its route on a well-organized system without orders from a car house foreman, inspector of traffic or division superintendent, and it should not be difficult in such case to give oral or printed advice to the passengers to the effect that the car will not follow its normal route, so far as the motorman and conductor are advised. There are many unforeseen delays in street railway operation on the crowded thoroughfares, but every change in route is foreseen, at least as far as the next track junction or car house. At least a simple sign marked, "Route Temporarily Changed," could be hung in or on the car, and it ought to be an easy matter for the motorman to announce his destination "via A or B Street" whenever a prospective passenger approaches.

It is reported from London under date of June 11 that an agreement has been reached by all the underground and electric railways in London for an advance in fares on July 1, and that the motor bus companies are expected to follow suit.

EXHIBITS AT THE ATLANTIC CITY CONVENTION OF THE MASTER MECHANICS AND MASTER CAR BUILDERS

As announced in the STREET RAILWAY JOURNAL of June 8, the Atlantic City meetings of the Master Mechanics' and Master Car Builders' Associations were scheduled for June 12-14 and June 17 to 19, respectively. The great steel pier was selected for the exhibits, which are not only arranged more harmoniously than at previous conventions, but are also notable for the increased display of heavy electric railway material. Through the courtesy of the exhibitors mentioned below, it is possible to present the following notes regarding their efforts to instruct and entertain the delegates:

THE SPRAGUE ELECTRIC COMPANY, New York, is represented by Allan C. Bakewell, president; W. A. Treat and E. E. Ruete of the armored hose department, and A. E. Braddell of the conduit department. Mr. Braddell is present in the interest of the well-known flexible steel conduit and flexible steel armored conductors, which the Sprague Electric Company is supplying to railroad companies for the wiring of cars and car buildings. The company is exhibiting its flexible steel armored hose in booths No. 1812 and No. 1814. This consists of armored air brake hose, armored air brake and signal line hose, armored car heating hose and armored hose for pneumatic tool service, also samples of nipples and clamps. The flexible steel armored hose is a radical departure from other types of protected hose, as the rubber lining is entirely enclosed in the steel armor. Thorough protection is thus afforded either in case of external injury or internal deterioration. It also binds the hose so tightly that if a rupture occurs sufficient pressure of air or steam is retained still to operate the mechanism.

The primary object to be attained in car wiring, as in all electric wiring, is obviously the reduction of the fire hazard to a minimum, which can only be accomplished by the use of well insulated conductors which are given a thorough mechanical protection. For this purpose the Sprague Electric Company's Greenfield flexible steel conduit or flexible steel-armored conductors are claimed to offer an ideal system for car wiring. All the cars of the Interborough Rapid Transit Company operating in the subway are equipped with this conduit in which are installed all insulated wires for the electric lights and heaters. The new cars for the electrically-operated division of the New York Central are equipped throughout with the same manufacturer's conduit, and this practice is being followed by many car builders. These conduits and conductors, of course, are equally applicable for the safe and convenient wiring of car houses and other buildings on New York properties.

THE GEO. W. LORD COMPANY, of Philadelphia, has on exhibition samples of its various combinations of chemicals sold under the trade mark "Lord's Boiler Compounds."

THE SHERWIN-WILLIAMS COMPANY'S exhibit shows a wider range of paint and varnish finishes for railroad equipment than any gotten together before. For outside coach work, much of which is directly applicable to street car work, it shows primers, surfacers, colors and varnishes; it also exhibits various operations of combining these into a complete, practical shop system. An important part of this feature are the exhibits on steel of surfacing materials and enamels, which the company believes will be the sort of material used in the future for the steel sides of coaches. This is of importance, because all signs point to a large increase in steel cars. There is also a complete exhibit of varnishes and dry colors, together with the materials used on locomotives and finishes for box-cars, gondolas, stock cars, refrigerator cars and other rolling equipment. There is also a complete line of interior finishes, such as wall and ceiling colors for baggage, mail and caboose cars, floor paints, seat-arm enamels, rattan seat enamel, etc.

An important feature is the entirely new line of material for painting headlinings, particularly adapted for use on fiber boards. A very extensive exhibit of these fiber board finishes is in the booth of the Indestructible Fibre Board Company. There is also a complete line of coach roof paints, truck colors, hand-rail enamel, etc. In addition to these practical exhibits the company expects to show an interesting demonstration of the facilities for manufacturing and distribution of the largest group of paint and varnish factories in the world. The booth is located in the entrance hall to the steel pier directly opposite the entrance. The representation includes W. B. Albright, E. M. Richardson, J. H. Eames, Thomas Madill, F. A. Elmquist and E. M. Williams.

THE GALENA SIGNAL OIL COMPANY, Franklin, Pa., does not intend to have any exhibit, but arranged a reception booth at the steel pier, spaces 391-399, where it is welcoming its railroad friends and others. The following representatives are on the ground: E. V. Sedgwick, Alex. Turner, P. H. Stack, J. A. Roosevelt, W. J. Walsh, Wm. Holmes, E. W. Grieves, W. O. Taylor, E G Johnson, John S. Patterson and J. S. Seeley.

THE PHILIP CAREY MANUFACTURING COMPANY, Cincinnati, Ohio, has an extensive exhibit at Atlantic City, among which were the following: 85 per cent magnesia sectional steam pipe covering, 85 per cent magnesia boiler covering, 85 per cent magnesia sectional locomotive lagging, all-asbestos train pipe covering, asbestos moulded coverings, asbestos moulded and felt pipe coverings, Nonpareil cork coverings for refrigerating pipes, asbestos fibers, paper, millboard, wick and rope packing, asbestos metallic gaskets, piston and sheet packing, asbestos cold water paints and miscellaneous asbestos materials, flexible cement roofing and roofing paints and cements

THE OHIO BRASS COMPANY'S exhibit is in space 1322, in charge of J. S. Hamlin, Nathan Shute, F. A. Strail and R. M. Campbell. The principal features are the Tomlinson automatic radial car coupler, the Lintern car signal system and the Nichols-Lintern supplementary sander valve. The various forms of the Tomlinson coupler are exhibited and the coupler mounted to demonstrate its operation, the method of attachment of draft rigging and also the spring draw-bar gear. There is also on exhibition the M. C. B. knuckle for attachment to the Tomlinson coupler, making it possible to intercouple automatically with M. C. B. couplers. The Lintern car signal system is shown in operation. This system is intended for classification and rear end signals on electric cars, and is operated from the car lighting circuit. An auxiliary battery of dry cells furnishes necessary current should current from the trolley fail. The battery also prevents fluctuation of the signal lamps and keeps them burning at normal voltage at all times. The various lamps adapted to this system are also exhibited, together with dummy car ends upon which are mounted the various styles of lamps and upon which will also be shown diagrams of connections for the combinations which may be made with these signals. The Nichols-Lintern supplementary sander valve, which is used with the Nichols-Lintern pneumatic sander, is shown attached to different styles of engineers' brake valves. An important feature of these styles is that the sander is at all times under instant control of the motorman. When the engineers' brake valve handle is moved to the emergency position the sander acts automatically.

THE HALE & KILBURN MANUFACTURING COMPANY, of Philadelphia, is located in spaces 1491, 1493, 1495, 1497. The representatives are: A. F. Old, H. T. Bigelow, B. F. Pilson and S. A. Walker. In addition to car seats of all kinds for steam railroads the company has samples of seats for heavy electric railway cars as used in the eighty-five large electric coaches of the Pennsylvania Railroad to Atlantic City; also the all-steel and fireproof seat used in the 185 steel coaches in the New York Central electric zone. The exhibit is particularly interesting to officials having in service steel or wood electric railway cars, owing to the rapid progress made by the company in the past year in seating for these modern cars, making such seats practically unapproachable in points of comfort and durability.

THE YALE & TOWNE MANUFACTURING COMPANY is showing portable electric hoists, equipped with graduated speed controllers for careful handling of material and close adjustment of parts, when assembling or placing machines; a 20-ton triplex chain block, enabling one man to lift a 20-ton load; a 1-ton triplex, duplex and differential block in operation under service conditions; quick-speed chain blocks for rapid handling of light loads; overhead "I" beam trolleys for use with hand and electric hoists; crane models and photographs of installations. The representatives in attendance are: F. A. Hall, E. J. Ford, H. E. Dickerman, William Hazelton, R. T. Hodgkins and C. W. Beaver.

H. W. JOHNS-MANVILLE COMPANY has the following representatives: H. O. Fettinger, Altoona, Pa.; E. C. Sawyer, Norfolk, Va.; John H. Trent, St. Louis, Mo.; W. F. Taylor, Milwaukee, Wis.; F. M. Gilmore, Chicago, Ill.; J. C. Younglove, Chicago, Ill.; C. E. Murphy, Indianapolis, Ind.; J. W. Allan, Minneapolis, Minn., and F. G. Corbin, New York. It also displays the following products: Asbesto-sponge felted sectional pipe covering, fire felt, fire felt train pipe covering, 80 per cent magnesia pipe covering. vitribestos pipe covering, vitribestos smoke jacks, asbestos fire felt and 85 per cent magnesia locomotive lagging, asbestos cement felting, 85 per cent magnesia cement, high and low-pressure, hot and cold water pipe covering, J-M asbestos roofings, air pump packings, asbestos steam packings, asbestos sheet packings, asbesto-metallic flange gaskets, vulcabeston packings, all kinds of fire resisting cements, electrical insulating materials, Noark fuses, fire extinguishers, refrigerator and produce car insulating material, Perolin and Portland sectional conduit for underground steam heating systems.

THE NORTON COMPANY, of Worcester, Mass., is represented by George C. Montague, Arthur C. Scott and George A. Stone. The exhibit consists of Norton grinding wheels made of alundum, oil stones and other abrasive specialities. The Norton Grinding Company, with whom this company is closely allied, exhibits a plain grinding machine with gap table, specially adapted for the grinding of locomotive piston rods with pistons in place, and any other cylindrical work on which there are projections requiring more than the normal swing. This machine is also adapted for grinding street car axles. In addition to this the latter company shows specimens of grinding and distributes literature particularly interesting to superintendents of motive power connected with electric railways. This literature relates to a machine especially designed for grinding car wheels. This machine will grind car wheels perfectly round and true very quickly. While a great many companies have rigged up means to grind their car wheels, many of them have been so light that it has been practically impossible to grind a wheel round. This machine is a very heavy tool, designed to remove large amounts of material rapidly. While the original machines were made for the Pennsylvania Railroad to grind steam car wheels, they can be adapted for grinding electric car wheels. While this machine may be of more interest to the electric railway men than anything else in connection with the company's exhibit, its grinding wheels also deserve attention.

THE SCHOEN STEEL WHEEL COMPANY'S exhibit this year is somewhat larger than last year's, as it is showing its present method of manufacturing the wheels from the slab to the first and second forging and the finished wheel. The wheels exhibited are those from steam and electric railroads that have been in service, and also new wheels for similar service. They include wheels for both steam and electric service.

THE CHICAGO RAILWAY EQUIPMENT COMPANY is showing its roller side bearings for street car service. This bearing is designed to reduce wheel flange wear, save rail wear and improve the riding of the cars, with the attendant advantages of reducing the cost of transportation, increasing life and capacity of the bolsters, and lessening the cost of truck repairs. The bearing cannot become clogged with dirt or be rendered inoperative in any way, and the construction admits unlimited travel as distinguished from bearings in which the travel of the rollers is limited.

THE WILMARTH & MORMAN COMPANY, of Grand Rapids, Mich., is exhibiting its nearly fifty styles of the New Yankee drill grinders. These are style "J A point," style "P" wet grinder" and style "J D." The latter machine is direct connected motor-driven drill grinder, and may be seen in operation. Chas. E. Meech is in charge of the exhibit.

THE JOHN DAVIS COMPANY, of Chicago, shows a comprehensive line of valves in addition to its armor-covered hose.

THE PERRY SIDE-BEARING COMPANY, of Chicago, has an excellent exhibit of bearings for steam railroad service, but there are also several styles adapted for street railway cars.

THE T. H. SYMINGTON COMPANY, of Baltimore, Md., is represented by T. H. Symington, president; E. H. Symington, J. F. Symington, D. Symington, C. J. Symington, W. W. Rosser, A. H. Weston, H. W. Baldwin, Carll Tucker and T. C. de Rosset. The exhibit comprises a full line of Symington journal boxes for freight and passenger cars and electric trucks of M. C. B. and special design, together with Baltimore ball bearings for steam cars, electric passenger cars, locomotive tenders and heavy freight service.

THE CONSOLIDATED CAR-HEATING COMPANY, of New York, exhibits and demonstrates the action of a new steam coupler with slide gasket and fitted with automatic lock. It also shows its hot water drum system, standard direct steam heating system, new low pressure steam heating system and the McElroy automatic car lighting system, consisting of an axle-driven generator and automatic regulator. For electric railways the company exhibits the cross-seat, truss plank and panel types of electric heaters and special switchboards; also a new automatic cab heater switch. The representatives are Francis C. Green, general manager; Cornell S. Hawley, general sales agent; W. S. Hammond, Jr., district manager, Western territory; S. Butler Keys, district manager, Eastern territory, and T. M. May from the New York office.

THE ATHA STEEL CASTING COMPANY, of Newark, presents its "Titan" steel railway motor gears and cast steel body and truck bolsters adapted for electric railway service. It is represented by C. W. Gennet, G. T. Paraschos, R. N. Barrows, C. W. Owston and Louis A. Shepard, acting vice-president.

THE U. S. METAL & MANUFACTURING COMPANY, of New York, is offering in spaces 1612 and 1614 its perfect pressed steel car replacers, Victor cast steel car replacers, Columbia lock nuts, "Ideal" draw bar centering device, Western malleable iron brake jaws, "Almetl" lumber stake and the Cliff and Guibert automatic fire hose reel. A car on the exhibition track is equipped with the company's Dunham hopper door device, Columbia lock nuts, "Ideal" draw-bar centering device, feasible drop brake staff and "Almetl" lumber stake. The representatives are: B. A. Hegeman, Jr., Thomas Beaghen, Jr., F. C. Dunham, M. Jackson Crispin, E. D. Hillman, John Varian and Fred Atwater.

THE AMERICAN BRAKE SHOE & FOUNDRY COMPANY has an exceptionally large number of representatives on hand, its interests being cared for by the following: W. S. McGowan, F. W. Sargent, H. S. Bradfield, E. L. Janes, E. B. Smith, L. J. Hibbard, F. L. Gordon, J. S. Thompson, C. C. Higgins, L. R. Dewey, Chas. Herron, B. H. Grundy, F. H. Coolidge and E. J. Searles. The exhibit consists of steel-back brake-shoes for steam railway service in particular, covering driver, coach and car-shoes, and such steel-back flanged coach-shoes with wrought-attaching lugs as are used in connection with electric equipment on interurban lines operated in connection with steam railroads, such as the New York Central, West Jersey & Seashore, Long Island, the heavy equipment on the interurban and elevated lines of New York and Chicago as well as the long distance electric roads in the Middle West. The company has sections 1410 and 1416, inclusive, on the steel pier. The reception headquarters are in the Marlborough-Blenheim, where the door is always open for friends desirous of rest and refreshment.

THE O. M. EDWARDS COMPANY, of Syracuse, N. Y., has models showing thirty designs of window fixtures and four designs of extension platform trap door fixtures, all of which are standard and in extensive use upon the leading steam and electric railway systems. In addition, it is showing samples of tin barrel spring rollers for both shade and sash balance use, including the ratchet design especially adapted for railroad car curtains and open street car awnings. The company is just commencing the manufacture of metal window sash in connection with its window fixtures, samples of which will also be shown. The following gentlemen will receive the visitors: O. M. Edwards, Edw. F. Chaffee, Franklyn M. Nicholl, George G. Norris, C. H. Rockwell and C. L. Eddy.

THE G. DROUVE COMPANY, of Bridgeport, Conn., has an exhibit consisting of a booth 10 ft. x 20 ft. with skylight of anti-Pluvius construction on roof and swinging sash on three sides operated with Lovell apparatus. Inside the booth the company has models of different styles of skylight construction.

THE NATIONAL LOCK WASHER COMPANY, of Newark, N. J., presents models of its curtain fixtures, sash locks, sash balances and lock washers. The representatives in attend-

ance are: F. B. Archibald, Daniel Hoyt, John B. Seymour and William C. Dodd.

THE WHEEL TRUING BRAKE SHOE COMPANY, of Detroit, Mich, has an extensive display of different styles of abrasive brake-shoes. It is represented by J. M. Griffin, president and general manager.

THE CURTAIN SUPPLY COMPANY, of Chicago, Ill., has a very handsome display this year, consisting of two circular booths, located in the open arcade. Among articles displayed are Forsyth roller tip fixtures, ring fixtures, Keeler eccentric fixture and also the ring fixture with projecting pins. The latter device is intended where it is desired to have a curtain which cannot be taken out of the groove. The company also has its usual full line of curtain material. The representatives are: W. H. Forsyth, general manager, and Messrs. Whipple and Hayes.

THE HARRISON DUST GUARD COMPANY, of Toledo, Ohio, has a dust guard adaptable for and in use by many electric railways. It also manufactures car journal lubricators, which are also adaptable to electrical equipment.

H. B. UNDERWOOD & COMPANY, of Philadelphia, are represented by A. D. Pedrick, C. O. Ralph and F. E. Emery. The tools displayed are the following: Portable boring bar outfit for cylinders 12 ins. to 26 ins. diameter, two-cylinder steam or air motor to drive the foregoing, and a portable rotary planing machine for flat valve seats on locomotives.

THE GRIP NUT COMPANY, of Chicago and New York, is offering a full line of square and hexagon shaped grip nuts, United States standard threads from 3/8 in. to 1 3/4 ins.; also a line of semi-finished hexagonal nuts for locomotive use. It is represented by E. R. Hibbard, president, Chicago; J. W. Hibbard, secretary, New York. N. Y.; R. S. Wickersham, general manager Chicago, and T. F. DeGarmo, general sales agent, Chicago, Ill.

THE INDESTRUCTIBLE FIBER COMPANY, for which Wendell & MacDuffie are the sole agents in the transportation field, has issued a booklet relating to "Fibrite," "Durite" and "Kantlite" and the purposes for which each of these is best adapted. The publication also shows the interior of an electric car with fiber-board head-linings and roof.

THE AMERICAN WATER SOFTENER COMPANY, of Philadelphia, Pa., shows a complete working model of its water softening and purifying systems.

THE J. H. WAGENHORST & COMPANY, of Youngstown, Ohio, have their usual exhibit of electric blue printing machines. The Wagenhorst Company claims three special features for its machine: The roller curtain, which does away with all clamps, hooks, etc., for fastening the curtain and makes filling the machine a matter of a second; the speed regulator, noiseless in operation, by which the lamp descent can be adjusted to meet the strength of any printing paper; and the automatic cut-off, by which the light is automatically extinguished as soon as the print is complete. This relieves the operator of the responsibility for shutting off the current.

THE INDEPENDENT PNEUMATIC TOOL COMPANY, of Chicago, has a complete working layout of its Thor pneumatic tools and appliances in space Nos. 989, 991, 993 and 995. The following representatives were in attendance: From New York, James B. Brady, W. O. Jacquette, J. A. Porter, J. P. Bourge and R. S. Cooper; from Pittsburg, R. D. Hurley, R. T. Scott and J. H. Davis; from Chicago, J. D. Hurley, A. B. Holmes, Vernon Job, George A. Gallinger and Campbell Mathie; from Boston, F. A. Barbey; from St. Louis, Charles Parsons, and from San Francisco, H. H. Hale.

THE STANDARD METAL MANUFACTURING COMPANY, Inc., of Chicago, presents its line of car-journal bearings. The company also sells filling-in pig form for electric railway companies to fill the shells. It is asserted that this bearing gives one-third more mileage than solid brass.

J. H. WATTERS, assistant master mechanic of the Georgia Railroad, Augusta, Ga., has a pneumatic track-sanding device, which he is showing at booth 1115 on the steel pier. This device is shown working in a glass case. It is designed for both electric railways and steam roads. One sander sands both rails.

THE GOLDSCHMIDT THERMIT COMPANY'S showing comprises samples of welded work made by the Thermit process, such as street car rails, wrought iron pipes, locomotive frames, steel castings, etc. The company also exhibits its new fire-brick molds, which greatly simplify the process of welding locomotive frames, as they do away entirely with the services of molders and pattern makers. In addition to these are shown samples of nickel thermit, manganese, chromium, manganese copper, manganese tin, ferro-vanadium, ferro-titanium and other rare metals which the company supplies. A. M. Guenther and W. R. Hulbert will have charge of the exhibit.

THE CROCKER-WHEELER COMPANY, of Ampere, N. J., has on exhibition one of its Form I-F field-weakening motors with speed variations of 3 : 1. It will be in constant operation during the exhibition. It has in addition a large supply of photographs showing motors and generators of their various lines from 1/10 hp to 4000 kw. Among the representatives who may be seen during the conventions will be: Hamilton R. Gilder, F. B. DeGress, H. J. Sage, L. S. Horner, A. L. Doremus, H. L. Patteson and R. J. Randolph, Jr., of the Eastern branch offices of the company.

THE NATIONAL BRAKE & ELECTRIC COMPANY, of Milwaukee, has the following representatives present: R. P. Tell, S. I. Wailes, J. T. Cunningham, W. H. Goble, C. N. Leet and Bert Aikman. The exhibits are in space No. 1030. They include the new type of National portable blowing outfit, which consists entirely, with the exception of the truck and hose receptacle, of standard National air brake apparatus, the sectional National air slide type motorman's valve (the latter also in section) and several framed enlargements of the company's apparatus.

THE GENERAL ELECTRIC COMPANY, while not presenting a regular exhibit, has attractive reception quarters in spaces Nos. 1384 and 13386 on the steel pier, adjoining the American Locomotive Company's exhibit. The company's representatives are as follows: W. J. Clark, manager traction department, New York office; W. B. Potter, engineer railway department; L. R. Pomeroy, New York office; R. E. Moore, Philadelphia office; C. C. Pierce, Boston office; J. J. Mahony, New York office; J. O. Barry, railway department; E. D. Priest, A. W. Jones and F. H. Gale.

THE WESTINGHOUSE COMPANIES exhibit many devices well known to railway men and also some new features developed by the several interests. The Westinghouse Air Brake Company displays a model of its friction draft gear, also working model of Westinghouse cross-compound 8 x 8 x 14½ air pump. The American Brake Company, of St. Louis, shows working models of slack adjusters on brake cylinders varying in sizes from 10 to 18 inches; also a working model of the Westinghouse automatic air and steam coupler, also a working model of the Westinghouse driver brake. For the Westinghouse Machine Company there is exhibited a Westinghouse auto-truck. The Machine Company also exhibits a line of car lighting batteries having a capacity of 280 ampere hours. The Westinghouse Electric & Manufacturing Company exhibits a switchboard used to control a 10-hp variable speed direct-current motor, equipped with a prony brake. The exhibit also includes the new mill type arc lamp for use on 250-volt direct-current and other arcs, meters, motors, etc. The Westinghouse Air Brake Company is represented by John F. Miller, vice-president; A. L. Humphreys, general manager; S. C. McConahey, assistant secretary; W. B. Turner, mechanical engineer; Arthur Johnson, chief engineer; E. A. Craig, Southwestern manager; Joseph R. Ellicott, Eastern manager; W. S. Bartholomew, Western manager; F. M. Nellis, Boston; Porris S. Clark, Los Angeles; S. D. Hutchins, Columbus; C. P. Cass, New York; Fred. Green, New York; Charles Ellicott, New York; T. L. Burton, Buffalo; C. C. Farmer, Chicago; S. J. Kidder and J. P. Kelley. The American Brake Company is represented by E. L. Adreon, vice-president; F. B. Schwentler, superintendent, and C. C. Higham, works manager. The Westinghouse Automatic Air & Steam Coupling Company is represented by N. F. Niederlander, president, and R. E. Adreon, mechanical engineer. The Westinghouse Electric & Manufacturing Company is represented by E. M. Herr, vice-president; J. H. Klinck, Chas. Talbot, R. F. Moon, D. B. Pendleton, John R. Warden, Chas. Robbins, C. F. Street and A. T. Chamberlain. The Nernst Lamp Company's interests are looked after by John Gossler, and those of the Cooper-Hewitt Electric Company by Eugene Hayes. The exhibit is in charge of J. C. McQuiston, manager of the publishing department of the Westinghouse interests.

FINANCIAL INTELLIGENCE

Wall Street, June 12, 1907.

The Money Market

The monetary situation has undergone no material change during the past week, at least so far as money rates are concerned. Money on call has been in abundant supply at rates ranging from 2½ to 1¼ per cent, but the demand has been extremely small, owing to the inactivity in the securities market. In the time money department business has been practically at a standstill, although a somewhat better inquiry was reported for periods running from five to eight months. Rates for those maturities advanced ¼ per cent, but otherwise the market has failed to reflect the heavy demand upon the local banks. During the early part of the week $3,600,000 additional gold was shipped to Paris, making the total exports to that country on this movement $10,400,000. On Monday last $500,000 was engaged for shipment, but this was subsequently canceled, owing to the advance in the Paris cheque rates and a decline of about 10 points in the local rates for sterling exchange, which made such transactions unprofitable. Whether or not the outward movement of gold will be resumed later in the week is still uncertain, but the indications are that shipments of the yellow metal are over, at least for the present. The fact that the Bank of France failed to bid for the $3,500,000 gold arriving from South Africa in London on Monday, together with the cancellation of the $500,000 gold above referred to, leads to the belief that the immediate needs of the Bank of France have been satisfied. The immediate future of the local money market, however, is rather uncertain. Last Saturday's bank statement showed a decrease in the surplus reserve of nearly $7,000,000, and since last Friday the banks have lost to the Sub-Treasury nearly $4,500,000. In addition preparations must be made for the July 1 interest and dividend disbursements, which are estimated at $175,000,000, the largest on record. These disbursements, however, will be partly offset by the refunding of the Government 4s on July 1. Under the recent offer of the Secretary of the Treasury about $21,250,000 of these bonds have been turned in for redemption, leaving approximately $39,000,000 outstanding and to be refunded on July 1. The demand from railroads and other corporations has been extremely light during the week, but there are rumors that several large loans are contemplated. Later in the month the city of New York is expected to offer for sale $29,000,000 corporate stock. The rate of interest which this stock is to carry has not been decided upon, but it is expected that a rate will be fixed upon to meet the present conditions of the money market. Bankers and other large lenders of money are not disposed to offer with any degree of freedom, the belief being quite general that rates for both call and time money will work firmer in the near future. The bank statement published on last Saturday made a very unsatisfactory exhibit. Loans decreased $1,514,300; cash decreased $9,065,200, or nearly double the amount indicated by the preliminary estimate. Deposits decreased $9,054,100, thus reducing the reserve required by $2,263,675. Deducting this from the loss in cash, the surplus reserve was reduced by $6,801,925. The surplus now stands at $5,980,925, as compared with $7,162,050 in the corresponding week of last year, $9,827,500 in 1905, $35,562,400 in 1904, $9,477,175 in 1903, $13,302,350 in 1902, $13,341,500 in 1901, and $18,374,250 in 1900. The Secretary of the Treasury has decided to call in the $30,000,000 special deposits made with the banks last September.

The Stock Market

Trading in the securities market was upon a somewhat larger scale during the past week, and while the dealings were accompanied by a decidedly irregular price movement, the final figures were in many instances above those prevailing at the close of last week. Speculation was again largely professional in character, the volume of commission house business clearly indicating that the so-called outside public was not taking even an ordinary interest in the market. At the outset prices developed strength, and the upward movement was continued, practically without interruption during the first half of the week. One of the chief influences working for higher prices was the failure of the money market to reflect in appreciably higher rates, the heavy withdrawal of gold by the Bank of France, and even the publication of the bank statement on last Saturday, which revealed a shrinkage of nearly $7,000,000 in the surplus reserve, failed to check the upward tendency in values. Day to day money was in abundant supply at extremely low rates, while money for fixed periods was practically unlendable at the current asking rates. Other important factors were the improvement in railway gross and net earnings, the more conservative attitude on the part of the Administration toward corporations and the decidedly better news regarding the growing crops. The Government June report on cotton, while making the condition the lowest on record, brought out the fact that the acreage under cultivation was considerably larger than in previous years, and indicated a yield of about 11,500,000 bales, or about an average crop. The Government report on grain was likewise more encouraging. According to traffic managers of the large railway systems the amount of business being offered is sufficient to tax the equipment of the companies to their utmost capacity. Activity continues in iron and steel and in many other lines of industries, the best evidence of this being the action taken by the managers of the American Car & Foundry and the American Smelting & Refining Companies this week in increasing the distribution to their stockholders. Toward the close of the week, however, the market yielded rather sharply on profit-taking sales. The heavy losses in cash sustained by the local banks was used by the professional element to bring about a lower range of values. The failure of a large steel manufacturing plant, for want of sufficient working capital, was also used by operators for the fall. The veto of the Two-Cent Fare bill by Governor Hughes brought about a rally in the standard railway shares, but this was followed by another downward movement, and the general tone of the market at the close was weak. The bond market was flat. The feature of this branch of the securities market was the dissolution of bond syndicates, several of which were announced during the week, and in no case have any considerable portion of the bonds been sold.

The traction stocks were practically neglected. The news from Albany late last week of the killing of the 5-cent fare bill started some buying of Brooklyn Rapid Transit and lifted the price several points. Later on the stock was openly accumulated by interests representing control of the company. This buying started inquiries about dividend prospects, and while no definite statement could be obtained an announcement of a dividend within the next three months is considered possible in usually well informed quarters.

Philadelphia

Dealings in the local traction shares continued upon a rather small scale during the past week, but prices with few exceptions ruled firm in sympathy with the improvements in values in the general securities market. Philadelphia Rapid Transit was the overshadowing feature of the trading, upwards of 14,000 shares changing hands. At the outset pressure was brought to bear upon the stock, and consequently the price yielded 1⅜, but during the latter part of the week buying by strong interests resulted in a sharp advance to 24¼, the final transaction taking place at 23⅝, or a small fraction higher than the closing figure of last week. Union Traction advanced to 59 on light purchases. Later the stock sold at 57¾ ex. the dividend of 2½ per cent, but at the close there was a recovery to 58. Consolidated Traction of New Jersey held firm at 72½, and American Railways brought 48¾. Philadelphia Company's stocks were steady, the common selling at 40 and the preferred at 44¾ and 44. United Companies of New Jersey lost a point to 245, and United Traction of Pittsburg preferred lost ½ to 47.

Chicago

The reorganization of the Chicago Union Traction Company is progressing favorably, and it is expected that many matters of importance will be settled this week. The feature of the market for traction shares was a further severe break in Chicago City

Railway stock to 150, an extreme loss of 20 points, but near the close there was a partial recovery to 157½. Otherwise the market was dull and uninteresting. Transactions included Union Traction at 3½, preferred at 16½ and 17¼; Northwestern Elevated at 24 and the preferred at 60.

Other Traction Securities

There was a decided improvement in the traction issues in the Baltimore market. Trading was light, but prices generally made substantial gains over those prevailing at the close a week ago. United Railway issues were conspicuously firm. The incomes, after selling at 50¼ rose to 51½ on moderate purchases, while the new funding 5s advanced from 78⅝ to 80. The 4 per cents brought 86 and 85¾. Other transactions included Macon Railway & Light 5s at 94½ and 95, Lexington Street Railway 5s at 99, Baltimore Traction 5s 108½, Norfolk Railway 5s at 95¼, and Baltimore City Passenger 5s at 101¼. The Boston market was extremely quiet and steady. Massachusetts Electric common moved up to 17, and the preferred stock advanced a point to 58. Other sales were Boston Elevated at 134, Boston & Suburban at 12, Boston & Worcester at 23 and 23½, West End common at 86¾ and 86, and the preferred at 104½.

Tractions were quiet on the Cleveland Stock Exchange the past week, and only a few small sales were made. The last sale up to Tuesday of Cleveland Electric stock was at 48. This security has held steady through the week with 46 bid and from 49 to 53 asked. Lake Shore Electric common has held about 12½, while the old preferred stock stands at 65 asked and the new stock is firm at 60. Forest City Railway stands at 98⅝ bid and 99½ asked. The stock of this company probably holds up because all that has been issued is represented in the property and there are no bonds. Northern Ohio Traction & Light stands at 23 bid and 25½ asked.

Security Quotations

The following table shows the present bid quotations for the leading traction stocks, and the active bonds, as compared with last week:

	June 5	June 12
American Railways	48	48
Boston Elevated	133	133
Brooklyn Rapid Transit	50¼	53½
Chicago City	160	150
Chicago Union Traction (common)	3	3
Chicago Union Traction (preferred)	16	17
Cleveland Electric	—	46
Consolidated Traction of New Jersey	71	71
Detroit United	66	63
Interborough-Metropolitan	15¾	16
Interborough-Metropolitan (preferred)	45½	46
International Traction (common)	50	45
International Traction (preferred), 4s	66½	68½
Manhattan Railway	134	134
Massachusetts Elec. Cos. (common)	16	15
Massachusetts Elec. Cos. (preferred)	56	56
Metropolitan Elevated, Chicago (common)	23	22
Metropolitan Elevated, Chicago (preferred)	63	[illegible]
Metropolitan Street	—	[illegible]
North American	66½	68
North Jersey Street Railway	40	40
Philadelphia Company (common)	40	39
Philadelphia Rapid Transit	23⅛	23½
Philadelphia Traction	91	91¼
Public Service Corporation certificates	64	64
Public Service Corporation 5 per cent notes	92	92
South Side Elevated (Chicago)	84	83
Third Avenue	105	105
Twin City, Minneapolis (common)	91½	91½
Union Traction (Philadelphia)	58½	*57¼

* Ex-dividend.

Metals

According to the "Iron Age" the blast furnaces did not do quite as well as expected during May. The production of that month of coke and anthracite furnaces footed up to 2,294,005 tons, as compared with 2,219,242 tons in April. The pig iron markets throughout the country are quiet but steady. Sellers have contracted their output far ahead, and buyers generally are well taken care of.

Copper metal holds firm at 25¼c. for electrolytic and 25½c. for lake.

REPORT OF CONSOLIDATED RAILWAY FOR TEN MONTHS

The report of operations of the Consolidated Railway of New Haven and its controlled lines for ten months ended April 30, 1907, shows as follows:

Total gross earnings from operation		$4,989,607
Less operating expenses		3,181,448
Net earnings		$1,808,159
Add income from other sources		851,647
Total income		$2,659,806
Deductions from income:		
Taxes	$299,608	
Rentals of leased lines	756,608	
Interest on current liabilities	85,492	
Interest on mortgage debt	394,421	
Interest on debentures	823,465	
Discounts on debentures	11,283	
Guarantee N. E. I. & S. Co.	145,701	
		$2,516,578
Net income*		$143,228

*Against net income there was charged:	
Six months' dividend paid Dec. 31, 1906	$200,000
Accrued dividend for January to April, 1907	100,000
Total	$300,000

The Consolidated Railway's general balance sheet, eliminating investment, interest and other inter-company accounts, as of April 30, 1907, compares with that of Feb. 28, 1907, and Oct. 31, 1906, as follows:

Assets

	April 30, '07	Feb. 28, '07
Cost of road and equipment	$52,481,397	$35,044,129
Due from leased companies	732,067	589,074
Miscellaneous investments	2,101,936	948,367
Material and supplies	850,217	545,673
Cash and current assets	15,128,819	13,391,800
Discount on debentures	652,653	654,900
Inter. Tr. Co., trustee	......	22,132
R. I. Hospital Trust	5,000	5,000
Waterbury Gas working capital	31,927	......
Marine disaster account	182,784	......
Imp. susp. acct	1,809,837	1,011,140
Total	$73,976,639	$52,212,214

Liabilities

	April 30, '07	Feb. 28, '07
Capital stock:		
Consolidated Railway	$30,000,000	$10,000,000
Leased and controlled lines	76,658	76,758
Mortgage debt	10,644,666	10,706,667
Consolidated Railway debenture	28,500,000	23,500,000
Hartford Street Railway debenture	310,000	310,000
Current liabilities	2,330,754	5,751,396
Accrued liabilities	971,477	697,741
Res. for disc. on ltg. accts	26,720	25,189
Accident and casualty fund	68,339	58,258
Skg. fund Wor. & Web. bonds	......	22,232
Ct. Ry. & Lt. cont. liab	260,548	262,747
Profit on sec. sold	71,012	71,012
Profit and loss surplus	159,701	730,314
Capital res. acct	556,763	......
Total	$73,976,639	$52,212,214

Of the item "cash and current assets," $9,369,243 is a note of the New England Investment & Security Company, given in payment for securities of certain street railways in Massachusetts. The item also includes notes for advances made to controlled companies.

THE CLEVELAND SITUATION

City Clerk Peter Witt and a force of city employees, including thirty or forty patrolmen, have been at work all week securing consents for a street railway on Central Avenue. The paper which people are asked to sign states only that the signer is willing to have a street railway built in front of his property and has no appearance of a consent, but it is said that the City Council will consider them as consents. It is claimed that many people do not understand this at all, and have signed the papers thinking that they were only making a statement of their willingness to have a road. It is reported that enough consents have been secured to make a franchise good on that street.

The franchise granted the Low Fare Railway Company on Monday evening of last week, giving it the right of joint use of tracks with the Cleveland Electric on Euclid Avenue, between the Public Square and East Fourteenth Street, and on Superior Avenue and Detroit Avenue west to West Twenty-Eighth Street, does not differ from the first ordinance passed for that purpose, with the exception that it contains a provision that the two companies shall agree upon the compensation to be paid the Cleveland Electric for such use, or, in case of disagreement, the matter shall be settled by the City Council. The first ordinance fixed the compensation, and this the court declared was illegal. This ordinance will probably open the way to litigation, as it is believed that the Cleveland Electric will not agree to any sum that the Low Fare Company will pay.

In the William R. Raynolds case, the Supreme Court of Ohio has rendered a decision to the effect that a renewal of a franchise cannot be granted to any other company than the original holder of the franchise in case the grant is made before it expires. The City Council had given the Forest City Railway Company renewal grants on Central Avenue and Quincy Street, and this suit was brought to test the question. However, it does not affect the present situation, as grants have been made since that time covering this point.

TRANSIT BILL REPORTED FAVORABLY IN PHILADELPHIA

After adopting a number of important amendments to the Street Railway bill as originally proposed by the Retail Merchants' Association, the members of the sub-committee of Councils of Philadelphia on Thursday, June 6, reported the measure favorably to the joint committee on finance and street railways, which at once sent it to Councils with a favorable recommendation. Every member of the two committees concurred in the recommendation, and from the unanimity of opinion shown by the Councilmen after several weeks of public hearings, it would seem that its final passage is practically assured. Among the changes to the bill is one in the city's representation on the directorate of the Rapid Transit Company, a yearly payment fixed on a sliding scale in lieu of the company being relieved of responsibility for street paving, license fees and the removal of snow, and an agreement that the City Hall loop of the Rapid Transit Company can be used by any company that may in the future construct the Broad Street subway. The city at the present time receives from the company about $415,000 annually, and the sum fixed by one of the amendments raises the annual payment for the next ten years to $500,000. According to a sliding scale arranged the annual rental at the end of ten years will be increased $50,000, and a like sum each succeeding ten years, making the payments during the last ten years of the agreement $700,000 per year.

According to the original suggestion, the city's representation on the directorate of the Rapid Transit Company was to consist of the Mayor, the president of the Board of Education and the president of the Board of City Trusts, but under the amended plan this representation shall consist of the Mayor and two men to be elected by Councils. The new arrangement will give Councilmen an opportunity of placing as a director an engineer and a business man instead of the two officials first suggested. Still another provision made by the committee is that the company shall pay the city 7 cents a square yard for the extension of its lines on macadam streets, 8 cents a yard for asphalt and 6 cents a yard for all others, in addition to the lump sum fixed for general charges.

CHICAGO TRACTION AFFAIRS

The objections of the underlying stockholders to the plans of reorganization of the Union Traction Company is said to be based on the discovery of a trust agreement, which it is claimed gives to the Chicago Railways Company (the corporation into which it has been planned to reorganize the Union Traction Company and its underlying companies) practically the power to veto any decision of the arbitrators, Judge Grosscup and Prof. Gray, of Harvard.

John F. Bass, secretary for the protective committees of the underlying companies, has issued this statement:

"The original agreement in the ordinance provided that the arbitrators should be sole and final judges of the distribution of securities of the Chicago Railways Company among the old companies.

"Since the passage of the ordinance the committee representing the underlying companies has discovered that two new elements had been introduced into this arbitration. The committee has been reliably informed that the people who are furnishing the new money and who are closely affiliated with Messrs. Krauthoff and Wickersham, will not agree to furnish that money until they know definitely what the distribution of the securities of the railway company to the old companies is to be.

"Secondly, the trust agreement under which the stock of the railways company is held provides that no plan of reorganization, even though approved by the arbitrators, shall be operative unless it finally meets with the approval of the railways company. This company is controlled by the Union Traction and North and West lines, who are closely affiliated with Messrs. Krauthoff and Wickersham.

"The underlying stockholders feel strongly that all questions at issue be left to the arbitrators, that all stocks may be deposited and the ordinances accepted without delay."

Regarding the situation, special traction counsel, Walter L. Fisher, is quoted as saying:

"It always has been distinctly understood that the Chicago Railways Company was to be obligated to accept and carry out any plan of reorganization approved by the arbitrators, and that it should not be controlled by any one or more of the Union Traction interests as against any other." Attorneys Krauthoff and Wickersham, who came to Chicago last week to announce the plans of reorganization, in view of the objections of the underlying companies, returned to New York without making any announcement.

Judge Grosscup will enter into negotiations with the various warring factions with the hope of bringing them together. He feels reasonably confident that the difficulties will be removed. His plan, it is understood, is to have left to himself and Prof. Gray the plan of reorganization and to have their decision as arbitrators final and binding.

The new Council committee on local transportation, at its first meeting, June 5, re-elected Walter L. Fisher special traction counsel at a salary of $10,000. The committee rejected former traction expert Doty's schemes for regulating traffic.

OPENING THE BRIGHTON BEACH LINE

The embankment section of the Brighton Beach improvement has been thrown open to regular passenger traffic. Stations along the embankment section of the Brighton road will exactly correspond with those along the former line at grade, and with those that were temporarily established along that section of the Long Island road. They are located at Fiske Terrace (Avenue H), Manhattan Terrace (Avenue J), Greenfield (Avenue M), Kings Highway, Avenue U, Neck Road and Sheepshead Bay. All these stations are local stops, the stations at Kings Highway and Sheepshead Bay being express stations in addition. For the present only two tracks will be in use along the embankment. Within a few weeks the two remaining or express tracks will be ready and then the schedules on the Brighton Beach line will be entirely changed and the service increased. The various attractions and the Brighton Beach Hotel open June 15, and an increased train service will be operated on and after that day. The Brighton Beach improvement was described in the Street Railway Journal of May 11, 1907.

BOSTON & EASTERN HEARINGS RESUMED

At a continued hearing before the Massachusetts Railroad Commission on June 10, John H. Bickford, of Boston, outlined the plans of the Boston & Eastern Electric Interurban Railway in connection with his petition for a certificate of approval of the road between Beverly and Boston. Mr. Bickford stated that the territory is divided into three zones: Salem, Peabody, Beverly and Danvers, averaging 17 miles from Boston, with a population of 80,000; Lynn and Swampscott, averaging 11 miles from Boston, with a population of 90,000; and Chelsea, Everett and Revere, 4 miles from Boston, with a population of 81,000. The territory has a population of 2855 per square mile against 361 in the State as a whole. The percentage of growth in the district is 11.58 against 7 in the whole State. Mr. Bickford estimated that in 1910 or 1911, when the road is in operation, its tributary population will be 221,000.

Mr. Bickford criticised the present trolley service between Boston, Lynn and Salem as essentially of a street railway rather than an interurban character, and also pointed out the traffic congestion on the Boston & Maine's double-track line between these cities. The steam road is trying to do a suburban business with through trains, and while the population along its eastern division has grown from 15.7 per cent in Salem to 103.8 per cent in Revere, only four stations in sixteen show an increase in train stops, two have the same number, and the others show a decrease. Lynn has grown 33 per cent in thirteen years, and the train service has increased only 13.5 per cent. The Boston & Maine is greatly hindered by the limitations of the Salem tunnel, and the trains are often behind time. Mr. Bickford stated that the Boston, Revere Beach & Lynn line, a narrow gage steam road, will soon reach the limit of its capacity.

The Boston & Eastern plans for a service entirely different from either steam or street railway traffic. It plans for a private right of way, no grade crossings, block signals and automatic stops. The power is to be distributed from a single power house through three sub-stations to a third rail; the cars will be of steel with four doors on each side, and may be run singly or in trains. Express and local service are planned, the speed of the former trains being 47 m. p. h, and the latter 30 miles. The maximum gradient of the main line is less than 3 per cent, except at stations, where it is 3.24 per cent. Four tunnels are planned, the longest being 2500 ft., and in Lynn it is proposed to build a semi-subway 6600 ft. long.

THE SAN FRANCISCO SITUATION

Disorder has almost ceased and travel on the cars in San Francisco is constantly increasing, more than 150,000 passengers being carried daily, with 215 cars in service. North of Market Street, the travel is becoming heavier than before the strike, due to the fact that many people are moving from other sections of the city into the Western Addition and the Richmond districts. The cars of the Sutter Street line are so crowded that many are unable to board them and are compelled to use other lines. This condition prevails in spite of the fact that the number of cars on the line has been increased 50 per cent since the strike. The Eddy, Ellis, Haight and Masonic lines are doing the normal amount of business for the number of hours that the cars are running.

Two new lines are now operated—the San Mateo and the Powell Street cable line. The Union Street line, which is an independent system, is operating with non-union men. The company started to run its cars with union men, paying them $3 for 8 hours. As the line has a transfer arrangement with the United Railroads, however, the union men refused to issue transfers for the Polk Street line, acting under orders from the president of the union. They were then discharged and their places filled with non-union men.

The car service has now been extended from 5:30 a. m. to 9:00 p. m., and the evening time will be gradually extended until the former service is in force. The company is enforcing rigid discipline among its new employees, and many discharges are occurring every day for various causes. In this connection an official said:

"Heretofore we have been unable to enforce discipline. No matter what a man did we could not discharge him without reckoning with the officers of the union and, rather than be engaged in a constant turmoil with them, we passed over many offenses and infractions of the rules of the company. Under present conditions we shall not be compelled to tolerate any violation of our rules, and we shall not do so. There will be no more 'skidding' of cars on dangerous grades nor passing crossings without stopping. We shall insist on courteous treatment of passengers, and all complaints will be investigated. We may have some difficulty in establishing discipline, but, once established, it will not be difficult to maintain. Dealing directly with our men we shall be able to give the public a better and safer service than heretofore."

NEW WORK IN PENNSYLVANIA

The Harrisburg capitalists who are backing the proposed electric railway between Lebanon and Mt. Gretna and Bismarck, made a trip over the route last week, and appointed an agent to secure the necessary rights of way. They anticipate no difficulty in securing grants from township commissioners and 51 per cent of the property owners.

President C. P. Northrop, of the Corry-Columbus Electric Railway, announces that rights of way are now being secured for a new line from Columbus to Ashville via Bear Lake, Panama and Blockville. It is expected that the Corry-Columbus line will be completed to Columbus by July 4. It is proposed to extend the line through the picturesque Brokenstraw Valley, northward to Panama, N. Y. All the grades are comparatively easy and the road would be easy to construct. At Ashville, N. Y., it is proposed to connect with the Chautauqua Traction Company and will afford another feeder to Chautauqua Lake from Northwestern Pennsylvania.

Charters were granted at the State Department last week to the Bellebridge Street Railway Company and the Crucible Street Railway Company, both of which are controlled by the same promoters. The Bellebridge line will be 4 miles long, extending from Glassport to Elizabeth, while the Crucible line will be 2½ miles long, extending from State Street in Clairton to First Street in West Elizabeth and the Allegheny-Washington County line. The capital stock of the Bellebridge company is $24,000, and of the Crucible company $15,000. The president of both companies is D. B. Neagley, and the directors are D. B. Neagley, E. L. Kern, J. K. Neagley, George McKain and N. F. Bicking, all of Pittsburg.

ORGANIZATION OF INTERBOROUGH-METROPOLITAN LEGAL STAFF

President Shonts, of the Interborough-Metropolitan system in New York City, announced last week a reorganization of the legal staff of the company. The organization is now constituted as follows: Paul D. Cravath, general counsel, New York City Railway Company and subsidiary companies; George W. Wickersham, general counsel, Interborough Rapid Transit Company and subsidiary companies; James L. Quackenbush, formerly general attorney of the New York City Railway Company, is now general attorney for all companies; A. A. Gardner, formerly attorney for the Interborough Rapid Transit Company, has been appointed general solicitor for all companies; Charles A. Gardiner, formerly general attorney for Interborough Rapid Transit Company, has been appointed solicitor for Manhattan Railway Company; Henry A. Robinson remains as solicitor for the New York City Railway Company, and has also been appointed solicitor in charge of the bureau of real estate and taxes for the various companies in the system; Van Vechten Veeder, formerly attorney of the New York & Queens County Railway Company, has been appointed attorney and solicitor for the litigation of all of the companies in the Borough of Queens and in Nassau County; Ambrose F. McCabe, formerly attorney and solicitor for the Union Railway Company, retains that position and has also been appointed attorney and solicitor for the litigation of all the companies of Westchester County.

The office of Theodore P. Shonts, president of the Interborough-Metropolitan Company of New York City, was moved last week from the Park Row Building, New York City, to the United States Realty Building, 115 Broadway, seventeenth floor. H. M. Fisher, secretary of the company, W. Leon Pepperman and H. H. Smith, also of the Interborough-Metropolitan Company, will have their offices at this place.

COMLIMENTARY DINNER TO J. N. SHANNAHAN

A complimentary dinner in honor of John N. Shannahan, of Gloversville, N. Y., who, as announced in this paper, has recently resigned the management of the Fonda, Johnstown & Gloversville Railway Company to accept that of the Washington, Baltimore & Annapolis Railway Company, occurred June 7. It took place at the Ten Eyck, Albany, and about seventy of Mr. Shannahan's friends, mostly from the central part of New York State, were present. The banquet was given in the large dining hall of the hotel, and the guests were seated on the outside of four tables, which were arranged in the form of a rectangle. The space between the tables was beautifully banked with flowers, palms and other potted plants, with a fountain in the center. After an excellent dinner, Mr. Klein, of Amsterdam, an old friend and business associate of Mr. Shannahan, acted as toastmaster. The speakers included Messrs. Shultz, of Utica; Burton and Mills, of Gloversville; Fassett, of Albany; Harrington and Lewis, of Utica; Schermerhorn, of Schenectady, and C. Loomis Allen, of Syracuse. All of the speakers had been associated with Mr. Shannahan either at Troy Polytechnic Institute, in the New York Central service, on the Fonda, Johnstown & Gloversville Railway or in New York State Association work. They spoke in the highest terms of Mr. Shannahan's ability and attractive personal traits, and extended their best wishes to him for success in the new enterprise in which he is to be engaged. At the conclusion of the speeches Mr. Shannahan replied in an appropriate way, expressing appreciation of the cordial friendship manifested by those present, and their expressions of interest in his future career. The committee in charge of the dinner consisted of H. N. Ransom, E. S. Fassett and E. F. Peck.

THE D. & H. TO PASS TO NEW YORK CENTRAL?

According to the New York "Tribune," the Delaware & Hudson Company will soon pass to the control of the New York Central & Hudson River Railroad. "It is understood in well informed Wall Street quarters," says the "Tribune," "that negotiations already have begun between the New York Central and some of the chief interests in the Delaware & Hudson for a transfer of Delaware & Hudson stock to the New York Central in exchange for stock of the latter company, and it is said the general plan for the merger will involve an offer on the part of the New York Central to all Delaware & Hudson stockholders for an exchange of stock on a basis that will return to the Delaware & Hudson holders a dividend income equal to that which they are receiving at present. In the last two years a large amount of Delaware & Hudson stock has been concentrated in the hands of banking interests in Wall Street, who have bought the securities in expectation of turning them over to the Vanderbilt road."

Cornelius Vanderbilt, it was announced Tuesday, June 11, had been elected a member of the board of managers of the Delaware & Hudson Company, taking the place of Frank E. Smith, who was elected a director of the company at the annual meeting of the shareholders a little over a month ago. It had been determined at that time to elect Mr. Vanderbilt a manager of the road, so it is said, but he was absent from the city, and it was deemed best not to elect him until his consent had been obtained. Mr. Smith was elected with the understanding that he should fill the vacancy caused by the resignation of Alexander E. Orr until such time as the management could obtain the consent of Mr. Vanderbilt to serve.

In connection with Delaware & Hudson Company affairs it is rumored that A. I. Culver, recently vice-president of the Delaware & Hudson, will remain with the company in control of its trolley interests. It is planned, according to report, to consolidate the Schenectady, Hudson Valley and United Traction Companies into one corporation, with Mr. Culver at its head.

CHANGE IN OUR CHICAGO OFFICE

The Chicago office of the McGraw Publishing Company and of the Street Railway Journal has been moved from the Monadnock Block to room 590 Old Colony Building, Chicago. A supply of current copies of this paper, as well as of other papers and books published by the McGraw Publishing Company, will be found at the new office and visitors will be welcomed by our representatives.

WISCONSIN'S ASSEMBLY PASSES UTILITIES BILL

Wisconsin's public utility bill, which has the support of the two committees of the Assembly and Senate, was passed by the Assembly June 7 without change from the committee draft. The measure puts all public utilities, except the telegraph and telephone, under the control of the State Railroad Commission. This Commission will have power to direct the nature of the service to be rendered, the rates to be charged, and the bill even goes so far as to give the Commission the right to say whether or not new companies shall be allowed to begin business. The corporations favor the measure, declaring that it will enable them to keep out of politics.

EXTENSIONS AT RIO DE JANEIRO

The conversion of the electric railway system at Rio de Janeiro, Brazil, by the Rio de Janeiro Tramway, Light & Power Company, Ltd., is being carried forward. The road possesses at present fifty electric cars equipped with Siemens & Halske motors, the rest of the system being operated by animal power. These electric cars are now being mounted on Brill trucks equipped with Westinghouse 101-B motors and magnetic brakes. Eventually about 3000 cars will be required to supply the city service.

The operating company is a New Jersey corporation, and as its name implies owns the tramway, light and power franchises in the city. Since the company acquired the property a year or so ago it has been busily engaged in laying new tracks, standardizing the gage and installing conduits and wire for city and house lighting. The company is also developing a large water power plant at Rio des Larges, 40 km, or 25 miles from the city. Two transmission lines, capable of carrying 20,000 kw, are now being built over the mountains separating the falls from Rio de Janiero. The plans at present provide for the increase of this power capacity to 80,000 kw, but as the power is practically unlimited all that is required in the city will eventually be taken from this source.

The work of construction and reconstruction in Rio de Janeiro has been in charge of Norman Berry, as superintendent of motive power, and F. A. Koziel, assistant superintendent. The New York office of the Rio de Janeiro Tramway, Light & Power Company is at 25 Broadway.

MEETING OF CENTRAL ACCOUNTING CONFERENCE

At the second meeting of the Central Electric Accounting Conference, held in the Claypool Hotel, Indianapolis, Ind., representatives were present from some twelve companies, in addition to which a number of traffic men were in attendance by special invitation. The question of the plan of settlement of interline accounts was continued from the meeting of March 2, at Dayton, and the further subjects were discussed of the method followed in checking Central Electric Railway Association and other mileage coupons, the recording of interline way bills, freight accounts, etc.

All roads check mileage coupons daily, separating the collections by lines and making a recount of all coupons at the end of each month before forwarding them to the issuing lines. In discussing the method of recording interline billing it developed that most lines have a system for recording interline way bills passing junction stations, using a record book. It was the opinion of those present that all interline waybills passing junction stations be reported in triplicate. This would afford a copy for the accounting departments of both the receiving and the forwarding line and a copy for the agent. A form embodying this arrangement will be printed, and it will be adopted by a majority of the lines handling interline billing.

Different systems are used for caring for freight and express shipments from non-agency points. There was, however, a full discussion of freight accounting forms and methods. As a result of the discussion, a committee was appointed to secure copies of all freight accounting forms in use on the various roads, and will report at the next meeting. Members of the conference are asked to forward to C. B. Baker, the secretary, who is freight auditor of the Western Ohio Railway Company, of Lima, Ohio, samples of all freight accounting forms in use on their respective roads and to make suggestions.

REPORT OF THE PARIS METROPOLITAN RAILROAD

At the last annual meeting of the Paris Metropolitan Railway, on May 18, it was stated that during 1906 the company has added 12.5 km, or 7.6 miles, to the Metropolitan system. The new lines are the Passy-Italie divisions of the South belt line and the Italie-Lancry section of the North and South line. Other sections are under construction. The power of the Bercy generating station has been increased to 14.400 kw, and four new sub-stations have been built. The rolling stock at present in operation includes 327 motor cars and 379 trailer cars; 254 other cars are in course of construction.

The total length of lines covered by franchise is 80 km (50 miles); the length at present in operation is 44.242 km (27.65 miles); the gross receipts in 1906 in round numbers were fr. 29,000,000, the expenses were fr. 12,000,000. Of the net receipts the city receives fr. 9,000,000, leaving fr. 8,000,000 for the company. This is an increase of fr. 2,000,000 over last year.

PRESIDENT LOWRY OF THE TWIN CITY RAPID TRANSIT EXPRESSES HIMSELF ON LOW FARES

Thomas Lowry, president of the Twin City Rapid Transit Company, who has been in the Southwest through the winter and spring, has returned to Minneapolis, and expects to give attention to business during the summer. Mr. Lowry says that while the general decline in securities has had its effect on the issues of his company, the real reason for the lower quotations for Twin City lines is the recent agitation for fare reduction and the unfavorable attitude of the municipalities through which the lines run.

"The six-for-a-quarter agitation," Mr. Lowry is quoted as saying, "affects our stock and our ability to borrow money and everything else. I have full faith, however, in the validity of our franchise and our ability to maintain fares."

For Minneapolis and the territory served by the Twin City lines, Mr. Lowry expects a year of continued good business, despite the somewhat more conservative tone to general reports. The comparative quietness in real estate in Minneapolis and St. Paul is due, he believes, to the fact that the decline in securities affected the purchasing power of a good many holders of stocks, who would otherwise be found more active in real estate, now that the spring season is opening.

ELECTRIC RAILWAY LECTURE AT WORCESTER POLYTECHNIC INSTITUTE

The annual engineering lecture at the Worcester Polytechnic Institute was delivered by Prof. A. S. Richey, of the Department of Electric Railway Engineering, on the evening of June 11, the topic being "The Development of the Electric Railway." Prof. Richey sketched the progress of the industry from its early days to the present time, showing a large number of lantern slides of cars identified with the experimental phase of the electric traction business and outlined the evolution of rolling stock and motors down to the latest locomotives in use in heavy electrified steam service.

Prof. Richey touched upon the efforts of Davenport, Davidson, Farmer, Hall, Siemens & Halske, Field, Edison, Sprague, Daft, Van Depole, Bentley, Short and Knight in the development of the art, and contrasted the statistics of the 1882 period with the figures of to-day. In 1882 there were 415 companies in the country operating 3000 miles of horse car track, with 35,000 employees and 18,000 cars. The service required 100,000 horses, and as late as 1890 the horse problem occupied the attention of the annual convention of the American Street Railway Association. According to the 1905 figures of the Census Bureau there are now about 33,000 miles of electric railway operated in this country by 200,000 men and 80,000 cars, with a passenger traffic of 7,000,000,000 per annum, and a capital investment of $3,500,000,000. The lecture closed with a sketch of the development of suburban and interurban service, including the limited interline, freight and express business, and concluding with a large number of illustrations of electric locomotives and electrified steam railroad installation work.

A NEW FRANCHISE SOUGHT IN TERRE HAUTE

Hugh J. McGowan, president of the Terre Haute, Indianapolis & Eastern Company, Robt. I. Todd and Ferdinand Winter, have presented to the Board of Public Works and a committee of the Council of Terre Haute, a new contract with the city for the company, and urge that action be taken speedily, as the company desires to make a number of improvements. According to the contract, the terminal station, which the new law requires to be erected at once, is promised within three years. Within two years the tracks in Main Street are to be relaid and sufficient cars are to be provided to equip all lines. It is promised that $850,000 will be expended for permanent improvements and in the building of interurban lines, the terminal station and new equipment. The right is granted to build such switches as are needed for the terminal station. The interurban cars are to be operated independently of city traffic. The fare is fixed at 5 cents for a continuous ride in the local cars and 5 cents for one continuous ride in interurban cars between any point in the city and the terminal station or other terminal points or any intermediate point, but it is agreed that the company may enforce such rules as it may deem to be to the interest of its interurban patrons respecting the use of its interurban cars within the city limits. The city cars are to be operated on "such reasonable schedule as the public convenience may require." The franchise is to continue until 1952, the date of the expiration as fixed in the present franchise.

PHILADELPHIA & WESTERN REORGANIZED

At a meeting of the incorporators and stockholders of the Philadelphia & Western Railway Company, successor to the Philadelphia & Western Railroad Company, last week, the company was formally reorganized. George R. Sheldon was elected president; Thomas Newhall, vice-president; Davies Murdoch, secretary and treasurer; George R. Sheldon, Randolph Rodman, James H. Brewster, Jr., Thomas Newhall, William H. Sims, W. Robinson Molinard and Joseph S. Clark, directors. It was decided to authorize a bond issue of $20,000,000, of which $4,000,000 is to be floated immediately; the remaining $16,000,000 being held for extensions, betterments and permanent improvements. It was also decided to issue $4,000,000 of stock, being $600,000 of preferred stock and $3,400,000 of common stock. Elsewhere in this issue appears an extended description of the property.

CHANGING THE BROOKLYN BRIDGE CAR SERVICE

Bridge Commissioner Stevenson revealed another feature of his plan to increase the traffic facilities of the Brooklyn Bridge at the meeting of the Board of Estimate last week, when he applied for an appropriation of $45,000 for making improvements to the structure. Ten thousand dollars of this appropriation is to be devoted in the installation of a local trolley service across the bridge, to take the place of the local train service which is now in vogue. It is the plan of the Commissioner to use the ground floor of the present terminal on the Brooklyn side for the installation of trolley loops similar to those which are now used at the Manhattan terminal. With the establishment of the new terminal loop station on the site of the "Staats Zeitung" Building, and the temporary terminal across Park Row into City Hall Park, it is the purpose of the bridge department to run through trains across the structure at all hours. This will obviate the necessity which exists at the present time of changing from the bridge trains during the rush hours to the elevated trains on the Brooklyn side. Mr. Stevenson points out that when this new train service is installed it will be impossible to continue the present local service. For the accommodation of the people who are using this service, Mr. Stevenson proposes to establish the local trolley service. Part of the appropriation is also to be used in making the operation of trains across the bridge safer than at the present time. A system of block safety signals will be installed all the way over the bridge, which will keep the trains operating in the same direction at safe distances from each other. The largest part of the money is to be expended in laying new ties for the railroad tracks. Mr. Stevenson's request was referred to Comptroller Metz for a report.

NEW PUBLICATIONS

"Etude sur le Metropolitan de Paris." By J. B. Thierry, Paris Librarié Polytechnique. Ch. Beranger, Paris. 1907. Paper, price, 50 centimes.

This monograph is primarily a study of the subways of Paris with particular reference to their structural features as bearing on the convenience, safety and hygienic features of their operation. As these subways and the methods used upon them are typical to those used elsewhere in the world the conclusions of M. Thierry have a far wider application than the locality to which they are particularly addressed. The author, in fact, uses the Paris conditions as a horrible example to what ought not to be in subway construction, and he writes with a full appreciation of the general faults of such roads. He states frankly that the same inconveniences described found in Paris exist always and have substantially the same cause in other subways, and lays down the fundamental thesis that such faults proceed from practically a single cause, to wit: That the constructors of such lines have treated them precisely as if they were trunk lines upon the surface, and have used the same general methods of construction and operation which would be appropriate to surface lines, entirely forgetting that the conditions of underground operations are in many respects very different. The particular weakness of the Paris subways, from the author's point of view, is their utter disregard of hygienic conditions, both as regards the general public and the employees of the company, and he presents some startling figures as to the loss from sickness to the actual personnel of the Paris subways.

The particular fault common to the Paris and other subways, M. Thierry holds, is a totally unnecessary and unwise use of the ballasted way, with the rails laid upon cross-ties, as is usual in railroad construction. An ordinary railroad runs for the most part at the ground level and over all kinds of country. It is necessary to level up the roadbed and to build it so that it will form a firm sub-structure, solid and well drained, substantial enough to keep the cross-ties permanently in position. The ordinary ballasted structure meets these requirements excellently, and it gives a firm roadbed for the heavy weights that must be carried, sufficiently resilient without being yielding, answering fully the requirements of the traffic which it is intended to carry. In subways the conditions are entirely changed. The walls and floors of the subway are of masonry or concrete, forming a solid and level way in itself. There is no need of ballast for the purpose of giving firm foundation or to provide for drainage. Broken stone such as is generally used for ballast, when employed upon surface track, forms part of the way, locking itself firmly together and into the gravel below. When used on the concrete floor the same ballast simply remains as a surface layer which does not at all unite with its sub-structure, and merely remains in place by its own weight on the smooth foundation. It does not even, under some circumstances, hold the cross-ties with sufficient rigidity against lateral movement.

Structurally, therefore, the use of ballast is not needed and is signally ineffective. The author then remarks: "What is the use of laying cross-ties on this layer of broken stones and at considerable trouble to buttress them against lateral movement due to insufficient cohesion of the ballast, when a foot or so below the ties there is already provided a firm and rigid floor." A more serious indictment brought against ballast is on the ground that its use is unhealthy. A subway is cut off from free access of light and air, and is generally damp without having any of the advantage that comes from the well ordered application of water, and the ballast becomes a trap for filth and dirt of every description, kept conveniently moist for the development and preservation of micro-organisms. Dust, which is formed or finds its way into the subways in so far as it does not join the slime in the moister part of the ballast, finds lodgment in the broken stone to be whirled up and conveyed to the lungs of the passengers by the passage of the trains. M. Thierry calls attention to the fact that subways are at once industrial and public establishments, and as such are subject to the statutes bearing upon hygienic conditions in such places, and that as now constructed they cannot possibly be kept clean, as provided in these statutes.

Further than this, in case of any trouble in the subways, such as has more than once occurred, a ballasted way carrying unprotected third rails, raised but little above its surface, is a very serious menace to many persons who are compelled to make use of it in order to escape the greater danger of remaining. Finally, the ballast, composed as it is of comparatively rigid material, does not sufficiently muffle the vibration of the trains. In point of fact a serious amount of vibration is communicated to neighboring buildings to the damage and inconvenience of the occupants. It does not even suffice to ameliorate what M. Thierry calls "the infernal din" of the trains, which rank with dust and evil smells at the head of the thousand causes of suffering inflicted on humanity in cities. This forms a serious indictment with many counts against the form of subway construction used in Paris, and, for that matter, elsewhere.

The solution of these difficulties proposed by the author is a simple and rational one. Instead of building a subway with a concave floor for the reception of a thick layer of ballast he would provide it with a solid floor of concrete and masonry, slightly convex on the interior and provided at each side with a longitudinal drain. At about the height of the top of the trucks, at each side, he would provide a platform wide enough for persons in single file to walk comfortably, supporting themselves by a hand rail projecting from the side of the subway at a convenient height. The platform itself forms a top of a recess carrying at its bottom the insulators for the third rail and provided with brackets for the feeder cables. In this way all dangerous conductors are safely stowed away under the platform, and the employees or persons leaving the train have always a safe course along the subway.

Instead of supporting the rails upon cross-ties, four deep semi-circular channels are provided in the floor of the subway. These channels carry longitudinal stringers, firmly bedded in asphalt, a thin layer of which covers the entire subway floor. On these stringers are laid the rails with a very ingenious device for further deadening the noise and vibration. Instead of the ordinary type of rails, composed of a head, web and a wide supporting foot, M. Thierry advises the use of a double-headed rail, an upper head forming the usual tread, while a smaller lower head is supported on chairs, placed upon the stringers, being bolted firmly through the web with blocks of hard wood clamped between real-head and chairs on each side of the web. These wood blocks and stringers, and the asphalt beneath, would give ample resiliency and would tend greatly to reduce the noise and vibration which now exist. Rails of this character have been used to some extent, and with at least a fair degree of success. A subway constructed in this manner can certainly be very effectively cleaned, and M. Thierry believes that a simple way of doing this would be to run through the subway at night a sprinkler car, sending through the entire cross section of the subway from the top a copious spray, cleansing the air and surface together. The platforms would shelter the third rails and cables from this purifying shower. The drains would carry off the water thus applied, and comparatively little hand work would be necessary for keeping the subway really clean.

With respect to ventilating the cars M. Thierry holds somewhat radical ideas. He believes in seats running lengthwise of the car so as to leave the interior comparatively free for the circulation of air, and then would provide large ventilating apertures at each end of the car, so there would be a steady stream of air produced by the motion of the train. How employees and passengers would endure the draft thus provided the book does not state. Beyond this the author proposes through ventilation of the cars during their passage around the loops of the ends of the routes or at some analogous point. To secure this he suggests a very powerful artificial current of air derived from blowers and directed obliquely across the track. As cars swing slowly around the loop all available apertures would be open, and in passing through the cross stream of air the cars would be thoroughly blown out while empty, and would start with at least something like adequate ventilation on their next trip. As M. Thierry grimly remarks, this solution is exactly the inverse of the practice usually followed, which consists of running around the loop with all the train doors closed so that in a few moments the cars arrive at the starting point ready for the next trip surcharged with all the infection accumulated on the previous runs.

The matter of noise is taken up at considerable length, especially with reference to the applicability of the form of rail already described with its sub-structure of asphalt. There seems to be little doubt that by skilful application of asphalt and similar substance it is possible greatly to reduce the noise and

vibrations, and while it may be impossible to produce quiet-running fast trains, what M. Thierry suggests would certainly very much relieve the situation.

The author's attacks on the conditions which exist in the Paris subway, substantially as outlined here, is well worth reading, for it gives in considerable detail the reasoning which leads to his somewhat startling conclusions. Certainly an ordinary subway is neither clean, quiet nor well ventilated, and any suggestion, even if an extreme one, in the way of relieving them is well worth reading by any engineer who is interested in subways.

In a postscript M. Thierry adds the interesting information that the engineers of one of the new Paris subways have taken up seriously the study of a project for a line laid out in accordance with the author's suggestions, and after an examination of his manuscript. Should the project be carried out it would certainly prove a most valuable object lesson in the application of new ideas and methods to a new and difficult situation.

STREET RAILWAY PATENTS

[This department is conducted by Rosenbaum & Stockbridge, patent attorneys, 140 Nassau Street, New York.]

UNITED STATES PATENTS ISSUED MAY 28, 1907

854,730. Control of Electric Cars; John J. Frank and Jesse S. Pevear, Schenectady, N. Y. App. filed Sept. 19, 1906. The primary of a small transformer is in shunt with the motor circuit and serves to automatically make the proper motor connections when the car passes from a direct-current section to an alternating-current section and vice versa.

854,733. Brake-Shoe; William G. Grant, Suffern, N. Y. App. filed Aug. 31, 1906. Comprises a plate of substantially uniform width having portions of its sides bent in opposite directions transversely across the plate, forming a integral key-lug.

854,759. Trolley Pole; Lee Radcliff, Danvers, Ill. App. filed June 29, 1906. A curved trolley pole having a wheel at either end and hinged at its middle portion on the roof of the car. Either wheel may be impelled upward against the wire by spring-pressed arms.

854,761. Separable Brake-Shoe and Head; Charles A. Remelius, New York, N. Y. App. filed March 30, 1906. The brake-shoe is keyed to the brake head in such a manner that it may be readily removed and replaced when worn.

854,767. Switch Stand; Fred W. Snow, Hillburn, and Wm. C. Kidd, Suffern, N. Y. App. filed Feb. 23, 1907. Details of a switch stand for use in any location where compactness of structure is a desideratum.

854,803. High-Speed Brake Apparatus; John W. Cloud, London, England. App. filed Sept. 20, 1905. A fluid pressure brake apparatus comprising a main brake set, an auxiliary brake set and a speed-controlled valve device for regulating the amount of braking pressure exerted by the auxiliary brake set.

854,804. Trolley Wheel; John C. Cordrey, La Junta, Col., and Patrick J. Brady, Harvey, Ill. App. filed June 30, 1906. The wheel is made up of sections of steel and brass so as to combine the wear-resisting materials of the first metal with the good conducting qualities of the second.

854,828. Car Wheel; Frank Latimer, High Bridge, N. J. App. filed Sept. 11, 1906. Details of a steel-tired wheel, the center of which can be readily retired after wearing down.

854,918. Electric Governor; Herman Weber, Colorado Springs, Col. App. filed April 30, 1906. Provides means for automatically closing an electric circuit and lighting a lamp or visual signal when a car stops to prevent rear end collisions.

854,970. Electrical Block Signal; Elza S. Stotts and Lester O. Dickey, Omaha, Neb. App. filed Aug. 13, 1906. A semaphore signal having a motor for raising the arm and a magnet trip for dropping it to danger.

854,985. Brake-Shoe; Seth A. Crone, New York, N. Y. App. filed Feb. 21, 1907. A brake-shoe having a cast metal body and plate back, the back having at its end portion a transverse inwardly depressed integral loop over which the cast metal extends.

855,053. Railway Rail Fastener; Walter S. Glasgow, Toledo, Ohio. App. filed March 29, 1907. The flanges of a metallic channeled tie are cut away and transverse plates are inserted to which the rails are secured.

855,090. Automatic Street Railway Switch; John A. Boquist, Minneapolis, Minn. A lever in the roadbed is engaged by an approaching car to throw the switch.

855,114. Suspender for the Contact Wires of Electric Railways; Joseph Mayer, Rutherford, N. J. App. filed Feb. 5, 1907. A suspender for electric trolleys adapted to clamp the wire and protect the same from bending strains.

855,183. Sand-Box; Peter S. Keck, Allentown, Pa. App. filed March 27, 1907. A plurality of shafts are mounted in the hopper and each have a series of pins thereon. The shafts are so geared to the discharge lever that they will be rotated when the lever is operated.

855,424. Guard for Switch Frogs, Guard Rails or the Like; Alfred Anderson, Minneapolis, Minn. App. filed May 3, 1906. Consists of a body plate and a longitudinal bar applied thereto and projected from its under side, said bar being toothed so as to engage the ties of the roadbed.

855,265. Rail Splice; James Thomas, Joliet, Ill. App. filed Sept. 7, 1906. The base and one side of one of the fish-plates are integral, the base extending under the rail and having an upturned lug in which is mounted a set-screw for engaging the other fish-plate.

855,323. Strain Adjuster for Contact Wires of Electric Railways; Joseph Mayer, Rutherford, N. J. App. filed Feb. 5, 1907. Relates to a trolley hanger designed to overcome the effects of changes in temperature in the trolley wire.

PERSONAL MENTION

MR. SAMUEL B. McLENEGAN, former superintendent of the Interurban Railroad, of Los Angeles, Cal., has been appointed general manager of the Central California Traction Company, of Stockton, which owns about seven miles of trackage in Stockton, which will be a basis for a larger system.

MR. A. W. Q. BIRTWELL, assistant treasurer of the Houston Electric Company, of Houston, Tex., has resigned from the company to become assistant treasurer of the Northern Texas Traction Company. Mr. Birtwell will be succeeded in the Houston Company by Mr. H. L. Harding, of the company.

MR. WESLEY WENTWORTH has resigned as general superintendent of the Houston Electric Company and will be succeeded by Mr. U. Foss, formerly superintendent of the lines of the Consolidated Railway, at New Britain, Conn. Mr. Foss before becoming connected with the Consolidated Company was with the Connecticut Railway & Lighting Company and the Syracuse Rapid Transit Company.

MR. EDGAR S. FASSETT, general manager of the United Traction Company, of Albany, N. Y., has been elected to the board of directors and made a member of the executive committee of the company. Mr. Fassett takes the place of Mr. William J. Mullin, resigned. Mr. Mullin is traffic manager of the Delaware & Hudson Company, and severed his connection with the traction company because of his many duties with the Delaware & Hudson. Mr. Fassett has been with the United Traction Company for many years.

MR. J. W. SHERWOOD, who recently resigned as assistant general manager of the Mexico City Railway Company, of Mexico City, has just returned to New York. Mr. Sherwood began his railroad career with the New York Central Railroad, with which he was connected until 1895, when he resigned to enter the service of the Brooklyn Heights Railroad Company under the general superintendent. Subsequently he left that position to enter a subordinate place at one of the depots of the company, where he spent more than a year thoroughly familiarizing himself with the details of management in order to fit himself for the position of chief clerk to the general superintendent. In 1902, after several years of service in the capacity just mentioned, Mr. Sherwood left the service of the Brooklyn Rapid Transit Company to become connected with the Public Service Corporation under Mr. W. W. Wheatly, the general manager. In 1903 Mr. Sherwood resigned from the Public Service Corporation to accept the position in Mexico City, which he recently relinquished.

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Changes of advertising copy should reach this office by 10 a. m. Monday preceding the date of publication, except the first issue of the month, for which changes of copy should be received two weeks prior to publication date. New advertisements for any issue will be accepted up to noon of Tuesday for the paper dated the following Saturday.

Of this issue of the Street Railway Journal 8000 *copies are printed. Total circulation for* 1907 *to date,* 206,050 *copies, an average of* 8242 *copies per week.*

The New Master Mechanic Changing Established Shop Methods

When a master mechanic takes charge of an already equipped shop, often one of the first things he does is to abandon many of the details of shop practice in use and substitute for them methods that are more in accordance with his own ideas. These changes are often made in such a short time and to such an extent that the whole shop is thrown into a more or less chaotic state, expenses are increased, and there is considerable interference with the regular work.

The advisability of making many radical changes just as soon as a man is placed in charge of a shop is rather doubtful. It is to his advantage to keep the shop maintenance expenses as low as possible, and it may be that the methods in use are peculiarly adapted to the conditions under which the work is being done, or else that the men have become so accustomed to working in one special way that the introduction of other methods will result in an increased rather than decreased cost. Even though the methods in use are hopelessly bad, more will generally be gained by making the changes gradually rather than by trying to effect them all at once. If sufficient time is taken, the men may be gradually accustomed to the changes, and a state of disorder which otherwise might be brought about is avoided. Again, where the former master mechanic did not leave of his own accord, it often happens that the workmen do not at once give the new man their confidences. Frequently the men are much attached to their former employer and seemingly regard the coming of a new man as usurpation. In such cases it is better to make as few changes as possible at the outset, as the men are inclined to feel that the abandonment of the methods of their former chief is a reflection on his ability.

Causes of Poor Vacuum in Turbine Plants

The efficiency of the steam turbine depends so closely for realization upon a high and maintained vacuum in its auxiliary condensing equipment that any defects in this part of a power plant are certain to make themselves felt in unduly large fuel bills. The adjustment of the condenser to the turbine is a matter to be settled long before an installation is begun, and the advice of manufacturers on this point is especially well worth bearing in mind. When troubles occur with the vacuum in an operating plant it is not always easy to fix the responsibility, and in some cases there is no remedy except the installation of a new and larger outfit. In other instances the trouble proves to be of an acute rather than of a chronic nature.

If the condensing plant is too small for the work, either as a whole or in any single part, the cost of rectifying the mistake is sure to be greater than the original investment in a proper layout would have been. It is almost invariably a more expensive matter to enlarge the capacity of a plant in piecemeal than to build it the proper size in the first place. The consulting engineer's advice nowhere should carry greater weight than in the recommendations which he makes as to the necessary cooling surface of condensers for turbo units, desirable size of circulating and vacuum pumps, and requisite cross section of exhaust and water piping.

Poor vacuum often arises from air leaks in that portion of the condenser and its connections where the pressure is below that of the atmosphere, or from leakage in one of the wet or dry vacuum pumps. Still another cause is the temperature of the cooling water running higher than was anticipated, especially in the warm season. The remedy for leaks is obvious, but it is a more serious problem to secure circulating water of the desired temperature. The cooling tower suggests itself at once, but space considerations may be unfavorable, the first cost of a tower may appear serious, and again, the cost of operating pumps and fans must be reckoned in. The conditions may call for a carefully planned cooling tower installation, and it is a fact that excellent operating economy is being attained in some of these cases, but the problem is peculiarily one for expert advice. If cooling water can be secured from a deep well, so much the better. With the exception of leaks, troubles in the condensing plant admirably illustrate the importance of the proverbial stitch in time.

Feeder Diagrams in Power Plants

In view of the fact that all feeder circuits in a direct current system of standard connections are primarily controlled from the power station switchboard, it is certainly an operating oversight that so few plants are provided with a set of feeder diagrams maintained in an up-to-date condition. On small roads the feeder system is usually a very simple affair, and in many instances there is doubtless slight need of working drawings of the overhead system as far as the conduct of the power house is concerned. At the same time it is well worth while to have at least a simple blue print of circuit breaker, trolley tap and line switch locations at hand for reference in times of emergency, especially when telephoned instructions have to be given to men on the road. As systems grow in size it becomes increasingly difficult to remember the exact layout of outside wiring, including the changes made from time to time by linemen. Even if the power house force can recall with promptness the outside conditions, it is important to save every possible item of mental energy at times when both inside and outside men must co-operate to keep things moving. Judgments exercised with instant grasp of unseen conditions are needed rather than feats of memory when things go wrong.

An excellent instance of the use of complete feeder diagrams in the power stations of a large city system may be cited in Boston. Every power plant there is furnished with a complete set of blue prints from the electrical engineer's office, showing the feeder circuits, trolley and third rail supplies, street and underground switches, the lines and territory fed from all the power houses on the system. Such diagrams prevent any working in the dark in the general distribution of power, as they enable the switchboard men to see the exact possibilities in the supply of current to the various surface, elevated, subway and tunnel lines. The sharing of loads between adjacent stations and the concentration of power at points of unusually heavy traffic are much facilitated by the availability of these diagrams for instant reference. While it would be hard to cite a more complex system than the Boston Elevated from a geographical standpoint, or one in which the technical organization is more complete, there is a wide usefulness for the feeder diagram in the power plants of smaller city roads. On the large system the effects of a change in feeder switching are less in proportion to the results than on a small road with few feeder sections, though the total amount of power involved may be greater in the former case. It is more a question of efficient distribution in the large city; in the small one the issue is mainly one of service reliability as expressed by the feeder capacity available. Feeder diagrams kept up-to-date in the power plant contribute to both these desirable conditions.

Steam Jackets

Many questions in engineering, whether steam or electrical, seem most satisfactorily settled by experiment alone. There is, of course, no real conflict between theory and practice when the theory is made broad enough to cover all the existing conditions. But until all of the laws of thermo-dynamics and electrical engineering can be reduced to simple formulæ and we know all about the properties of the materials with which we have to deal, differences of opinion will exist. An example of a subject upon which steam engineers have not yet reached a unanimous verdict is the question of heating steam in its passage through the engine. For instance, nothing seems so certain, from a cursory view of the situation, as that the receiver of a compound engine can economically be employed as a reheater. But the fact remains that the saving is so small it is very doubtful whether the reheater does pay. Very possibly the ordinary method of heating a receiver is wrong. It is usually made to do duty as an evaporator and to manufacture fresh steam from the water discharged into it, thus practically negativing the compound principle. Under abnormal conditions it might happen that the receiver could be put inside a brick chamber and heated by the waste gases from the boiler, but such opportunities will be rare. The very doubtful economy secured from ordinary reheaters leads to the belief that they ought not to be called on to act as evaporators. Instead, when used, an efficient separator should be used so that the working of the reheater may be confined purely to drying and perhaps slightly superheating the steam on its way to the low-pressure cylinder. One form of reheater employs as its heating agent superheated steam which has been made too hot to enter the high-pressure cylinder with safety. Whether this system can or cannot be more economically worked with a drained or an undrained receiver can best be determined by experiment, but even here there is a strong probability that the receiver should be drained and the superheat temperature kept as low as would be then necessary to supply steam of correct superheat to the first cylinder.

Similarly it would appear that steam jackets are good or are useless according to circumstances. To jacket a cylinder with steam of boiler pressure does not sound like good practice. There is more mass of metal and greater radiation surface, and that, too, of higher temperature, the jacket being now the outer vessel. To secure better results it has been suggested that the jackets might be fed by a special boiler at a pressure higher than that in the main boilers, so that there might be a constant flow of steam through the

jackets, all the steam passing by way of a suitable throttle valve to the main boilers. An extension of this principle would be to superheat the steam and pass it in series through the high-pressure jacket, the reheater and the low-pressure jacket, the first two numbers of the series being interchanged in precedence and the last number eliminated at times with a view to demonstrate its actual working efficiency.

Most of the experiments which have heretofore been made on jacketed engines may, perhaps, be better described as experiments with jackets that may or may not have been more or less filled with steam, air or water. The fact that there is a small economy with the thoroughfare jacket seems to point to the economy possible with all jackets if they are really steam jackets and free from heavy air, or heavier water, pockets. Those who make experiments on steam-jacketed engines appear to shut their eyes to the use of the air pump in the steam cycle and the impossibility of running long without one. The power to employ superheated steam brings forward considerable possibilities in steam engine working, and some of these may be capable of being turned to profit in the direction of jacketing. But experiment is wanted to determine just how far these things can be carried out with economy, for no certainty can be had from argument, no matter how apparently sound the basis of reason.

Economy in Car House Operation

Detailed observation of the efficiency of car movements on important electric railway systems proves that the manner in which cars are handled while off the street exerts a large influence upon the punctuality of the schedules. The responsibilities of the car house foreman or starter are not always appreciated in their relation to economical service, but few subordinate officials have it more within their power to insure smooth running of cars and to maintain satisfaction among the regular and extra platform men whose individual work counts for so much in the operation of the system. Promptness in starting cars on the precise minute or half-minute which the schedule demands, alertness in the provision of extras when the regular intervals are either too long or interrupted by delays, and skill in reducing idle movements within the car house and on its approaches to the minimum consistent with flexible service are all required of the employees whose successive shifts bring them in charge of these divisional operating centers.

The design of any car house obviously conditions the work which can be done inside its walls, but skill and tact in the handling of cars and men do not depend upon the track layout exclusively. Most car houses contain a number of parallel tracks carried to stub terminals at one end of the building, though in some late interurban installations a through arrangement of tracks has been provided, outlets being at both ends, as well as inlets. Experience has clearly shown that any car house storing rolling stock operated on short headway should be provided with separate tracks for inward and outward movements, even though the cars may be switched back and forth by a transfer table or interior cross-overs after they are run into the house. When a double-track trolley line passes a car house which is important as a route terminus or division headquarters the failure to provide separate inward and outward tracks in connection with the usual ladders or spurs opens the door for serious delays and obstruction to free movement.

Classification of cars according to routes and sometimes according to type of rolling stock are essential features of car house work on a large scale. Cars entering the house may be finally placed in positions remote from the entrances, but whether this is done by straightforward movements on spur tracks, by the use of convenient cross-overs, or by transfer table, it is important that the last crew to leave a car shall leave it in perfect condition to start out again at any time. The turning of the seats and trolley, adjustment of fenders and similar points require valuable time, and in the daylight hours it is desirable in a well-organized car house to keep each car's trolley against the wire ready for an immediate start, with the main and auxiliary switches cut out, however. The transfer table may not be justified in a small house holding but two dozen cars, but in a large house the movements become so frequent in the morning and evening rush hours that often a single transfer table is hard pressed to furnish cars in the proper sequence. These interior movements depend so much upon weather conditions and the variations in traffic volume, breakdowns and minor repair requirements that it is difficult to plan them with the detail which steam railroads practice in making up trains daily for suburban service. Too many interior cross-overs lead to wasted storage space and dangers of fouling, whereas the transfer table method requires a definite rectangle set apart for interior car movement and enables the balance of the trackage to be utilized to the last inch of clearance. In the exigencies of street railway service the last car in may not be the first car called out, and the handling of the interior movements with the least feasible dead mileage and delay is a task where experience counts for economical service.

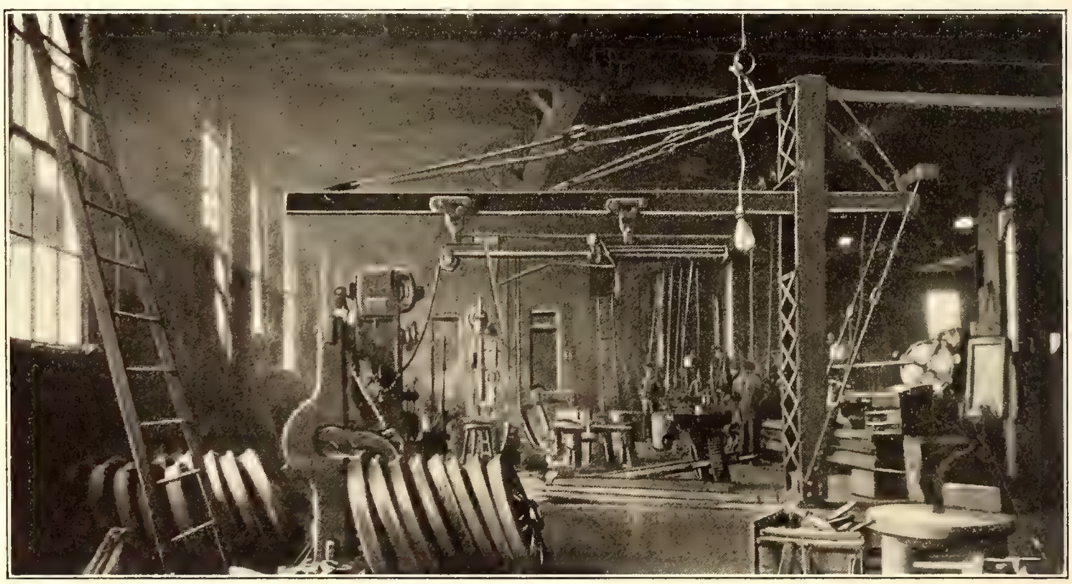
The execution of minor repairs is invariably a feature of car house operation, and the facility with which cars may be jacked up, suspended and supported for overhauling beneath, rail sections dropped out for the replacement of wheels, and inspection as a whole carried on determines to a considerable extent the economy of light maintenance. These features of car house practice have often been emphasized in these columns and need not be detailed at this time save to point out one or two matters which still need attention on many roads. The importance of liberal pit lighting can scarcely be overestimated; the desirability of being able to run trucks as a whole into even small blacksmith shops and to have room to inspect from above, as well as below, are not always realized. Thorough organization in the stock room, the use of cradles in the pits with simple jib hoists above, and the provision of a few good machine tools are all helps to efficient work in large car houses. Comparatively few roads of the larger size do much repair work in their car houses, but the existence of splendidly equipped shops at some other point on a system should never be an excuse for the failure to provide the few good motor-driven tools, appliances and men who are needed for the light emergency repairs of the important divisional car houses.

NEW SHOPS AND SHOP PRACTICE OF THE OMAHA & COUNCIL BLUFFS STREET RAILWAY COMPANY

About one year ago the Omaha & Council Bluffs Street Railway Company completed the erection of new shops at Twenty-Sixth and Lake Streets, Omaha, and through the courtesy of W. A. Smith, general manager of the system, this publication now is enabled to give an account of the shops and the practice in them. The buildings were designed by and erected under the supervision of H. B. Noyes, chief engineer of the company. As completed, the shops contain every facility for carrying on the work, and it is estimated that the same repair work is done at about two-thirds the former cost.

EXTERIOR VIEW OF THE OMAHA SHOPS

The exterior of the shop building is of rather pleasing appearance, as the walls are of dark colonial brick with limestone trimmings. The floors in the shops are all of concrete, while the roof is of mill construction and is covered with Carey's roofing. The shops are on a plot of ground of such size as to permit extensions to four times the present capacity. The main portion of the building is one story high, rectangular in section, and measures 245 ft. x 120 ft. An extension to the shop building proper contains offices, drafting room, toilet and locker rooms, a fireproof vault on the first floor and a boiler room in the basement. The thirteen tracks entering the shops are served by a transfer table traveling the full length of the building. The next building to be erected, and which will probably be put up during the coming season, will be built on the opposite side of the transfer table runway.



GENERAL VIEW OF MACHINE SHOP, SHOWING THE CRANE

FIRE PROTECTION

Fire walls separate the rectangular building into five rooms, each devoted to a department of the repair work. The storeroom occupies the central portion and doorways from it lead directly into each of the other four rooms.

The whole shop is equipped with a dry sprinkler system, similar to that described in the STREET RAILWAY JOURNAL of March 30, 1906. In the paint shop the heads are carried down between the cars at a height a few inches below the top of the side windows. In the other rooms they are placed just under the roof. There is a total of 818 heads of the Grinnell type installed in the building. A reserve water supply is maintained in a tank of 40,000 gals. capacity placed 30 ft. above the roof.

The shop is also provided with fire lines connected to the city system, and numerous outlets are provided with hose. The division walls are all carried up above the roof and the passageways through them are provided with double fire doors. All of the rooms are piped with city gas mains and gas is used in melting solder, burning old paint off cars, heating soldering irons and various other purposes.

Compressed air is supplied to all portions of the building from a motor-driven air compressor with a 10-in. x 10-in. cylinder.

WIRING

All of the shop wiring is carried in loricated conduit. The power wiring runs under the floor, and the conduits are brought up at the bases of the machines, several of which have individual motor drive. One of the illustrations shows a combination fuse and switch box employed in the light wiring system. The box is of cast iron, and when the door is closed only the handle of the snap switch is exposed.

LIGHTING

The shop is lighted throughout with incandescent lights. Near each machine is a pipe post with a swing arm carrying a cluster of five lights. The wires are brought up through the floor and post so as to be entirely hidden. The open pits are lighted with lamps installed in the concrete piers. The wiring for these is carried underneath the floor and up through the pier.

HEATING AND TELEPHONES

Heating is accomplished by a steam heating system, steam being obtained from a boiler in the basement under the offices. Each department is connected with the office by a private telephone system.

CRANES AND LIFTS

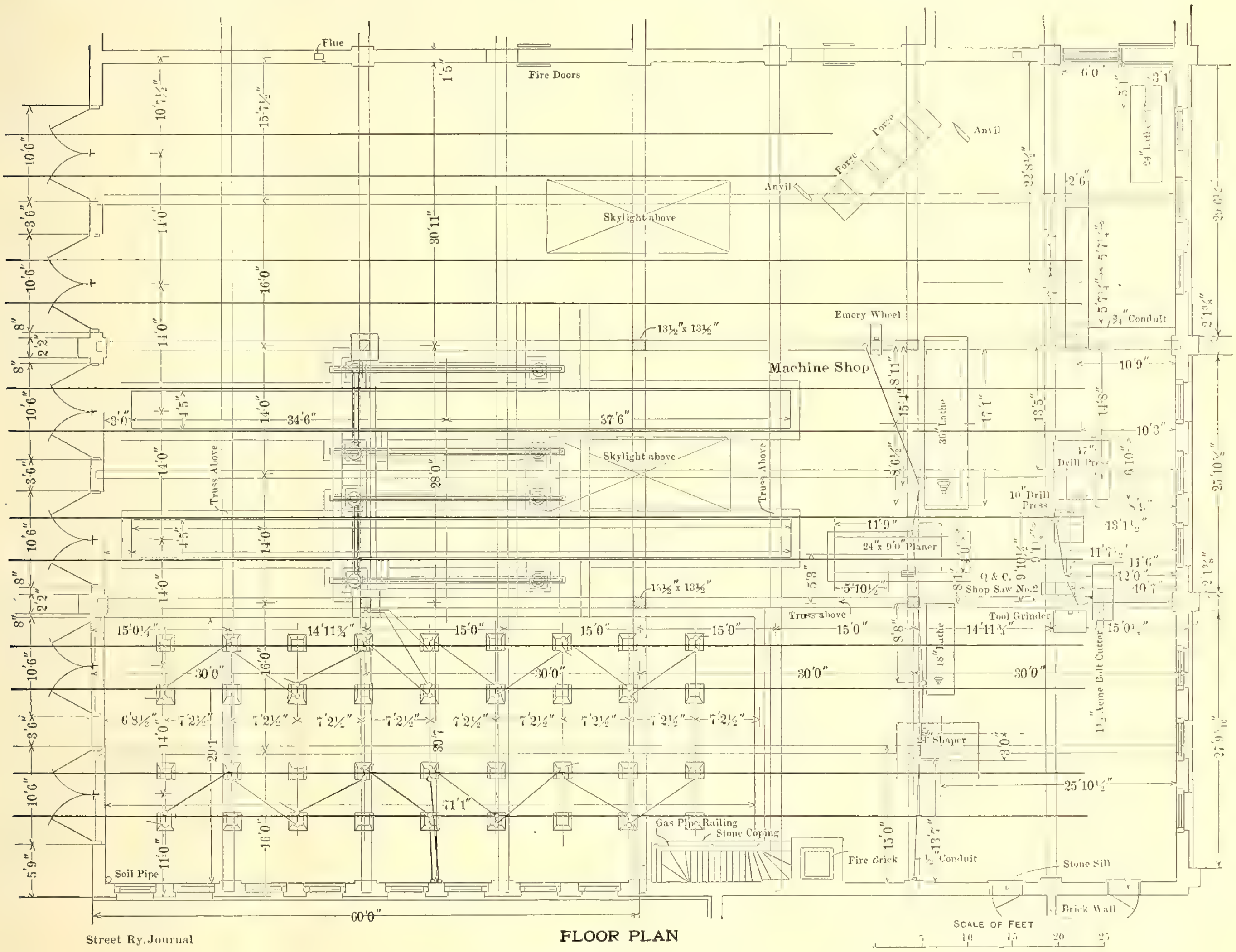
The machine shop, armature room and pits are provided with cranes and hoists which practically eliminate all heavy lifting. A specially constructed jib crane serves several of the machines in the machine shop. The post built of two 10-in. channel bars latticed together rests in Moffet roller bearings in such a manner that it can be turned through an arc of 360 degs. The boom is a 10-in. I-beam, and extends 17 ft. from the post. A double trolley running on the lower flange carried a 6-in. horizontal air hoist. By an ingenious arrangement this crane is employed in moving the attachments of the wheel press.

One illustration shows a crane outside the building for unloading wheels and other heavy materials from cars. This has a trussed wooden boom 32 ft. long, the base of which is swiveled in a plate against the wall. A chain secured to an eye bolt in the wall supports the upper end. The hoist is operated by a 10-in. air cylinder with a 4-ft. stroke placed inside of the building. Sheaves multiply the lift to 12 ft. A lever near the end of the boom controls the air so that one man can operate the crane.

There are several overhead tramways provided throughout the shops with air hoists, and, in fact, the pits and all the machines are served by lifts of some type.

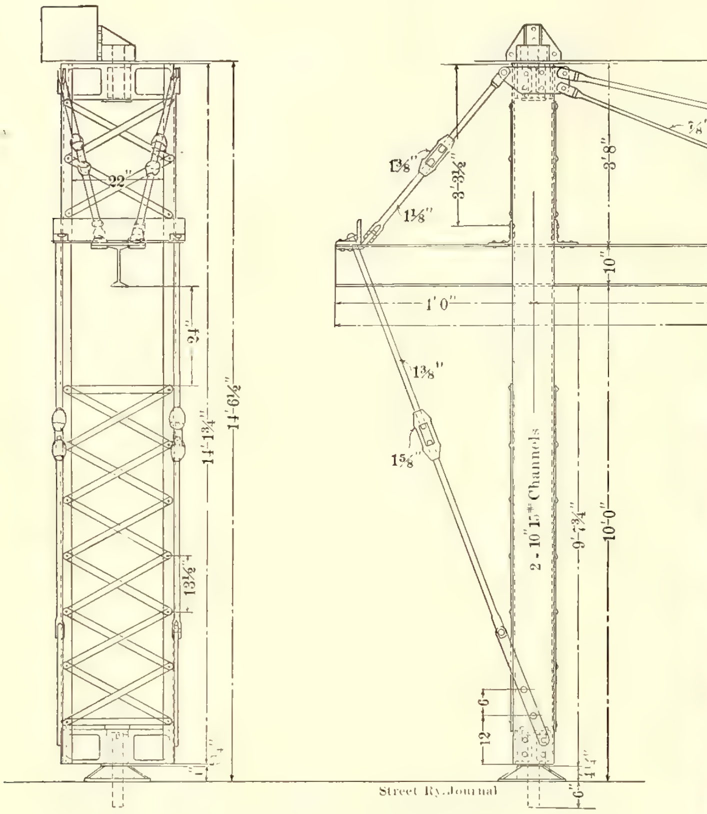
THE PITS

The repair pits have been located adjacent to the machine shop equipment so as to necessitate the least handling of wheels and heavy parts. Two of the four pits are of the open type and have the tracks supported at the floor



GENERAL PLAN OF THE SHOPS OF THE OMAHA & COUNCIL BLUFFS RAILWAY COMPANY

level of the concrete pit floors. To prevent accidents due to loose wheels and wheels out of gage, and to facilitate



TWO-TON CRANE BUILT IN THE OMAHA SHOPS

the handling of cars with broken axles, guard rails are bolted to the running rails over the pits. These open pits have been found better adapted to general repair work than those of the ordinary type, and as much of this work as possible is done over them. An overhead tramway runs the full length of the open pits between the tracks, and for work under the car Watson hand-operated hydraulic hoists are provided. Each track is provided with two sections of removable rails. The removable sections are hinged at the end so that they may simply be unbolted at one end and swung outward. At the hinge a 2-in. pipe is embedded in the concrete pier. The rail is bolted to a pin 18 ins. long which works in the pipe. One of the illustrations shows the rail sections at one point swung aside and the pit jack being used in lowering a pair of wheels. After being lowered a sufficient distance the jack, with the wheels, is hauled out between the tracks and the wheels are picked up by an overhead air hoist and conveyed to the machine shop floor. Using this method, two men usually change the wheels in six different cars in one day. The work includes getting the cars into the shop and in bringing the wheels in from the yards. The other two pits, which are of concrete and of the usual type, are provided with Pittsburg car hoists. Each hoist consists of two 10-in. I-beams, 25 ft. long, placed about 2 ft. outside the rails, and mechanism for raising them. The beams are supported at each end by a screw, and all four screws of each hoist are geared to a car motor installed in the pit. The beams have a travel of about 3 ft., and when lowered are flush with the concrete floor.

OPEN PITS, SHOWING METHOD OF HANDLING WHEELS AND THE REMOVABLE SECTION OF TRACK

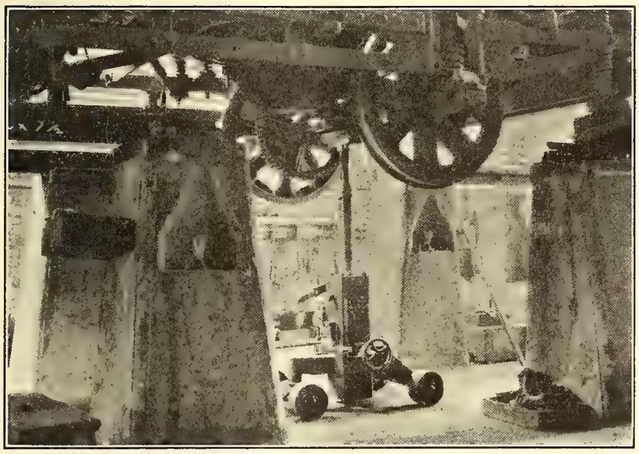
AIR-OPERATED CRANE FOR UNLOADING MATERIAL FROM CARS. A TRANSFER TABLE IS IN THE BACKGROUND

CHANGING OVER BODIES

During the changing-over season a gang of six men change over from six to ten bodies per day by the use of the hoists just described. The open and closed bodies are placed on the hoists side by side and the dummy truck and the motor truck, with the aid of the transfer table, are interchanged in a minimum amount of time. In changing, the same truck is put back under the same body year after year.

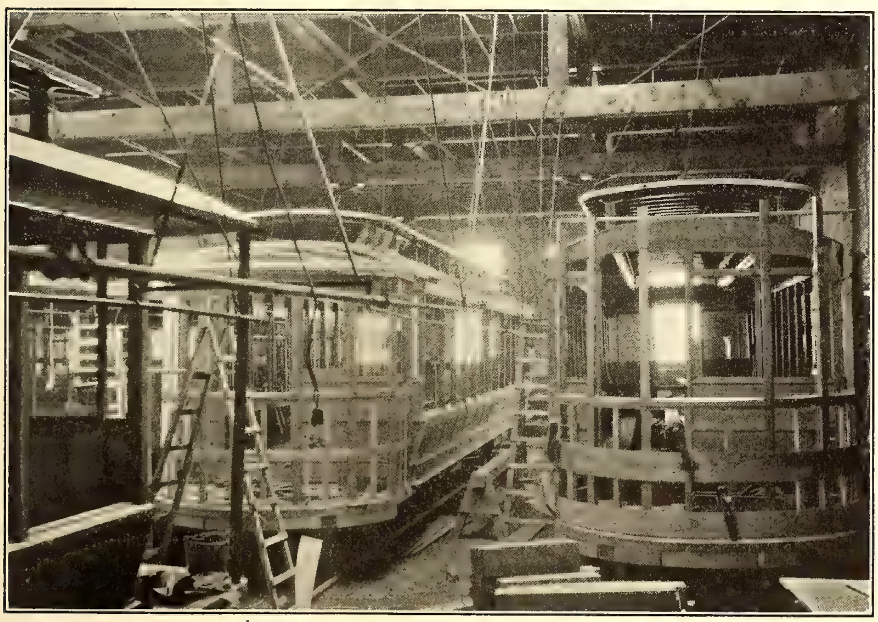
SPECIAL MACHINES IN THE MACHINE SHOP

One of the illustrations shows a machine for punching iron. This was formerly hand operated and required the services of a man and a boy. The services of the boy have been eliminated by operating the machine by compressed



HANDLING WHEELS IN THE OMAHA SHOPS. THIS VIEW ALSO ILLUSTRATES THE METHOD OF PIT LIGHTING

air. The 7-in. brake cylinder is controlled by a straight air engineers' valve placed in a position convenient to the

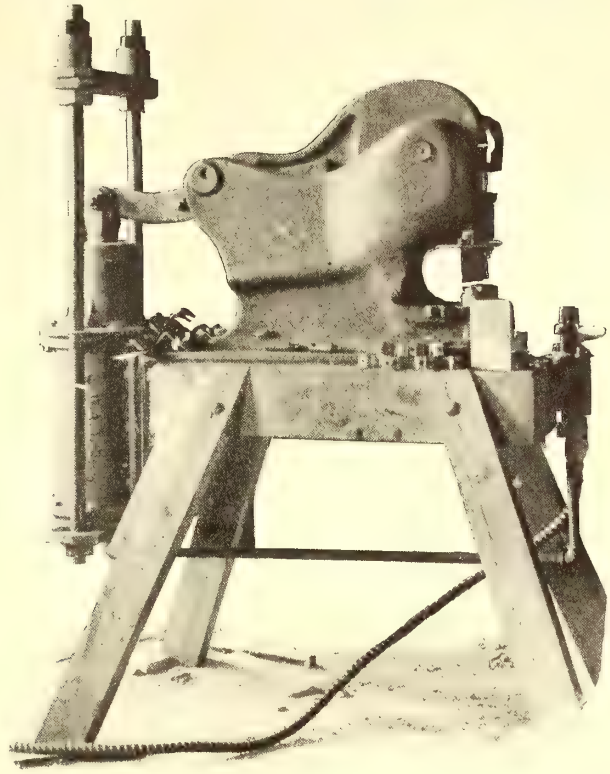


SOME OMAHA CARS UNDER CONSTRUCTION. THIS VIEW ALSO SHOWS THE SHOP SPRINKLERS IN PLACE

operator. A similar brake cylinder similarly controlled is bolted to one of the posts supporting the roof and is used in bending conduit and small bars.

THE WINDING ROOM

The winding room is well equipped and provided with conveniences. For testing armatures a special lamp circuit is arranged which gives the customary trolley voltage, and, in addition, three-fifths of this voltage. The lamps and



AIR-OPERATED MACHINE FOR PUNCHING IRON

plug sockets to which the test points are attached are supported by an overhead bracket, which may be turned through almost a complete circle. To give the reduced voltage, two of the lamps of a circuit of five are shunted by the test points. A snap switch connects the points either in the circuit of five or the circuit of three lamps. All of the reels of wire in the room are supported on a neat channel bar frame. The armature stands have cast-iron bases and iron pipe standards, and the armature bearings rest between rollers.

GROOVING ARMATURES

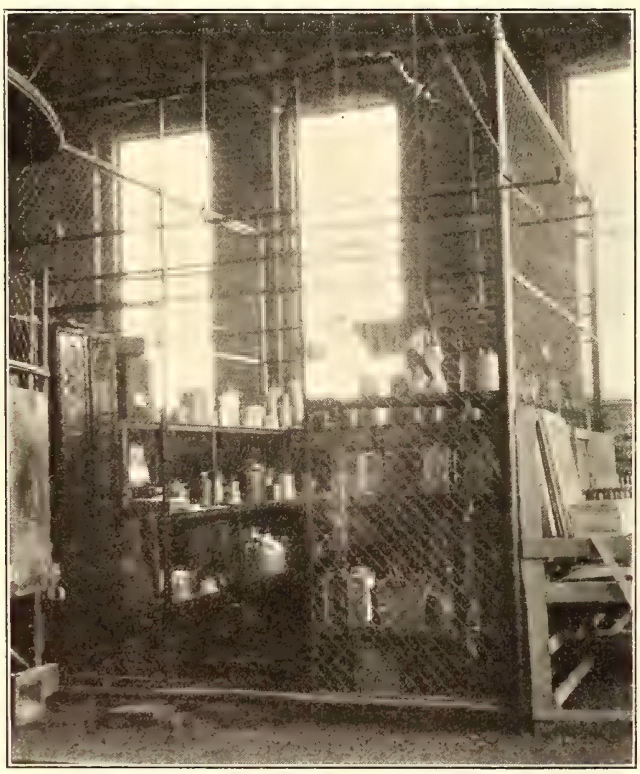
Armature troubles have been considerably reduced by grooving the mica out between the commutator bars. For doing this a special lathe attachment has been gotten up. The tool post in the carrier is replaced by a post carrying a small screw-cutting saw. The saw is held in a vertical shaft having a small pulley at its upper end. The belt driving this pulley is carried around the larger of the cone pulleys and also passes over two guide pulleys, one of which, supported on a long arm under tension of a spring, acts as an idler and keeps the belt at the proper tension through considerable movement of the carriage. After the armature has been turned the grooving device is put in position and the process is carried out by moving the carriage back and forth before the armature is

removed from the lathe. About twenty minutes is required to groove an armature and dress it up.

BABBITING BEARINGS

Babbit for bearings is melted in a Motts gas furnace pot of the type used in newspaper offces for melting type metal. It has been found exceedingly well adapted to the work. Commutator end bearings are babbited by means of the usual type of apparatus, consisting of a mandrel supported in a cast-iron base. One of the illustrations shows the device used in babbiting split bearings. A half mandrel, with ridges for cutting out the oil ways, is bolted on each side of a place supported on a cast-iron base. After two bearing shells have been placed over the half mandrels enclosing shells are clamped over them.

LOCKER AND WASH ROOM FOR OMAHA SHOPMEN



PAINT-MIXING CAGE IN OMAHA SHOPS

THE MILL ROOM

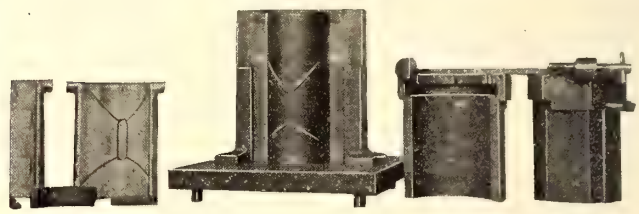
The mill room is provided with a complete equipment of machinery for building cars. The equipment consists of a hollow mortiser, 10-in. Hermance molder, 26-in. planer, universal woodworker, shaper, tenon machine, cut-off and rabbeting machine, combination cut-off and rip saw and a band-saw.

THE PAINT SHOP

At the present time a portion of the paint shop is being used as an erecting shop. Mention has already been made of the arrangement of the sprinklers in this room. Cars are washed in one corner of this shop over a concrete floor which has proper slope for drainage. A portable wire cage serves as a paint mixing room. The cage is 10 ft. x 12 ft. square and the wire is 2-in. mesh. A cage of this type was designed largely because it eliminated the use of wood and thereby reduced the fire hazard.

THE STOREROOM AND OIL STORAGE

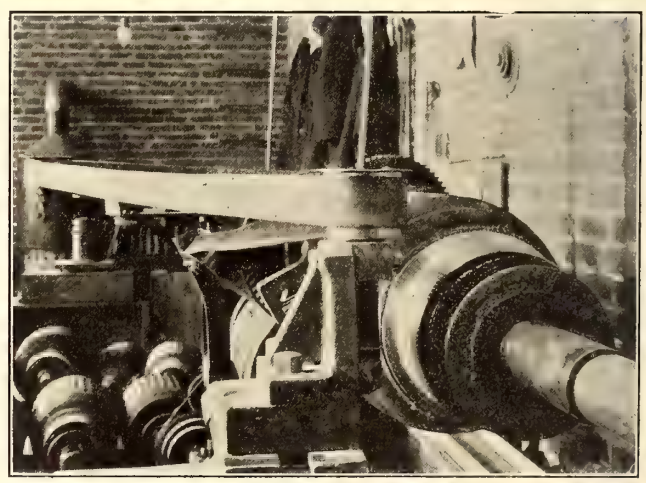
A track extends through the mill room and into the storeroom to facilitate the handling of materials. Below a portion of the storeroom is a fireproof vault for the storage of oil. Bowser oil pumps in the storeroom are piped to the oil tanks below. The gasoline tank is buried in the yard outside the building, but is connected through piping to a pump in the storeroom. There are seven pumps for as many different kinds of oil and paint materials.



DEVICE FOR BABBITING BEARINGS AND BABBITED BEARINGS

WASH ROOMS

The advantage of proper wash room facilities were appreciated, and very few railway car shops are as well equipped with wash basins, lockers and toilets. An illustration shows the arrangement of the twenty-four wash basins, which are supplied with hot and cold water. Each man is furnished with an expanded metal locker.

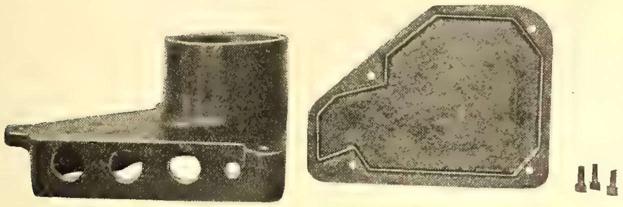


DEVICE FOR GROOVING COMMUTATORS. THE CIRCULAR SAW IS IN THE VERTICAL SHAFT AND AT THE LEVEL OF THE CENTER OF THE ARMATURE SHAFT

MISCELLANEOUS SHOP PRACTICE—CAR CONSTRUCTION

The company has begun the construction of cars and is now building eight of the semi-open type. One of the illustrations show some of these cars under construction.

They are built along the general lines of cars already in service, are 46 ft. 6 ins. long over bumpers, and measure 7 ft. 10½ ins. over sills. A channel bar, which is carried around the ends of the body, reinforces the side sill. A side panel extends up 18 ins. from the floor. The platform timbers are almost completely enclosed in two channel bars, one below and one above each timber. The motors

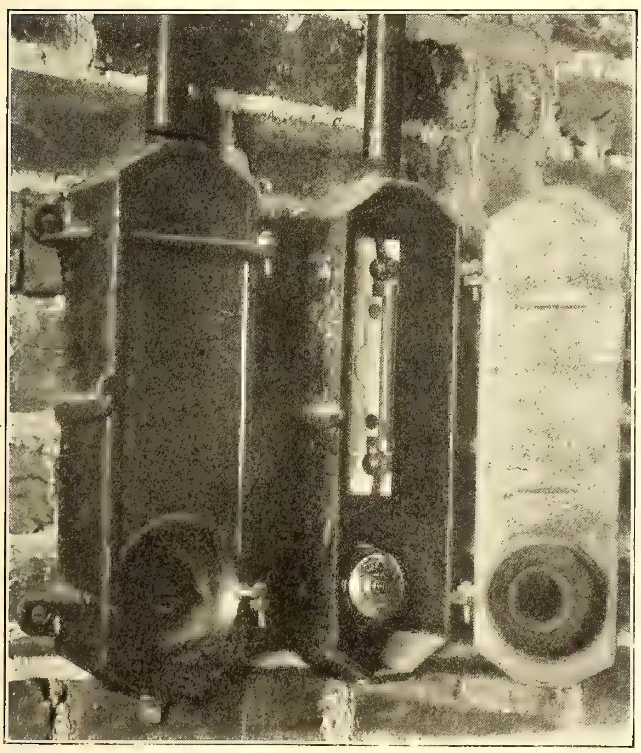


BOX USED AT THE BASE OF THE CONTROLLER, SERVING AS A TERMINAL FOR THE CONDUITS

of the new cars will be used under snow plows during the winter season.

CAR WIRING

All wiring for new cars is carried in conduit and all of the old cars have within the last year been rewired with conduit wiring. The wiring under the cars is especially well installed. One of the illustrations shows a special box in which all the conduits to the controller terminate. This box is bolted underneath the floor directly under the controller. The upper projection enters the controller

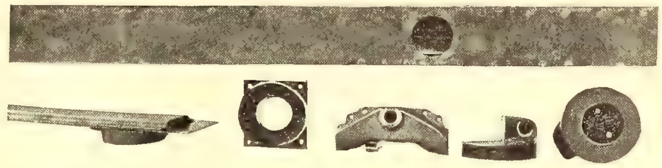


COMBINED FUSE AND SWITCH-BOX EMPLOYED IN WIRING THE OMAHA SHOPS

base and effectually prevents the entrance of water into the controller. At the motors the conduits end in General Electric connection boxes.

The light wiring is also carried in conduit. In many of the old cars the wires for the lights have been put in pipe conduit, carried under molding above the monitor windows and across to the center of the car above the headlining. In the accompanying illustration the cast junction (4) is employed where the branch cross pipe to the center of the car is taken off, that conduit running longitudinally above the monitor windows. The outlet box (5) and (6) brings the wires out of the conduit and into the cluster.

The light wiring of the new cars is being installed in specially constructed conduit (1) and (2). This conduit, built up of No. 14 gage iron, is 9/16 in. high and about



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1 3 4 5 6

SPECIAL BOXES AND CONDUITS USED IN CAR-LIGHT WIRING

4½ ins. wide. The two parts are riveted at intervals of 3 ins. It is run through the center of the car with the flat side against the upper side of the headlining. Outlet boxes (3) are bolted to it at clusters where wires are brought out. In a few old cars this conduit will be placed on the roof of the car and covered with painted canvas.

REPAIRING CURTAINS

The life of old open car curtains is being increased several years by taking the curtains off the roller, turning them upside down and re-hemming them. A special hemming machine has been installed in the shop for this purpose.

CHANGING ARMATURES

When the new shops were first occupied the practice of changing the armatures of and making small repairs on all the cars in this shop was instituted. It was found, however, that the time saved by the better facilities in the new shop was more than lost in the long hauls to and from it, and the practice has been abandoned. Each division shop now changes armature and fields and makes small repairs.

BRAKE-SHOES

The practice of having brake-shoes cast by local foundries has been abandoned and the shoes are purchased from manufacturers. A hard shoe is used for air brakes and a softer one on cars equipped with hand brakes.

SAND BLASTING

Ornamental glass is blasted by a sand blaster in the boiler room, compressed air for which is obtained from the shop air lines.

The shops are under the immediate charge of T. E. Wood, master mechanic, to whom acknowledgment is made for much of the information in this article.

The Rhode Island Company is to build two sub-stations, one, a temporary affair, to be located on Pawtucket Avenue, in East Providence, and the other near the village of Limerock. The East Providence station will be fed from the Manchester Street plant in Providence, and the Limerock building from the main station in Woonsocket. It was found necessary to erect the East Providence station in order to supply the demand of the lines to Boyden Heights, Vanity Fair and Crescent Park. The building at Limerock will be 34½ ft. by 54 ft., of brick with a concrete floor, and will contain two 400-kw rotary converters. The station in East Providence will be of wood and will contain two 400-kw rotary converters.

NEW POWER PLANT OF THE PITTSFIELD ELECTRIC STREET RAILWAY COMPANY

The Pittsfield Electric Street Railway Company, operating about 30 miles of urban and suburban tracks in Pittsfield, Mass., and its vicinity, has nearly completed a new steam-driven power station at a site on Seymour Street near the Housatonic River. The plant is of interest as an example of standard reciprocating engine practice proportioned to the requirements of economical operation in a small system. Pittsfield is an attractive Berkshire city of about 25,000 inhabitants, and besides containing a varied group of manufacturing plants, including the Stanley branch of the General Electric Company, paper, woolen and other mills, it is celebrated as a summer resort and urban center of the entire Berkshire region.

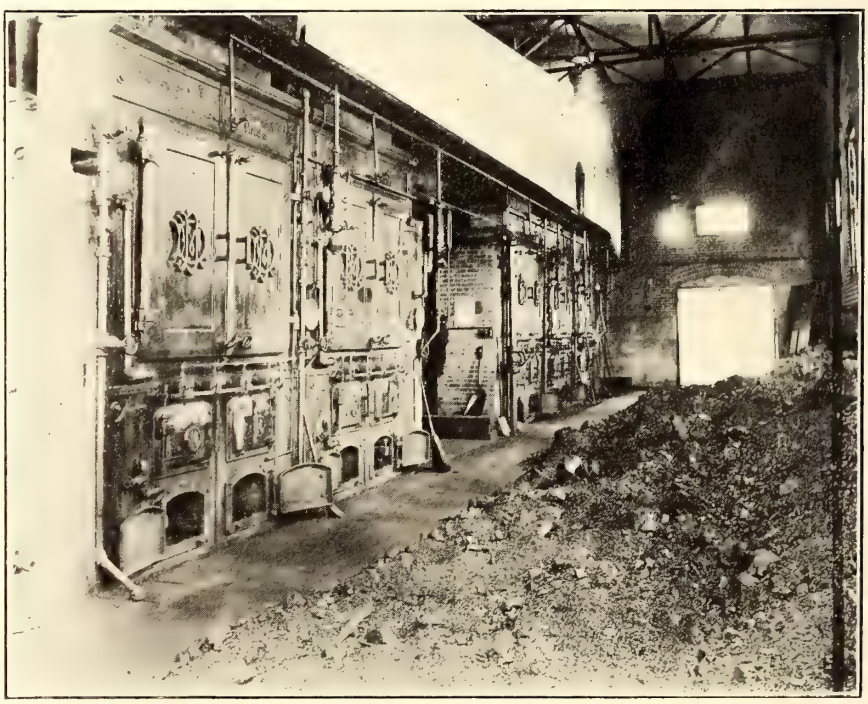
EXTENSION OF THE PITTSFIELD STATION

Previous to the inauguration of service from the new Seymour Street plant, which occurred in February, 1907, nine months after construction began, the company's power was supplied from machines located in the old central station of the Pittsfield Electric Company. These machines were run non-condensing, and the plant was not as near the electrical center of distribution as is the new station. The consulting engineer for the new plant was the late Charles K. Stearns, of Boston.

The new station is a brick and steel structure with the usual type of concrete foundations and a concrete roof with metal reinforcement. It is divided into a boiler room, 80 ft. long and 45 ft. wide, and an engine room, 100 ft. long and 57 ft. wide, with a 12-ft. basement beneath the latter. An 18-in. fire wall separates the boiler and engine rooms. At the Seymour Street side of the plant is erected an Alphonse-Custodis radial brick stack 7 ft. 6 ins. in internal diameter and 150 ft. high above the ground. A ladder was provided for both the inside and the outside of this stack, and this proved to be a great convenience during construction.

The boiler room is practically at the ground level, and it at present contains two batteries aggregating five Dillon boilers rated at 150 hp each. Each boiler has ninety-two 4-in tubes and is of the horizontal return tubular type, operating at 150 lbs. steam pressure. A good grade of soft Pennsylvania coal is at present brought to the plant and fired into the furnaces by hand; ultimately it is planned to bring coal to the station by trolley. Each boiler is equipped with a Climax smoke consumer arranged to operate when the doors are opened for firing. The stack was erected at the end of the boiler room to allow for free expansion of the plant westward in case it becomes necessary. All coal is weighed on special scales before being fired, and the ashes are wheeled by the firemen to the land on the west side of the plant toward the Housatonic River, where they are used for filling in the ground to a level with the boiler room floor. Later it is expected that some sort of coal storage will be effected on the west side of the station, thereby rendering the company less dependent upon the regularity of transportation by the coal cars to the plant. The scales will then be in direct line between the furnaces and the coal pile, so that no return motion of fuel will be necessary. The flue gases from the boilers are carried into a breeching which is supported above the fronts and discharged through a green fuel economizer located at the east end of the room and thence into the stack. The smoke flue is 4 ft. by 8 ft. in full cross section, and the damper arrangements provide for by-passing the economizer when desired. The economizer tube scrapers are motor driven.

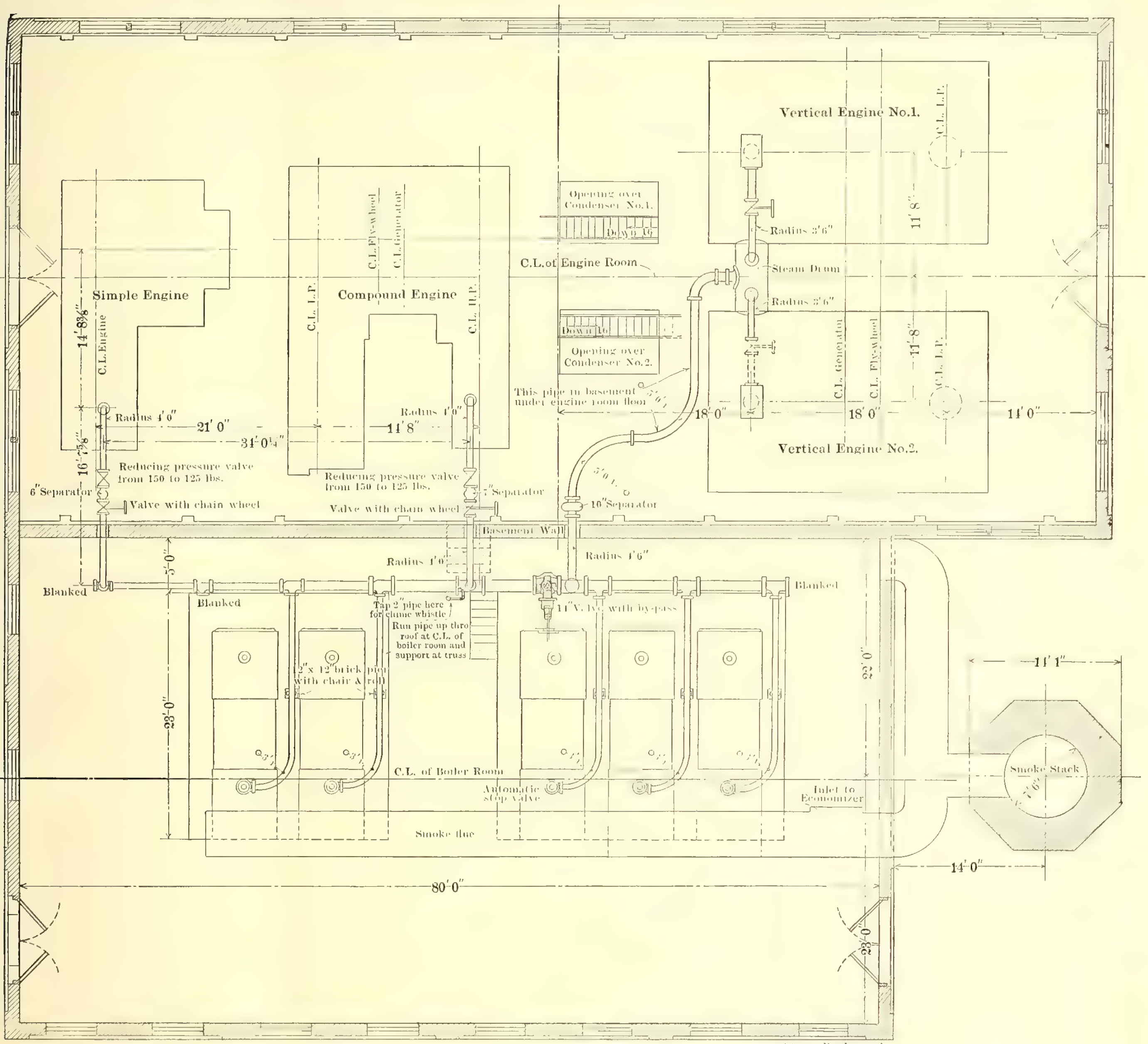
The company is fortunate in being able to draw water, both for condensing and boiler feed purposes, from the Housatonic River, although an emergency connection with the city water service is provided. The river is located about 550 ft. from the power plant, and about 50 ft. west of the plant a circular concrete well, 12 ft. in diameter and 11 ft. deep, has been built to receive water from the river by gravity. A wooden conduit or box tank 3 ft. square in cross section connects the river with the well, 2-in. x 2-in. slots being provided for screens at the outlet of the conduit into the well. From the well two 10-in. pipes lead to the



BOILER ROOM OF THE PITTSFIELD POWER STATION

condenser suctions, the discharge water from the condensers being returned by a single 20-in. pipe to the river below the inlet line. The boiler feed-water is drawn from the well to the feed-pumps by a 4-in. line. Two screen slots were provided so that one will always be in use while the other is being cleaned, and both condenser suction lines are provided with a separate valve operated by a hand wheel on a vertical spindle extending to the top of to facilitate inspection and repairs. The draft in the chimney is controlled by a Spencer automatic damper regulator. A 500-hp Erie City feed-water heater with by-pass is installed in the engine room basement.

Four generating units are installed in the engine room. These aggregate 1600 kw in normal rating. There are two 500-kw, 600-volt General Electric generators, each direct connected to an 18-in. by 36-in by 36-in. Brown-Corliss



PLAN OF MAIN STEAM PIPING IN THE PITTSFIELD POWER STATION

the well. The condenser discharge pipe only extends about 70 ft. from the power house at present, as an arm of the river extends close to the station. The company owns the land extending from the power house to the river, and there is room for indefinite enlargement of the power house in this direction. The boiler room is large enough so that a sixth boiler can be added without extending the building. The feed-pumps consist of two Blake duplex units, 7½ ins. by 4½ ins. by 10 ins. in cylinder dimensions, mounted in a passageway to the engine room between the two batteries of boilers. They are of ample size for the work and run at slow speed. The foundations of the feed-pumps extend 2 ft. 6 ins. above the floor, vertical, cross-compound condensing engine operating at 135 r. p. m. and 150 lbs. steam pressure; a 350-kw, 600-volt General Electric generator direct driven by an 18-in. by 30-in. by 36-in. Knowlson & Kelley horizontal cross compound non-condensing engine, and an 18-in. by 36-in. engine of the same make driving a 250-kw Westinghouse 600-volt, direct-current railway generator. Both these two latter machines run at 120 r. p. m., and it is expected in the future to install a condenser in connection with the larger outfit.

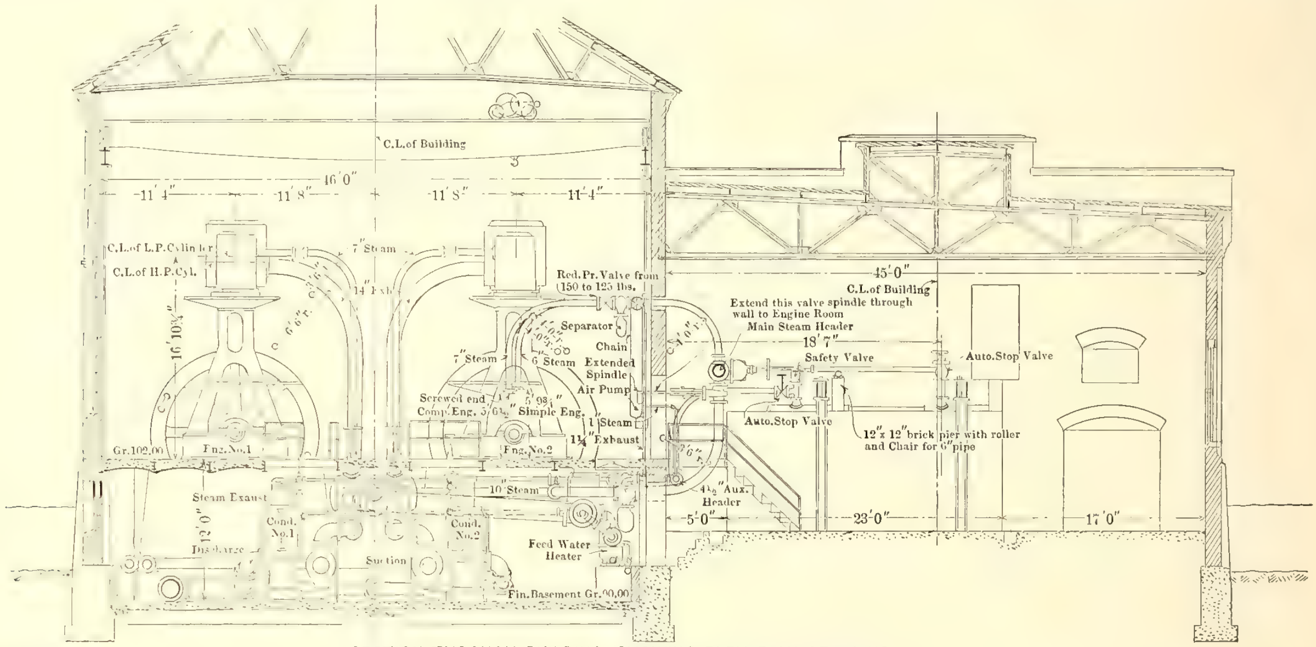
There is also a 15-kw, 225-volt generator in the engine room direct connected to a 7-in. by 7-in. Sturtevant vertical engine whose normal speed is 400 r. p. m. This is used

in lighting the power house, offices and car house, the two latter being located about 1000 ft. from the station at a point on the system passed by all the cars of the company. Three eight-hour shifts run the station, the small Sturtevant unit carrying the lighting load all through the night. A 15-ton Whiting hand-operated crane sweeps the entire engine room, and this was installed during construction to facilitate erection of machinery. On a raised platform about 20 ft. above the engine room floor is located a glass-enclosed office for the chief engineer, F. E. Eckerson. This office is reached by a spiral stairway, and it commands the entire engine room. Telephone service in a sound-proof booth is provided in the engine room.

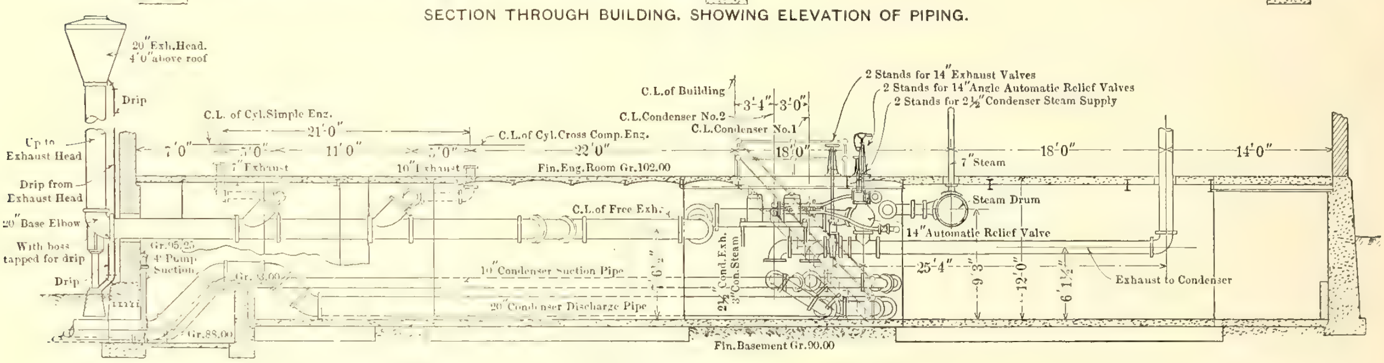
All the main steam piping is equipped with extra heavy fittings. Each boiler delivers live steam into a main header running parallel to the engine room wall through a 6-in. riser with stop valve at each boiler outlet. The main header varies in size from 14 ins. diameter in the center of the boiler room run to 12 ins. at the chimney end and 6 ins. at the west end. The two large vertical engines are fed jointly by a 10-in. steam line which drops down from the boiler room header and runs beneath the engine room floor to a steam drum between the two engine foundations, and from this drum each engine is supplied by a 7-in. steam riser equipped with a stop valve. The two smaller engines were designed for operation at 125 lbs. pressure, and in each of their supply lines, which are taken separately from the boiler room main, are installed a pressure reducing valve and a stop valve operated by a chain from the engine room floor. The larger engine is supplied by a 7-in. steam line and the smaller one by a 6-in. line. Cochrane separators are used in both cases.

The auxiliary steam piping is all extra heavily fitted also, and a special 4½-in. header is located horizontally 4 ft. above the boiler room floor for this service. At the rear of each boiler steam drum is a 4½-in. riser with automatic stop valve connecting with the auxiliary header. The feed-pumps are supplied by a 2-in. branch line with 1½-in. taps for each pump, and the two condensers of the vertical engines are supplied through a 3½-in. main, the direct branches to the air pump steam cylinders being 2½-in. pipes. A Westinghouse steam-driven air compressor is installed on the engine room wall with a reservoir tank in the basement for storage purposes.

The exhaust piping provides for the operation of either or both vertical units non-condensing if desired, with the usual connections for operation with condensers. Each low-pressure cylinder exhausts into a 14-in. pipe leading directly to a Warren vertical twin jet condenser, 12 ins. by 25 ins. by 18 ins. in cylinder dimensions. Branches from the 18-in. exhaust lines from the engines are brought together by a Y and carried to the atmosphere in the shape of a 20-in. outboard exhaust main which terminates in a run of spiral riveted pipe extending to an exhaust head 4 ft. above the roof level. The condenser injection pipes are brought from the well in 10-in. lines, as previously described, and the discharge of each condenser is by a 14-in. line leading into the 20-in. trunk discharge running to



SECTION THROUGH BUILDING. SHOWING ELEVATION OF PIPING.



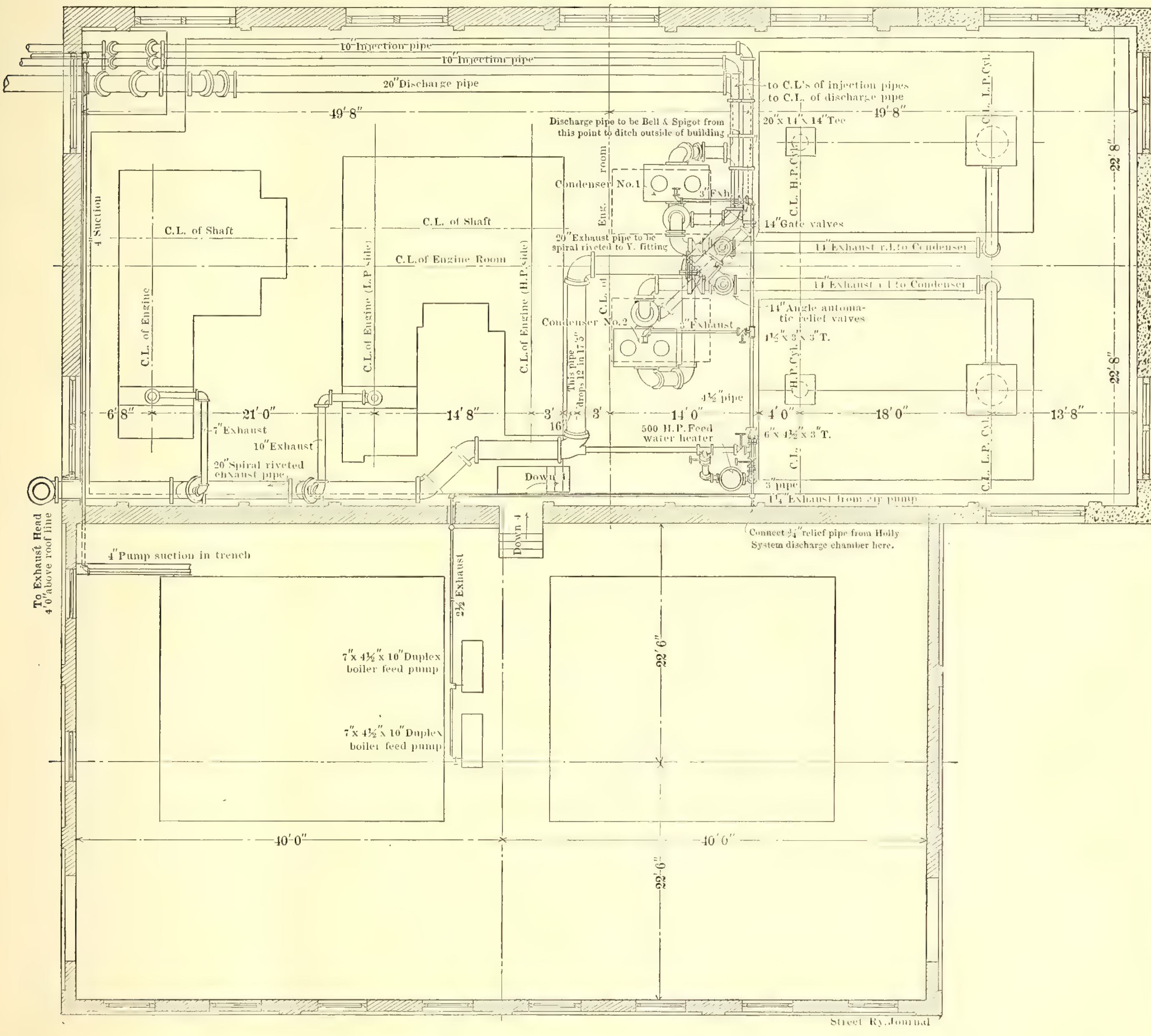
LONGITUDINAL SECTION THROUGH ENGINE ROOM BASEMENT. SHOWING ELEVATION OF PIPING. Street Ry.Journal

ELEVATIONS OF THE MAIN AND EXHAUST STEAM PIPING IN THE PITTSFIELD POWER PLANT

the river. The cross compound Knowlson & Kelley engine discharges into the main outboard exhaust by a 10-in. line beneath the engine room floor, and the smaller engine by a 7-in. exhaust line leading into the main at a point further west.

Both air pump steam cylinders exhaust into 3-in. lines leading into a 6-in. pipe which connects with the Erie City feed-water heater. The Westinghouse air compressor pump also exhausts into this line by a 1½-in. pipe connecting with a 3-in. line which carries the feed-pump exhaust steam into the heater. Each feed-pump exhausts by a 1½-in. pipe into a 2½-in. main, which joins the Westinghouse compressor line above mentioned at a point near the feed-water heater. All high-pressure drips are returned to the boilers by the Holly gravity loop system.

A gravity oiling system is in service in the plant. Oil is delivered to the engine and generator bearings by a pipe system running downward from two 70-gal. storage tanks located at the level of the engine room roof truss. After being used the oil is discharged into a 50-gal. rectangular tank located in the basement. This tank is divided into two compartments by a vertical partition. The lower portion of the tank is filled with water, while the oil discharges through an outlet near the top through an overflow pipe into two cross filters which connect with an 80-gal. storage tank near the floor level in the basement. The water entrained with the oil in the first compartment tank passes downward through one compartment, upward through the next, and out by a waste pipe. A valve in the water outlet controls the rate of flow. From the main storage tank



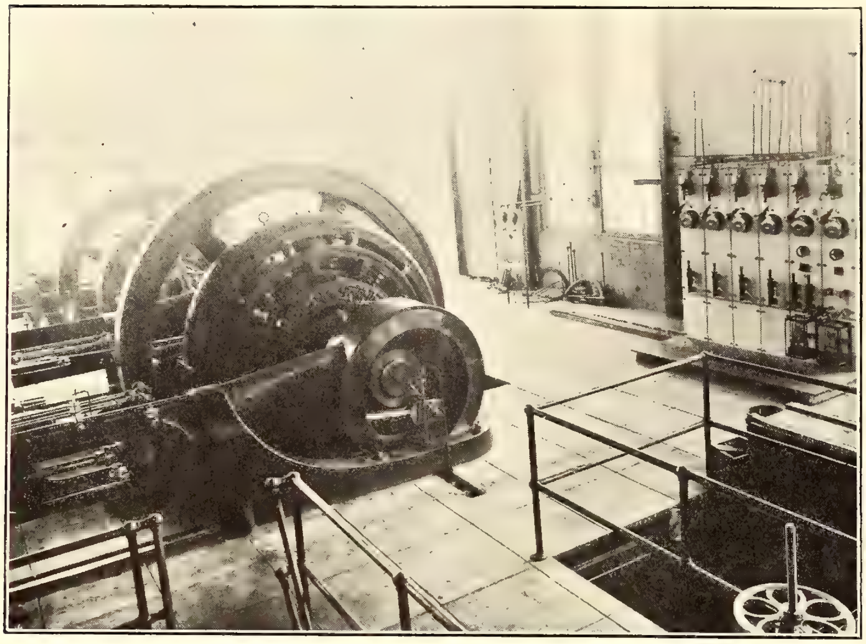
PLAN OF THE EXHAUST PIPING, PITTSFIELD POWER HOUSE

the oil is pumped into the two roof tanks by a 2-in. by 1¼-in. by 2¾-in. Blake duplex oil pump, the lift being about 40 ft. This head gives a very positive flow in the bearings of the engine room machinery. The oiling arrangements were designed by Mr. Eckerson.

The system of electrical distribution is simple in this plant, and when the station is completed the switchboard will consist of twelve panels, including four generator, one totalizing station panel and seven feeder panels.

In addition to the power house construction the company has recently enlarged its car houses and added several four-motor open cars to its list of rolling stock. At

this time of year the schedules are maintained by a minimum of ten cars, about twenty cars being required at times of heavy travel. Cities the size of Pittsfield seldom have a rush-hour traffic of much magnitude, but in this case a heavy flow of travel occurs at morning, noon and night. Usually six extra cars are operated at these periods to take care of the travel to and from the Stanley Works. The company maintains double equipments for winter and summer service, believing that the cost of changing over frequently in the face of the sudden weather fluctuations encountered at an altitude of about 1000 ft. above the sea-level is greater than the expense of maintaining the two sets of motors. Acknowledgments are due to General Manager Dolan for courtesies extended in the preparation of this article.



LOOKING TOWARD THE HORIZONTAL UNITS AND SWITCH BOARD IN THE PITTSFIELD STATION

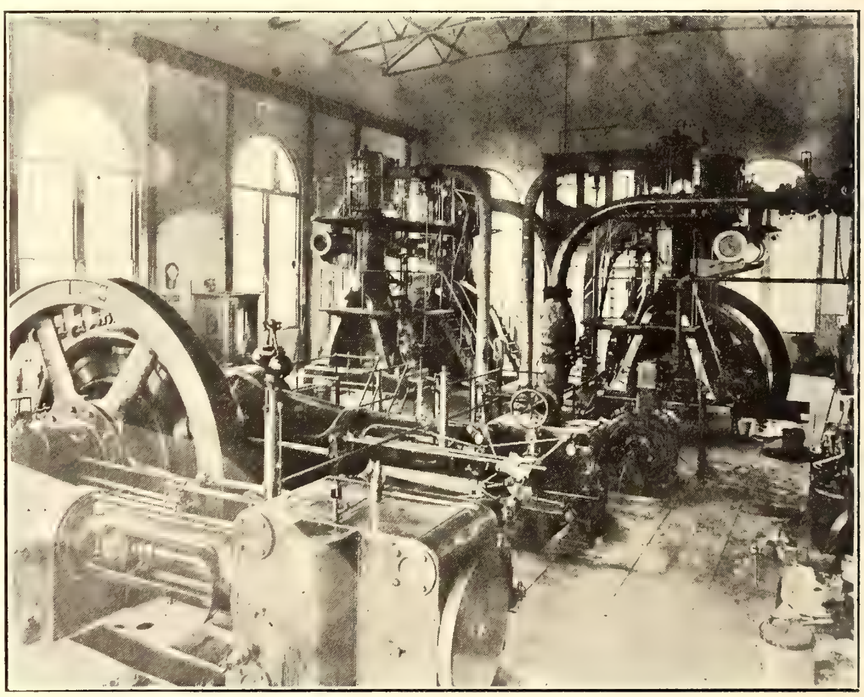
NEW ENGLAND TROLLEY TRIPS

The passenger department of the Boston & Northern and Old Colony Street Railway Companies has issued two separate trolley publications, one covering the Old Colony system and entitled "Trips by Trolley," and the other covering the Boston & Northern and entitled "Trolley Trips." The feature of the publications this year is a large four-colored map of Eastern Massachusetts east of Worcester, Southern New Hampshire and Northern Rhode Island, showing not only all the trolley lines of these companies, but all trolley lines in the district, as well as all the parks, groves and other inland and shore pleasure resorts. The map forms the inside of both folders, while the rest of the space is devoted to schedules showing the routes, distances, fares and mileage on the variou lines. Everything is arranged in as condensed a form as possible. The covers of the two folders are in colors. That of the Boston & Northern shows an attractive view of a cool, rocky shore, a bay with an island in the distance, all on a background of striking red. The Old Colony cover is a delightfully typical little country scene. The books are published for gratuitous distribution.

CONNECTICUT TOURING CARS

Among the innovations which the Consolidated Railway Company will install this summer on its lines will be a tourist car which will leave Waterbury every Sunday at 8 a. m. for New Haven. After traveling over the local lines in New Haven, the car will proceed to Bridgeport, when a tour will be made of that city. The return trip will be made reaching Waterbury at about 9 o'clock in the evening. All the places of interest along the route will be announced to the passengers by a lecturer with a megaphone, after the fashion of the sight-seeing omnibuses or cars in operation in all the large cities.

In connection with the talk of legislation to be passed at the next Assembly in Ohio, President Horace E. Andrews, of the Cleveland Electric Railway Company, has expressed the opinion that a non-partisan State Board should be established, to have charge of the granting of franchises in municipalities. He believes that this power should be vested in a disinterested body of men with power to act after public hearings have been held.



INTERIOR OF THE PITTSFIELD STATION, SHOWING THE VERTICAL ENGINES

The Cincinnati Board has decided to give commissions as private policemen to all traction company inspectors.

CYLINDER LUBRICATION

BY W. H. BOOTH

If oil lubrication is still to be employed in modern steam engines, may not some exception be taken to the very usual custom as to the feeding of valve oil into the steam so that it is thoroughly atomized in the steam? With modern temperatures and superheating, the steam at the entrance to the engine is hotter than it is at any point on its passage through the engine, for as it travels towards the exhaust it becomes gradually colder from loss of heat by radiation, by the heat interchanges between the cylinder and the steam and by the ordinary effect of expansion. The object of lubrication is to produce smooth running. When oil is mixed with steam and the steam is condensed to any extent upon the cylinder surfaces some of the sprayed oil must be deposited upon the surfaces. Since the two main surfaces exposed to steam initially are the face of the piston and the face of the cylinder cover, the greater portion of the deposited oil must arrive at those two surfaces, neither of which stands in any need of any lubrication whatever and both of which will shed the oil upon the bottom of the cylinder if the latter is horizontal. If oil be heated it loses much of its lubricating power. Where steam is worked pretty hot the glazed brick walls of an engine room will sometimes be found varnished over with a sticky brown film. This is mineral oil that has been volatilized by heat and has become deposited by condensation upon the cold walls of glazed brick. It would appear, from a careful consideration of all the facts of lubrication, that the system of feeding oil into the steam is not so correct as has been thought. With wet steam no doubt quite a lot of the oil does get carried to where it is wanted, but even with wet steam it appears very probable that the bulk of the oil simply goes straight through to the condenser.

It would seem that the more correct place to lubricate would be the middle band of the cylinder over which the piston travels, and that oil should be introduced at this zone and caused to spread all round the circumference of the cylinder, the piston carrying it gradually toward the ends, whence it can only escape to the condenser after full use has been made of it. The central part of a cylinder is never exposed in ordinary practice to the highest temperature of the steam. The piston has traveled half the stroke plus its own length before the central band is ever touched by the steam and cut off has almost surely taken place long enough before the exposure of this central part by the moving piston takes place. Expansion has commenced and all superheat has gone, and the piston has a fairly cool oil to sweep onward. Every reason points to the central zone of the cylinder being the place where oil should be introduced. Properly distributed, it should prove as effective as several times the quantity introduced by way of the steam pipe, and, which is of great ultimate advantage, the oil will probably be very much less emulsified and there will be less difficulty in separating it from the condensed steam after it has done its work.

It seems rational on other grounds also to suppose that the middle of the cylinder is the proper place to put in oil. In the first place, it is as far removed as possible from the exhaust port, and must, therefore, travel the maximum distance to get out of the cylinder. It can only travel along the cylinder barrel by virtue of the rubbing to and fro of the piston, that is, by doing the very thing it should do—getting in the way of the piston. When an engine starts, a slight flush of oil will naturally be run in to act as a commencement, after which each successive drop should certainly be very much more efficient than each drop flowing into the steam pipe and carried more or less into the cylinder. Such a method may, in a sense, have served its purpose with saturated steam, especially if we are to believe, as many tell us, that wet steam without oil is a sufficient lubricant alone. But how can it be right to turn the oil into dried, parched superheated steam? It cannot be good practice. In the cylinder the temperature of superheat never extends very far. There is rarely a cylinder without water at the time cut-off is reached, so that the oil entering by the middle of the cylinder cannot be toasted out of its life, for it gets little or no higher in temperature than it would do in a cylinder fed with initially saturated steam.

CORRESPONDENCE

NORTHWESTERN ELEVATED RAILROAD COMPANY

Chicago, Ill., June 14, 1907.

Editors Street Railway Journal:

The accompanying illustration is a copy of the wheel axle and tire assembly record used on this system. To make the indicated record a pair of dividers is required by the

NORTHWESTERN ELEVATED RAILROAD COMPANY.

KIMBALL AVE SHOPS WILSON AVE SHOPS

ASSEMBLY RECORD OF WHEELS, AXLES AND TIRES.

Prefix ⊕ if New
Prefix ⊖ if Remounted.

190

○ WHEELS		○ AXLES		○ TIRES
No.	Pressure	Material	Make	Make
No.	Pressure	Material	Diam. of Jour.	Thick

NOTE.—Shrinkage of Tire to be 1-100" to the foot; 6 13-16" Gear Fit; 30 tons pressure; 3-16" Caliper Drag.
CAST IRON COACH WHEEL CENTER: 4" Wheel Fit; 50 to 60 tons pressure; 9-16" Caliper Drag.
CAST IRON MOTOR CAR WHEEL No. 2 END: 5¾" Wheel Fit; 60 to 70 tons pressure; 13-16" Caliper Drag
CAST STEEL COACH WHEEL: 4" Wheel Fit; 60 to 70 tons pressure; 5-16" Caliper Drag.
CAST STEEL MOTOR CAR WHEEL: 6⅝" Wheel Fit; 75 to 90 tons pressure 7-16" Caliper Drag

CORRECT: Pressman

CORRECT: Foreman.

ASSEMBLY RECORD OF WHEELS, AXLES AND TIRES

lathe hand, the points of which are spaced the amount of the caliper drag required and drawn in a parallel plane to the axle on the wheel or gear seat. One leg of the caliper is held on one of the lines drawn while the other leg of the caliper should just engage the other line.

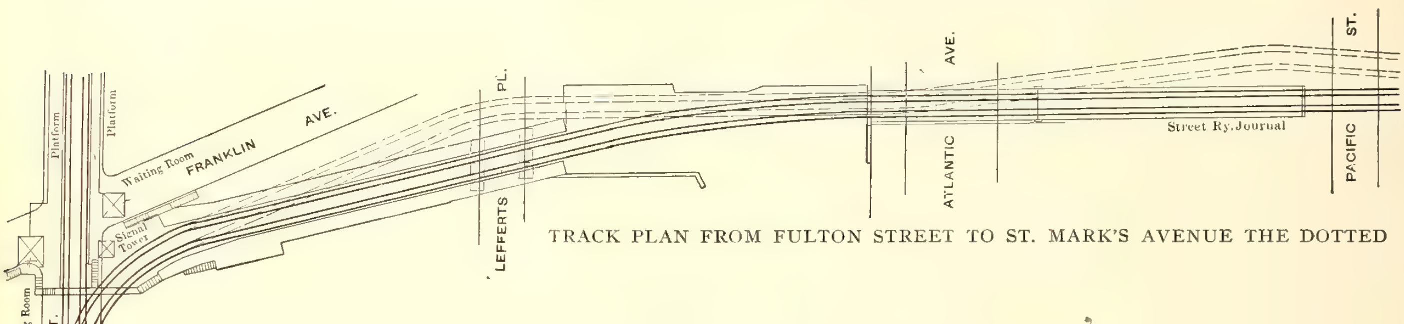
During my experience in making crank-pin fits, etc., I have found this method more reliable than any other.

J. E. Osmer, Master Mechanic.

The formal opening of the new direct express line of the Eastern & South Bethlehem Transit Company took place on Saturday, June 15, when the first car left at 5:35 o'clock a. m. Cars leave every hour until and including 12:35 o'clock a. m. The last car reaches Center Square in the County Seat at 1:30 o'clock a. m., according to schedule. The car leaving Third and New Streets at 11:35 o'clock p. m. is the last to make connections for Butztown. Cars leave Easton for Freemansburg and South Bethlehem on the half hour, except the first car, which will leave Center Square, the starting point, at 5:35 o'clock a. m., and is scheduled to make the run to the Bethlehem Steel Works in 50 minutes.

THE FRANKLIN AVENUE IMPROVEMENT ON THE BRIGHTON BEACH LINE OF THE BROOKLYN RAPID TRANSIT COMPANY

In connection with the other extensive improvements which the Brooklyn Rapid Transit Company is carrying out on its Brighton Beach elevated-surface line, work is now under way on the re-alignment of an elevated section about 1500 ft. long between Fulton Street and St. Marks Avenue. This change will include an entirely new station at Dean Street and the remodeling of the junction station at Fulton Street and Franklin Avenue. The extent of the change will be noted from the general plan, on which the present tracks are shown in broken lines and the future route in full lines. It is evident that the realignment will effect a considerable improvement by removing the two sharp curves now between Fulton and Bergen Streets.

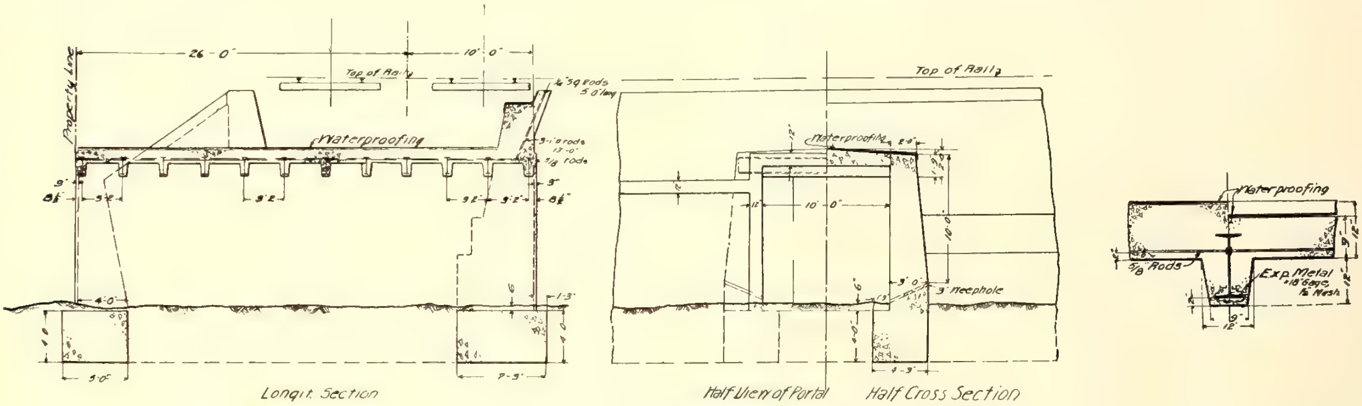


TRACK PLAN FROM FULTON STREET TO ST. MARK'S AVENUE THE DOTTED

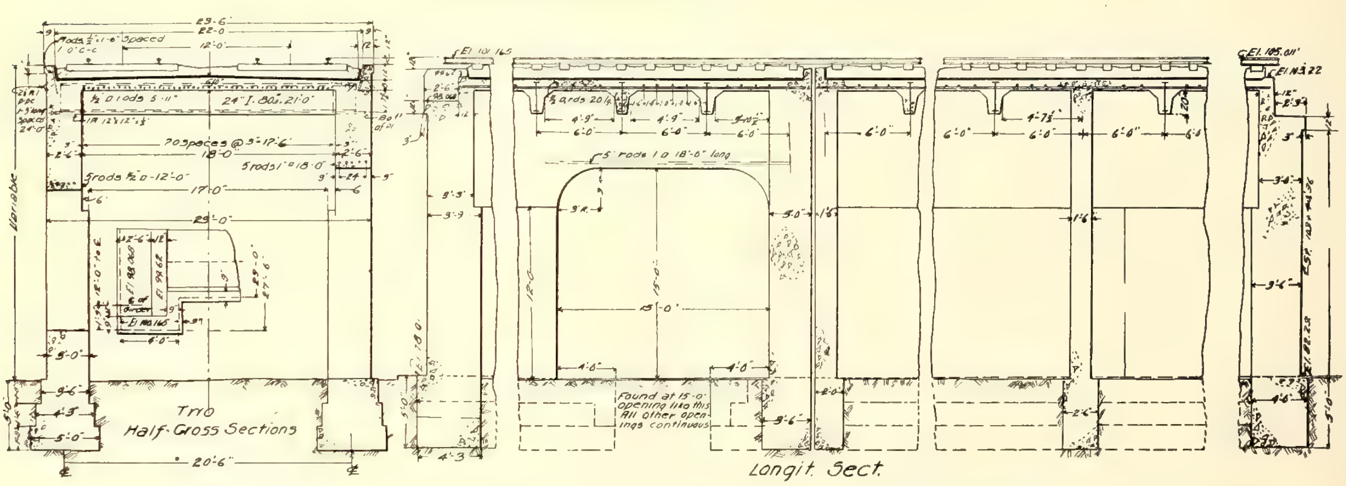
For a time the company was undecided whether the section to be changed should be of the ordinary steel column and girder type or carried over a fill supported by concrete side walls and abutments. The latter method finally was adopted for the greater part of the route and enough property purchased to permit the eventual construction of a four-track line between Park Place and Fulton Street.

CONCRETE WORK

As different conditions as to clearances and loads were encountered in building the retaining walls and overgrade street crossings, a clearer idea of the character of the work may be obtained by treating separately the blocks of this section, starting at Fulton Street.



SPECIAL SECTIONS AND FLOOR DETAIL



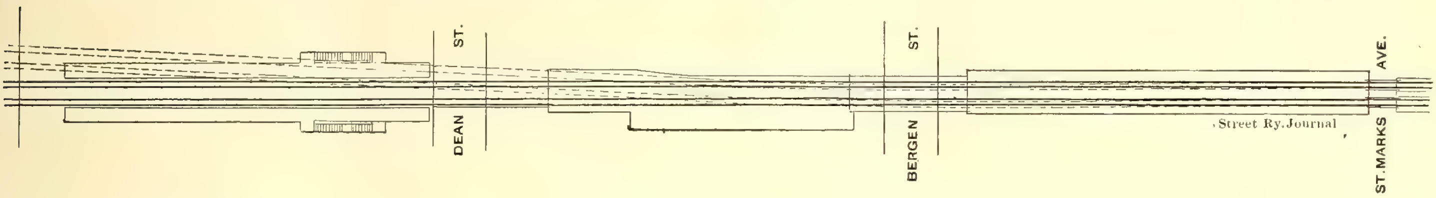
SECTIONS FROM ATLANTIC AVENUE TO PACIFIC STREET, UNDER WHICH SHOPS WILL BE BUILT

Between Fulton Street and Lefferts Place the concrete work embraces two side retaining walls and two abutments. The side walls have a vertical free face and are battered on the rear; the footings are 9 ft. x 6 ft. Both the walls facing Franklin Avenue and the other are 2 ft. wide at the top. The Fulton Street abutment at the Franklin Avenue station is 41 ft. 5 11-16 ins. wide, and the Lefferts Place abutment is of similar section and type, with a total width of 72 ft. 4½ ins. From the Lefferts Place abutment four girders are carried across the street

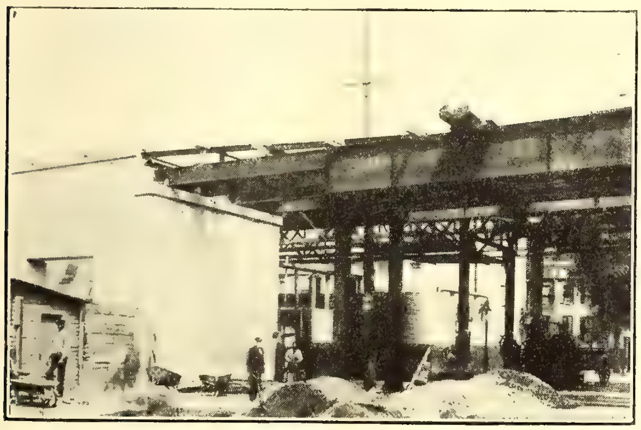
to a corresponding abutment. These girders are carried at intermediate points on both sides by opposite sets of three steel columns carrying an average load of 3100 lbs. per sq. ft.

The concrete work on the following block, Lefferts Place to Atlantic Avenue, consists of a side retaining wall running along Franklin Avenue for the entire length of the block. This is of similar section to the Fulton Street and Lefferts Place wall, which faces Franklin Avenue, and, with a second but shorter and smooth-faced wall, forms the support for the fill on this block. The street abutments do not differ materially from those previously described. The two sets of three columns for supporting the girders at intermediate points are designed for an average load of 3000 lbs. per sq. ft.

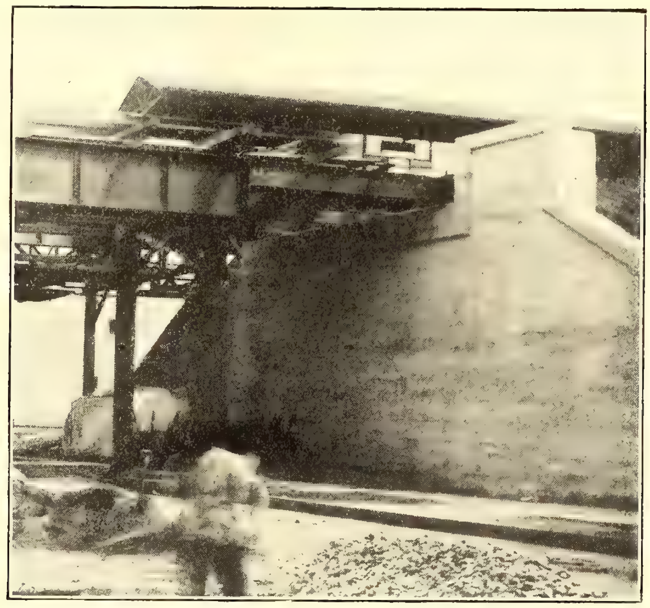
Between Atlantic Avenue and Pacific Street the line crosses the yard of the railroad company used by the superintendent of buildings for lumber storage and a carpenter shop. Through this section the construction assumes the form of a concrete viaduct 23 ft. wide with side walls and a reinforced concrete roof. This, while a part of the track support, also forms a roof for a carpenter shop, blacksmith shop and planing mill. The side walls have doors and windows. Reference to the plan shows that



LINES SHOWING THE OLD ROUTE AND THE FULL LINES, THE NEW ONE



CROSSING AT PACIFIC STREET, SHOWING THE CONCRETE BUILDING TO BE USED FOR SHOP PURPOSES

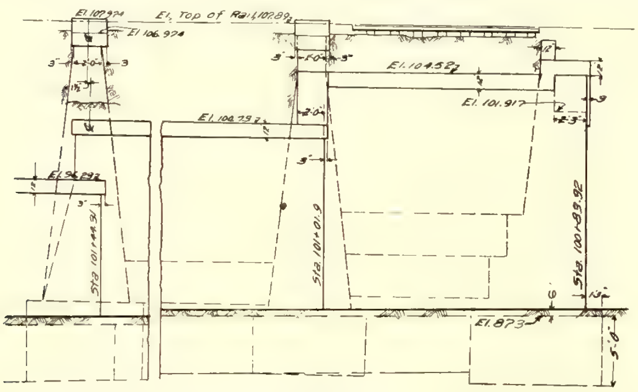


THE PACIFIC STREET END OF THE DEAN STREET STATION, SHOWING AN ABUTMENT

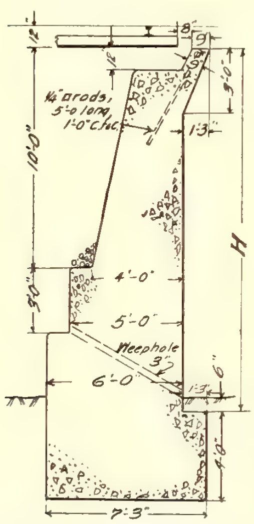
CROSSING AT ST. MARK'S AVENUE, ILLUSTRATING THE USUAL MANNER OF CROSSING THE STREET

the roadbed rests on 80-lb. I-beams laid transversely at intervals of 4 ft. 9 ins. on 12-in. x ½-in. x 12-in. foot-plates bearing in the concrete. The beams have their top and bottom members covered with No. 18 ½-in. mesh expanded metal. The floor is longitudinally reinforced by ½-in. square rods, 20 ft. long, embedded in 10-in. concrete. The crossing over Pacific Street is over the usual abutments and two sets of two columns each carrying 2700 lbs. per sq. ft.

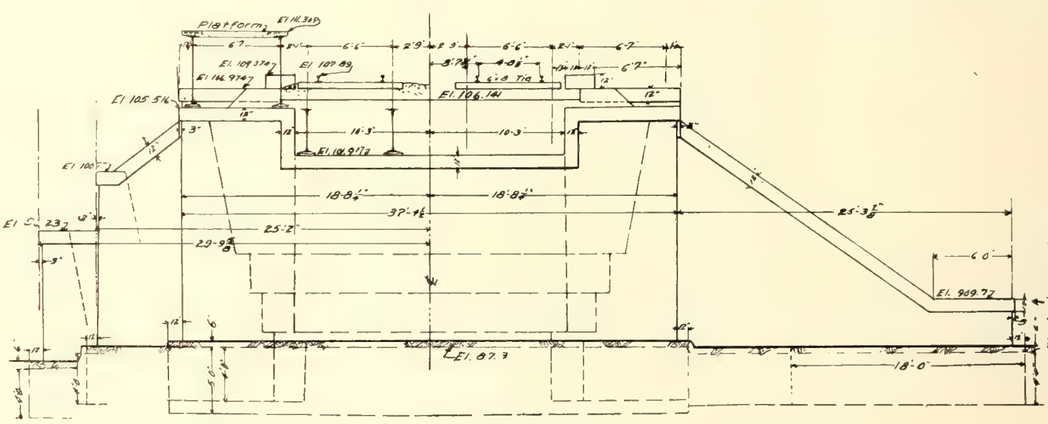
As the block between Pacific and Dean Streets will be occupied by a station, there are, in addition to the usual abutments and retaining walls, three concrete piers on each side of the track for carrying the platform girders. These piers will be spaced 42 ft. 6½ ins., and will have footings 6 ft. x 8 ft. 1 in. carried to depths varying with the condition of the soil. Cuts on this page illustrate the north and west side elevations of the abutment on Dean Street. The views on page 1107 are of particular interest as showing the construction at platforms and the position of the four through-girder spans over Dean Street. These girders are also supported by two pairs of intermediate columns designed for 3600 lbs. per sq. ft.



PART ELEVATION OF RETAINING WALL ON WEST SIDE OF DEAN STREET ABUTMENT

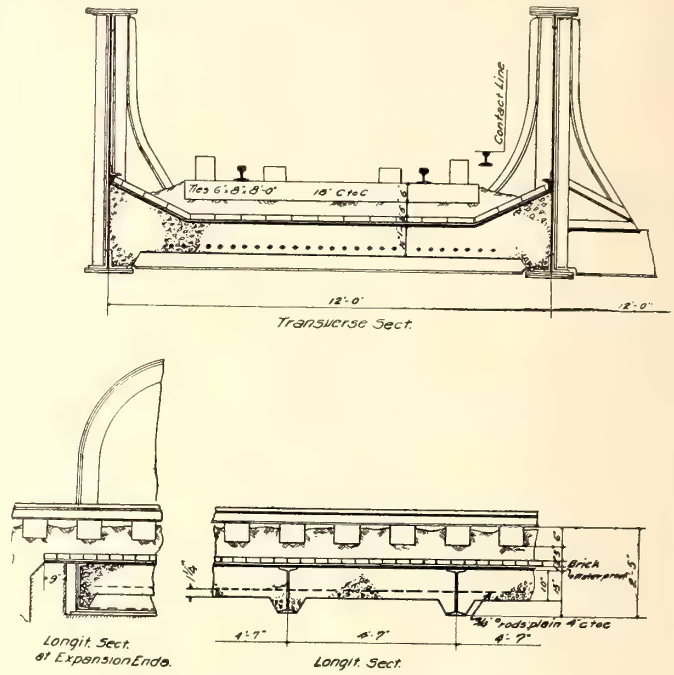


DETAIL OF SPECIAL SECTION OF RETAINING WALL BETWEEN DEAN AND BERGEN STREETS



ELEVATION OF DEAN STREET ABUTMENT ON THE NORTH SIDE

The section between Dean and Bergen Streets is completely enclosed by the retaining walls and abutments, but owing to special conditions there are several variations in construction. In the first place, it was necessary to allow for the construction of a 10-ft. x 10-ft. driveway under the middle of this division for wagons from a brewery located alongside the property. Over this tunnel the roadbed is carried on 15-in., 42-lb. I-beams embedded in concrete at intervals of 3 ft. 2 ins. and covered at the base with No. 18 gage ½-in. mesh expanded metal. There is also a reinforcement of ⅝-in. rods. Another special feature is the pipe duct for the brewery built in the structure. This is 3 ft. wide and 3 ft. 2 ins. high. The roof of this duct is of 6-in. concrete reinforced with ⅜-in. square rods. The type of retaining wall used alongside the brewery is particularly interesting, as the clearance was so small along this property that to permit the passage of cars on the adjacent freight tracks it was necessary to build a sloping top. Since a straight concrete construction would be too weak to carry the load, this portion is reinforced with 5-ft. ¼-in. square rods spaced every 12 ins.



TYPICAL FLOOR FOR THROUGH SPANS

The retaining walls and abutments between Bergen Street and St. Marks Avenue form a perfect rectangle. In general, they are like the standard walls already mentioned, with footings 7 ft. 9 ins. x 7 ft. 3 ins.

ROADBED

Roadbed sections on through and deck spans also are shown on this page. The rails rest directly on wood ties laid in rock ballast. The latter, in turn, is placed on a single layer of 2-in. brick with grouted joints, which covers 1-in. waterproofing laid on the reinforced concrete floor. A similar construction is used at the Dean Street station platform.

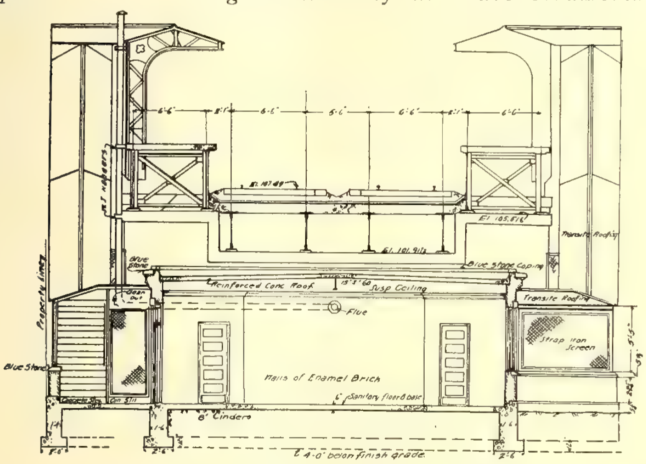
DRAINAGE

From the cut on page 1104, showing the construction betwen Atlantic Avenue and Pacific Street, it will be noted that the roadbed is drained through a depression in the concrete, which throws off water through 2½-inch wrought-iron pipes set at intervals of 24 ft. In general, the walls are drained through 3-in. weepholes pierced at various intervals.

THE DEAN STREET STATION

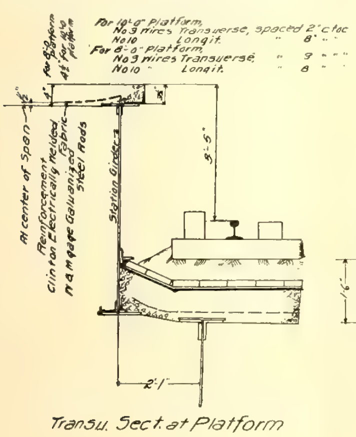
The station at Dean Street will be built at the street level with a stairway leading to each side platform. The exterior of the building will be of hard-burned brick with bluestone copings, and the interior will be faced with white enameled brick.

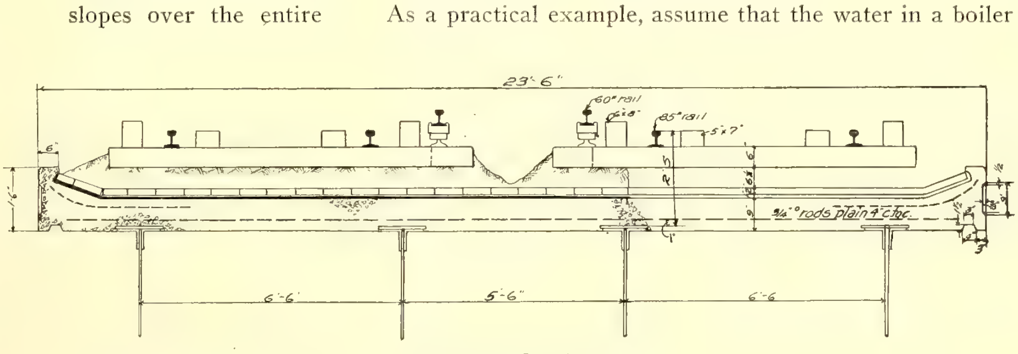
Each of the two platforms will be carried on 50-ft. span girders resting directly on the concrete piers forming a part of the retaining walls. They will have ornamental



SECTION OF DEAN STREET STATION

iron paneled fences, and the platform floor will be of reinforced concrete. The innovation in the platform fences is that their sheet-iron panels are constructed to the exact size of standard advertising posters, thereby eliminating the unsightly advertising boards so commonly used on elevated station platforms. The canopy is constructed of steel posts with a single column on the outside of the platform. The top slopes over the entire canopy roof, which, like the station building and stairway roofs, is covered with Johns-Manville transite.





TRANSVERSE SECTIONS OF FLOORING ON DECK SPANS

The station building is furnished with the usual ticket office, turnstile and news stand. The toilet accommodations are excellent, porcelain closets being used with nickel-plated pipes for the exposed fittings. To add to the general healthfulness, the floor of the building is of non-absorbent material throughout. The entire installation, including the stairways, is lighted by series incandescent lamps on the 600-volt railway circuit.

BOILER EFFICIENCY

Experiments now being conducted by the boiler division of the United States Geological Survey fuel-testing plant at St. Louis, Mo., on the nature of boiler efficiencies have suggested that stationary boilers ought to be made to do ten to twenty times as much work per unit of heating surface as they do now. This great increase in capacity is to be obtained by subdividing the heating surface and water streams more finely, by allowing less restriction of the water inside the boilers and by using high forced and induced draft to put a large mass of gases through the boiler at a very high speed.

Up to the present time there have been only vague ideas among engineers as to what factors influenced the efficiency of the steam boiler portion of the steam generator apparatus so as to cause it to absorb more or less of the heat generated by the combustion. John Perry, a distinguished mechanical and electrical engineer of England, went into the subject mathematically a few years ago and set forth general conclusions tentatively in his book on the "Steam Engine and Gas and Oil Engines."

About a year ago the government testing plant took up the mathematical investigation of the theory of the steam boiler and of heat absorption and extended Mr. Perry's theory somewhat. For some weeks past Walter T. Ray, assistant engineer, acting under the supervision of Prof. L. P. Breckenridge, engineer-in-charge of the boiler division, has been conducting a series of experiments on small multi-tubular boilers dimensioned as to enable the theory to be verified, or modified, or refuted. The boilers are fed with air heated electrically. Mr. Perry's theory states that modifying conditions being omitted from consideration, every boiler will always absorb by convection from the gases passing through it the same percentage of heat which could possibly be absorbed by any boiler containing water at a given steam temperature. This efficiency is, therefore, independent of the temperature of the entering gases and of the amount of gases flowing through the boiler. Of course, it must be understood that the above statement of the theory is slightly subject to modification even theoretically and more so in practice.

As a practical example, assume that the water in a boiler circulates with entire freedom, which is an unwarranted assumption, and that its temperature is 300 degs. F.; let the gases enter the boiler at 1300 degs. F., then the difference between the two is 1000 degs. F., and consequently it would be possible for a boiler infinitely long to reduce the temperature of the gases passing through it to 300 degs. F. Let us assume, however, that the gases leave the boiler at 500 degs. F., which is 200 degs. above steam temperature. The efficiency of the boiler then is 80 per cent, because it has reduced the temperature 800 degs. out of a

possible reduction of one thousand degrees Fahrenheit.

If the same boiler be supplied with gases at 2300 degs. F., the gases enter the boiler at 2000 degs. F. above steam temperature. Mr. Perry's theory states that this particular boiler will reduce these gases 80 per cent as much in temperature as would a boiler infinitely long, that is, to 400 degs. above steam temperature, which is 20 per cent of 2000 degs., or to 700 degs. F. It will be noticed that the mass of gases does not enter into consideration at all.

This surprising deduction is being accurately verified by the aforementioned division of the Survey, from which it is found, when keeping other conditions the same and when keeping the initial temperature of the gases constant, that the final temperature of the air remains the same whatever the amount of air sent through the boiler per second. So far the upper limit has not been reached with tubes clean inside and out, although the rate of evaporation has already been pushed up to many times that obtained even in locomotive practice.

Perry's theory takes into consideration four fundamental features affecting heat absorption at any point of the heating surface:

First. Temperature difference between the gases outside any portion of the boiler tube and the water inside.

Second. The number of molecules per cubic inch in the gases outside the boiler tube.

Third. The specific heat of the gases at constant pressure.

Fourth. The velocity of the gases parallel to the heating surface.

Of the four above factors, only the first has usually been considered. It will be readily seen that if we increase the temperature of the gases we decrease the number of molecules beating against any square inch of tube heating surface, and thus the second factor largely neutralizes the first, especially at high furnace temperatures.

The third factor can be taken as constant equal to 0.24.

The fourth factor is the new and surprising one. Mr. Perry considers that a high velocity of gases parallel to the heating surface scrubs off more or less of the dense film of gases adhering to the metal surface, which film of gases has already become cold by proximity to the metal. The higher the velocity of gases the more the scrubbing effect, and consequently the greater the amount of heat transmitted. This theory necessarily assumes that the ability of the metal to transmit heat is practically infinite, and when we consider that we ordinarily never put through a boiler tube more than 1/1000 of heat it could possibly carry, it will be realized that this assumption is warranted.

Mr. Perry's theory and the Survey's verification of it will result in placing the steam boiler on a fairly secure mathematical basis, the same as generators and motors are now on. Thus far the experiments check out the theory excellently. The theory and results will be embodied in a special bulletin to be published in two or three months, to be followed by later bulletins as the work proceeds.

REPORT FROM RIO DE JANEIRO

The Rio de Janeiro Tramway, Light & Power Company, in its first annual report, which is for the year ending Dec. 31, 1906, shows gross earnings of $5,575,000 and operating expenses $4,010,000, leaving the net profits at $1,565,000. The earnings of the first three months of 1907 are at the rate of $5,583,748 of gross earnings, $3,775,000 of working expenses, and $1,808,748 of net earnings.

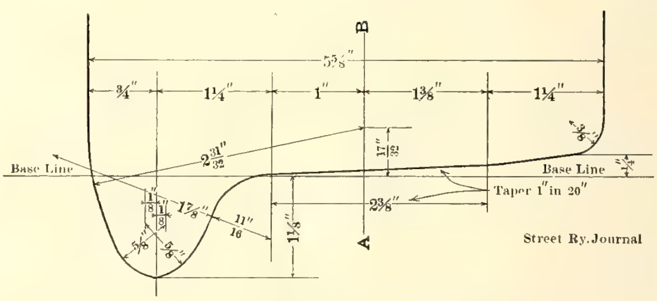
NEW M. C. B. WHEEL STANDARD

The report of the standing committee of the Master Car Builders' Association on cast-iron wheels rendered at the Atlantic City convention on June 18 was in favor of the modified section suggested at the last convention. This section differs, so far as the flange and tread are concerned, from that formerly used, in three particulars, viz.: (1) the main coning of the tread has been increased to a taper of 1 in. in 20 ins., the coning on the outside 1¼ ins. of the wheel remaining the same as before; (2) the thickness of the flange has been increased ⅛ in.; (3) the radius of the throat has been increased 1/16 in.

The committee stated that the new section has the endorsement of a committee representing the car wheel makers of the United States, the personnel of which is as follows:

C. A. Lindstrom, Pennsylvania and Central Car Wheel Companies.
S. H. Blewitt, American Car & Foundry Company.
W. C. Dickerman, American Car & Foundry Company.
A. G. Wellington, Maryland Car Wheel Works.
G. P. Rhodes, National Car Wheel Company.
Rudolph Ortmann, Griffin Wheel Company.
Thomas Griffin, Griffin Wheel Company.
W. W. Lobdell, Lobdell Car Wheel Company.
J. W. Nute, St. Louis Car Wheel Works.
P. H. Griffin, chairman, Wheel Makers' Committee, New York Car Wheel Company.

Joint meetings were held by the two committees during February and April, 1907, at New York City. The committee recommends the diameter of chill molds for 33-in.



SECTION (HALF SIZE) OF NEW M. C. B. STANDARD WHEEL

wheels to be 33½ ins., and that for 30-in. wheels to be 30⅜ ins., measured on the line A B (see illustration).

At the meeting on June 18, A. W. Gibbs, of the Pennsylvania Railroad, said that in 1904 his company had increased the thickness of its flanges to 1⅛ ins., which is above the M. C. B. standard, and in 1903 it began the use of the coned tread. The number of failed flanges was much less than formerly. Several members referred to the failure of wheels due to the development of a seam in the throat of the flange. This was not attributed to blows which the flange received, but to the peening effect caused by the rails, and one member inquired whether it would not be desirable to increase the radius of the throat still further. Mr. Gartsang, of the committee, replied that this radius had already been increased 1/16 in. from the old dimension, and that the flange had been increased a thickness of an eighth of an inch. These changes were about as far as the committee felt was required at the present time, although some of the prominent railroads are using a throat of ¾-in. radius.

It was decided to adopt the report of the committee and that it be referred to a letter ballot. The new wheels will be marked "M. C. B., 1907."

MOTOR CARS FOR LIGHT PASSENGER SERVICE

At the Atlantic City Convention of the American Railway Master Mechanics' Association, the committee on the "Development of Motor Cars for Light Passenger Service" presented a series of statements on the principal self-propelled cars used in this country and abroad. The report opened with a reference to the Union Pacific Company's gasoline motor cars, described in W. R. McKeen, Jr.'s, paper read before the New York Railroad Club on April 19 and published in the STREET RAILWAY JOURNAL of April 27, 1907. The only other American gasoline motor car with mechanical transmission mentioned is the "Sunny Brook," built recently at Indianapolis for service in Yellowstone Park. This car has a four-cylinder gasoline motor with 6-in. x 6-in. cylinders, the engine developing 50 hp at 700 r. p. m. The vehicle is built like a street car and weighs 30,000 lbs. The maximum speed claimed is 35 miles an hour.

The gasoline motor cars with electric transmission discussed in the report are the Strang, St. Joseph Valley and the second Delaware & Hudson car built by the General Electric Company. The Strang cars were described in the STREET RAILWAY JOURNAL of March 3, 1906, and Aug. 18, 1906, and three are now in regular service between Kansas City and Olathe, the first for over a year and the second and third between six and seven months. It is claimed that the gasoline consumption is but 0.45 gal. of gasoline per car-mile for 60,000 miles. The St. Joseph Valley Traction Company's car was described in the STREET RAILWAY JOURNAL of April 8, 1905, but the equipment was destroyed by fire within the past two months. The service of this car consisted in hauling one to three trailers three round trips a day over a line 11½ miles long. The half trip was made in 35 minutes, with four stops, and the heaviest grade did not exceed 1½ per cent. It is stated that the fuel consumption with one trailer was 0.75 gals. per mile. The General Electric Company's new car is said to be a considerable improvement over the original Delaware & Hudson car. The equipment will consist of an eight-cylinder gasoline motor of 150 to 175 hp, direct connected to an interpole 90-kw generator with a 3½-kw exciter to excite the main generator fields and effect control by varying the voltage. There are also two 65-hp motors, one on each truck. The report on American cars concluded with a reference to the steam motor car of the Canadian Pacific Railway, in operation all last summer between Montreal and Vaudreuil, a distance of 24 miles, giving three round trips per day, including twelve stops. When the car was first placed in service 1.8 gals. of crude oil were consumed per mile, but this was reduced later to 1.6 gals. No other statistics of operating cost were given.

The only foreign gasoline motor car with mechanical transmission discussed in the report is the German Daimler car, which is used on the Wurtemburg State Railways, the Swiss Federal Railways and other lines. It is only 33 ft. long and seats thirty-six. Power from the 30-hp engine is transmitted from the four-cylinder motor through a leather-faced cone friction clutch and a sliding gear transmission to one of the axles.

The report also takes up the gasoline motor cars with electric transmission operated in England by the Great Northern Railway and in Hungary by the Arad & Csnadar Railway. Operating statistics on these cars were contributed by H. G. Chatain in the discussion on Mr. McKeen's paper. Mr. Chatain also gave similar statistics on the steam motor car of the Great Western Railway of England and on the Paris-Orleans road, where the Purrey system is used. The other foreign cars mentioned in the report are those built by the Taff-Vale Railway and the Lancashire & Yorkshire Railway, of England; the Ganz Company, of Hungary; the Serpollet car, and the Komarek car. The Taff-Vale cars have a total length of 70 ft., seat forty-three, and weigh 42 tons. In general, the cars resemble those of the Great Western Railway, the chief difference being in the construction of the boiler. The car is capable of running 35 miles an hour, and will ascend a 2½ per cent grade at 20 miles an hour. The Lancashire & Yorkshire cars are similar to the Taff-Vale cars. The Ganz cars have been described several times in these columns. The Serpollet cars differ from the Purrey and Ganz types chiefly in that the boiler is of the flush type and petroleum is generally used as fuel. They are used on the Paris-Lyons-Mediterranean Railway, where they are stated to have been rather unsatisfactory because of tube troubles attending the high degree of superheat. The Komarek car is used to some extent by the Austrian State Railways. It is capable of running at 25 miles an hour while hauling trailers comprising a total of 50 tons. The operating cost is given at 5 cents per train-mile, exclusive of the guards' pay, with coal $3.25 per ton. On a mileage basis, the cost is as follows: Coal, 0.0253; oil, 0.0014; labor, 0.0046; maintenance of material, 0.0011; driver, 0.0116, making a total of 0.0484 cent. The car is 51 ft. long, seats thirty-five persons and weighs empty 20 tons. The length of the boiler and fuel compartment is 10 ft., coal capacity 1100 tons, water capacity 420 gals. The motor is of the two-cylinder, cross-compound type.

The conclusions of the committee are that there is a field for the rail motor car, its extent being now limited only by the development of motor car power equipment. Steam has always possessed the distinctive advantage of flexibility of control, as well as reliability, but the internal combustion motor within certain defined limits of size has developed to that stage of excellence where it partakes of these advantages. It is probable that both types of power equipment will have their distinctive fields, depending upon the availability of the fuel.

SHOP ADDITIONS AND PARK IMPROVEMENTS AT MOBILE

A new storage barn, 225 ft. x 47 ft., is being completed by the Mobile Light & Railroad Company. The barn is of fireproof construction with brick walls and concrete roof and rolling steel doors. It is divided into two compartments, each containing two tracks. To the repair shops adjacent is being built an addition, 55 ft. x 60 ft., which will be used largely for machine tools and a formerly open space between two buildings, 30 ft. x 75 ft., is being roofed over for utilization by the shop department.

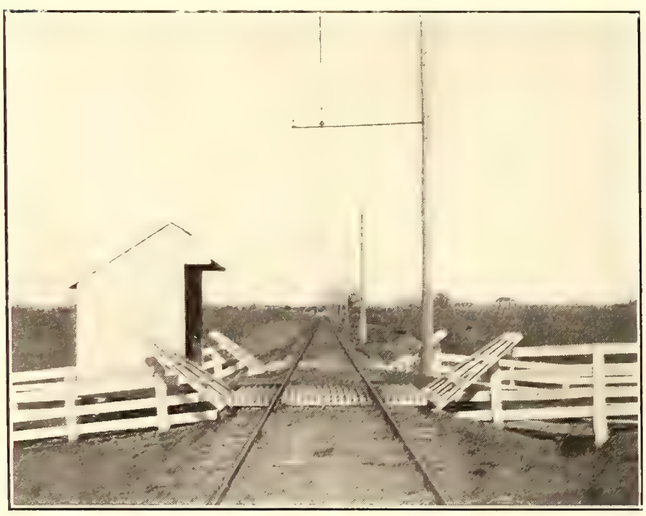
At Monroe Park the Mobile Light & Railroad Company is building a pier 1400 ft. out into Mobile Bay. The pier will terminate in a promenade 150 ft. square.

A combination car storage building and picnic pavilion has recently been erected. The building, which is provided with a concrete floor and latticed sides, is intended for the storage of cars during the winter. During the park season, however, it is utilized by club and Sunday school picnic parties, and it serves as a shelter in the event of showers. A new band stand and a refreshment stand have also been built.

THE OSKALOOSA-BEACON DIVISION OF THE OSKALOOSA-BUXTON ELECTRIC RAILWAY COMPANY, IOWA

The interurban line between Oskaloosa and Buxton, Ia., has been completed and is being operated to Beacon, a town of about 300 people located 3 miles south west of Oskaloosa. This short road has the distinction of being the first road in Iowa built with catenary construction. When the line is extended it is the intention to operate it with alternating current from a power house in Oskaloosa. The ultimate terminal of the road, Buxton, is a coal-mining town of about 6000 people, 18 miles distant from Oskaloosa, and it is owned outright by the company operating the mines in the vicinity. The proposed road will also pass through Lakonta and White City, two smaller mining towns, and several small mining camps.

STANDARD CAR OF THE BUXTON ELECTRIC RAILWAY COMPANY



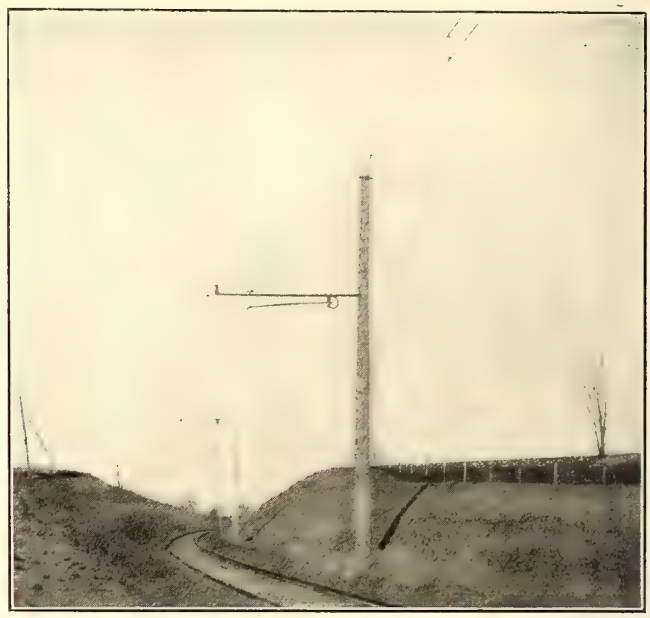
TYPE OF SHELTERS ERECTED AT ALL ROAD CROSSINGS ON THE OSKALOOSA-BEACON LINE OF THE OSKALOOSA & BUXTON ELECTRIC RAILWAY COMPANY

The Oskaloosa-Beacon line is built on private right of way 70 ft. wide. The roadbed, which is ballasted with cinders, contains one grade of about 2½ per cent 200 ft. long, but other than this the grades are all under 1 per cent. There is one 20-ft. cut on the line and several fills 10 ft. to 20 ft. high.

The rails are 70 lbs. and are in 30-ft. lengths. Cedar poles, 35 ft. long and spaced 100 ft. apart, carry only the bracket supporting the messenger. The poles are, however, of sufficient height to carry the high-tension wires to be installed when the line is extended. The trolley brackets are of angle iron with cast heads, into which the rods supporting the end are screwed. The trolley is of No. 000 grooved wire. It is placed 18 ft. above the rail and is suspended to the messenger at intervals of 10 ft. On curves the trolley is held over the center of the track by a steady strain at each bracket. The inner end of the steady strain is secured by a special insulator, which, in turn, is clamped to the angle iron bracket by a clevis bolt.

Power for the line is obtained from the power house of the Oskaloosa Traction & Light Company, in which two 200-kw units are installed. A single No. 0000 feeder extends from the power house to about the central point of the line.

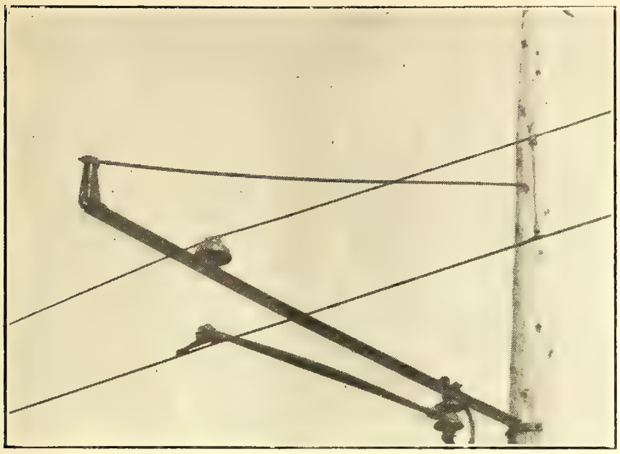
A forty-minute schedule is maintained with one car. The car is 41 ft. over bumpers, and is equipped with two Westinghouse 101 B motors and National air brakes. One extra car of smaller size is provided. The equipment is cared for in the shops of the Oskaloosa Traction & Light Company. The cash fare between terminii is 10 cents and the round-trip fare 15 cents.



CATENARY CONSTRUCTION ON CURVES ALONG THE OSKALOOSA-BEACON LINE

The road is operated in connection with the Oskaloosa Traction & Light Company, of which H. W. Garner is general manager. The construction work was done by the Engineering Construction & Securities Company, of Chicago.

The accompanying illustrations give a good idea of the interesting features of the system. Although the road has



ANGLE-IRON BRACKET AND STEADY BRACE ON THE OSKALOOSA-BEACON LINE

been in operation but a few months, its earnings have been such as to encourage extending it as originally planned.

OPENING OF THE ELECTRIFIED WEST SHORE BETWEEN UTICA AND SYRACUSE

Regular passenger service over the electrified division of the West Shore Railroad between Utica and Syracuse began on Sunday, June 16, but as a fitting preliminary, C. Loomis Allen, general manager of the Oneida Railway Company, made preparations for an inaugural trip on June 15. Invitations were issued, therefore, to a large number of prominent citizens in the towns along the line, to officials of affiliated railway companies, electrical apparatus manufacturers and representatives of the daily and technical press. Owing to the size of the party and to make the trip more convenient for the guests, it was found advisable to run one two-car train from Utica, in charge of Mr. Allen, and a similar train from Syracuse, in charge of Wm. J. Harvie, electrical engineer of the Oneida Railway Company.

The Utica party started at 9:40 a. m. from the company's headquarters and reached the city line at 10:01 a. m. The distance of 44 miles between the limits of Utica and Syracuse was covered in 69 minutes, but Frank Blume, who acted as motorman after Mr. Loomis gave up that position, showed the possibilities of the equipment by running a mile in 66 seconds. At Syracuse greetings were exchanged with the other party, and after a trip to the business center the party returned to Utica, stopping on the way, however, for an inspection of the sub-station at Clark's Mills. The weather was splendid and the trip proved very enjoyable. On reaching Utica, the guests were taken to Baggs' Hotel, where a fine luncheon was served to the combined parties by Mr. Loomis, as host.

Among those who were invited to this trip were C. E. Parsons, chief engineer of the Hudson River Electric Power Company; M. J. Brayton, general manager Utica Gas & Electric Company; S. Piek, superintendent Niagara, Lockport & Ontario Power Company; Paul T. Brady, of the Westinghouse Electric & Manufacturing Company; H. N. Ransom, of the General Electric Company; N. M. Garland, New York manager of the Ohio Brass Company; J. J. Stanley, vice-president of the Oneida Railway Company; A. L. Linn, Jr., general auditor of the Oneida Railway Company; Chas. H. Clark, engineer maintenance of way International Railway Company; M. J. French, engineer maintenance of way Utica & Mohawk Valley Railway Company; W. K. Vanderbilt, Jr.; James H. McGraw, of the McGraw Publishing Company and STREET RAILWAY JOURNAL.

THE ROCK ISLAND GASOLINE CAR

The Rock Island Railroad has been operating between Stearcy and Higginson, Kan., a Sheffield gasoline motor car furnished by Fairbanks, Morse & Co., of Chicago. The line is one where the passenger traffic does not warrant the maintenance of a regular train schedule. The cost of operation is given as follows:

	Miles Per Gallon	Cost Per Gallon	Cost Per Mile
Gasoline	8	.15	1.8
Lubricating oil	60	.40	.6
Operator, per day	$2.50	...	1.4
Repairs	....	...	.15
			3.93

It is figured that if the car were operating on a basis of 180 miles, the actual cost per mile would come down to 3 cents.

The motor equipment consists of a four-cylinder Sheffield engine connected to a planetary transmission with meshed gears and a separate clutch for each speed. Now there are two speeds in each direction and the control of the car is considered very satisfactory. The car can be started from rest and run to maximum speed without throwing any severe strain on the engine. It is not necessary to tease the engine by throwing a friction clutch in and out.

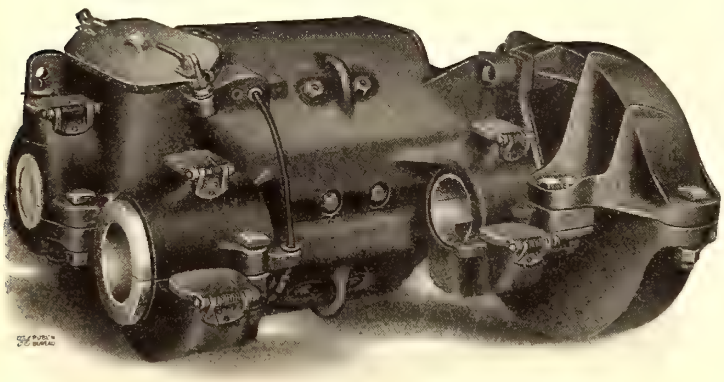
The car runs in either direction at the same speed, and has a controller at each end. All parts are readily accessible and interchangeable. The engine is mounted in one end of the car and radiators of ample size are located in either end under the car and protected by steel pilots. A water tank of sufficient size is furnished, and circulation by means of a vane pump keeps the cylinders cool. A 30-gal. tank of gasoline is furnished, good for a 240-mile run. There is an auxiliary tank for supplying the immediate wants of the engine, which, when the gasoline falls below a certain level, gives warning to fill the tank from the reserve store.

The car body is of steel and has a seating capacity of twenty-one people.

The Pacific Electric Company has petitioned the Board of City Trustees of Monrovia for the freight-carrying privileges of a "railroad with electric motive power" on its main line between the east and west city limits for a period of fifty years. In towns of less than 5000 a municipal permit is not necessary. The ordinance decrees that all switching must be done within the company's yards; only parcel freight can be moved from 6 o'clock a. m. to 8 o'clock p. m., and the cars used must be of the regular passenger type; lumber and other heavy freight, necessitating flat or box cars, may be moved only between 8 p. m. and 6 a. m. An exception was made of company construction and repair material, which may be hauled at any time. Action has been deferred by the city until objecting property owners in the vicinity are given a hearing.

GENERAL ELECTRIC COMMUTATING POLE RAILWAY MOTORS

Commutating pole motors have been used for a long time in stationary work, but up to within recently no attempt has been made in this country to employ this design for railway service. Within the last few months, however, several large orders have been taken by manufacturers in this country for motors fitted with commutating poles, and the General Electric Company is now prepared to supply them in six different sizes, varying in output from 50 hp to 200 hp. These motors are called GE-202, GE-204, GE-205, GE-206, GE-207 and GE-208, arranged in order of size. The principal advantage claimed is practically sparkless commutation even on heavy loads, lower magnetic densities and smaller core loss. At present these motors are being wound for 600 volts as standard, and have a liberal margin of safety at this voltage. One of these motors was exhibited at the Columbus convention, but although there has been a great deal of speculation as to the construction of these machines, information has only just been made public.



EXTERIOR OF NO. 204 COMMUTATING POLE MOTOR

The two smallest motors, namely, the 202 and the 204, are constructed with a split frame designed to allow the bottom part to be swung down into a pit for inspection or renewal of parts. The largest motors are of the box frame type with large bored openings at each end through which the armature can be inserted or removed. The general construction of both types is similar to that employed in the standard motors, the chief point of difference lying in the addition of commutating poles.

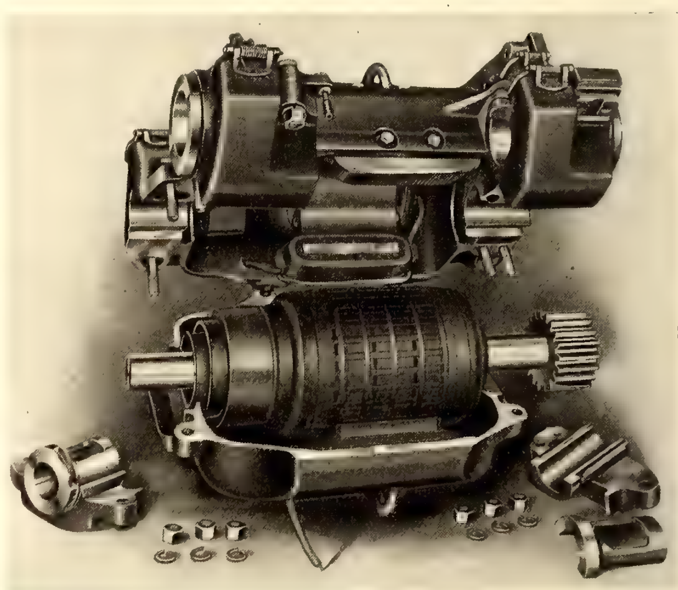
The commutating poles, located between the main exciting pole pieces, are connected up with their windings in series with one another and with the armature. The magnetic strength of the commutating poles varies, therefore, with the current through the armatuure, and a magnetic field is produced of such intensity as to reverse the current in the armature coils short-circuited during commutation. The pole pieces are so proportioned and wound as to compensate for armature reaction and practically insure non-flashing and sparkless commutation up to the severest overloads. As the magnetizing current around the commutating poles is reversed with the armature, the poles perform their functions equally well in whichever direction the motors are running.

Due to the remarkably good commutating characteristics of the motors, a more rugged form of motor is obtained which is less subject to injury through careless handling by motormen than the present standard railway motor. This fact is of importance on heavy grades or where cars are provided with equipments geared for high-speed work, and at the same time are required to stop and start frequently in cities. If for electric locomotives or other special applications forced ventilation is used, high continuous outputs can be obtained from these motors, as the current input can be considerably increased without commutation difficulties occurring, the heating of the motor being kept within normal limits by the increased ventilation, which may be effected by means of a blower.

As will be seen, the main exciting pole pieces are bolted to the frame at an angle of 45 degs. to the horizontal, while the comutating pole pieces are bolted to the frame at points midway between the exciting poles. Small holes fitted with malleable iron covers and gaskets are provided at both ends of the motor for inspection or ventilation whenever service conditions will permit.

With the box type of frame the main exciting pole pieces are located at the top, bottom and sides with the commutating poles between. In both types of frame the opening over the commutator is inclined at an angle to allow the brush-holders being readily reached either from under the car, or if desired, through a trap door in the floor of the car. All bearings are designed for oil and waste lubrication.

In addition to the advantages of sparkless commutation, the manufacturers claim these motors have less wear on the commutator, increased life of brushes, they are cleaner and more reliable because of the reduced carbon and copper dust from brushes and commutator, and they have increased efficiency and free running capacity, because of lower core and commutator losses.



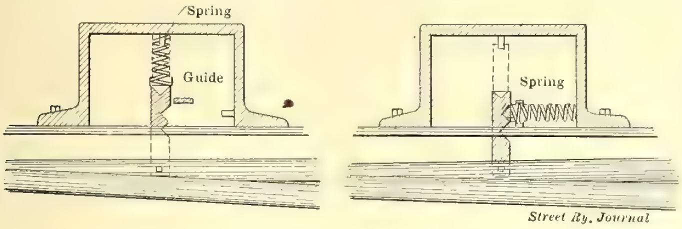
COMMUTATING POLE MOTOR WITH FRAME LOWERED AND ARMATURE IN LOWER HALF

The capacities of these motors for continuous service are high owing to their good electrical efficiency and ventilation. No announcement is made by the manufacturers of any voltage for these motors higher than 600.

The Brooklyn Rapid Transit Employees' Association has decided to co-operate with the railroad company in caring for members retired on a pension by paying their association dues.

NEW ANTI-STRADDLING DEVICE

A variation from the usual form of anti-straddling devices for switch tongues has recently been devised by Alfred Oldfield, lately engineer of the Winnipeg Electric Railway Company. A horizontal link is attached to the base of the tongue near its point and slides, with the movement of the tongue, in guides in a switch box. In the side of this link are two notches which engage with a spring detent



ANTI-STRADDLING DEVICE FOR SWITCH TONGUES

enclosed in the box. The spring detent holds the tongue on either side, as shown in the right-hand drawing, but does not prevent the tongue from being thrown over with a switch iron. If a spring switch is desired, the spring is moved from the side to the end of the lever, as shown in the left-hand drawing. The device is in use in Winnipeg.

TRACK BALLASTING IN SAN FRANCISCO

In equipping its principal cable roads with the overhead trolley system, the United Railroads of San Francisco decided to use for reballasting the lines the concrete torn up when the bed and iron braces of the cable roads were removed, and in this work is using several ballasting machines, which consist of small rock crushers mounted on platform cars, the crushers being operated by electricity from the trolley wire. The shattered fragments of concrete, broken stone, etc., are tossed into the hoppers of the crusher and are very quickly reduced to small pieces, the crushed material falling between and on either side of the tracks, where it is rapidly spread by the ballasters. The cars on which the crushers are mounted are moved forward as rapidly as the work progresses. While the idea of the portable crusher is not new, its use in this particular instance and way is novel, and is of interest, especially as it has helped greatly to dispatch the reconstruction work.

FLAT CAR EQUIPPED WITH CRUSHER FOR BALLASTING

INDIANA COUNTY RAILWAY SYSTEM IN OPERATION.

The combination passenger and baggage car, of which an illustration is presented, was the first car to be operated on the new Indiana County railway system, which is controlled by the Jefferson Traction Company, which also operates the railway lines in Punxsutawney. Only 6 miles of track are laid at present on the new line, namely, from Indiana, which is about 30 miles south of Punxsutawney and 50 miles east of Pittsburg, to Ernest and Creekside. Fifteen miles have been graded from Indiana to Clymer, where connections will be made with the Pennsylvania Railroad and New York Central Railroad. The other proposed route, which it is expected will be graded this summer, is from Indiana to Blairsville, 16 miles due south.

EXTERIOR OF COMBINATION CAR FOR INDIANA COUNTY RAILWAY

The type of car shown, which was furnished by the J. G. Brill Company, is an excellent example of a straight-sided, grooveless post, semi-convertible car, and resembles in many respects the semi-convertible coaches which are doing service in Punxsutawney. It measures 34 ft. 4 ins. over the end panels and 43 ft. 9 ins. over the crown pieces and vestibules, and the width over sills, including sheathing, is 8 ft. 6 ins. The side sills are 4 in. x 7¾ in.; end sills, 5¼ in. x 6⅞ in. Sill plates are 15 in. x ⅜ in. The baggage compartment is 9 ft. 2 ins. long. The passenger compartment is finished in cherry with birch ceilings. Other features in this compartment, including the saloon, are shown in the illustrations. The trucks are the No. 27-E1 with 6-ft. wheel-base. Four 45-hp motors are installed to each car. The weight of car, including trucks and complete electrical equipment, is 48,700 lbs.

INTERIOR OF COMBINATION CAR FOR INDIANA COUNTY RAILWAY

EXHIBITS AT ATLANTIC CITY

In addition to the manufacturers named in these columns last week, the following firms were exhibitors and had representatives on the Steel Pier, Atlantic City, in connection with the American Railway Master Mechanics and Master Car Builders conventions:

AMERICAN AUTOMATIC VENTILATOR COMPANY OF NEW YORK—A pleasant feature of the convention was the trip arranged by the American Automatic Ventilator Company, of New York, on Saturday. A party made up of a number of the delegates with several newspaper representatives traveled to Philadelphia by the Reading Railroad on a special car which was equipped with automatic ventilators. Lunch was served to the party at the Bellevue-Stratford, and the party returned to Atlantic City in time to attend the ball game in the afternoon. In addition the company exhibited on the exhibition tracks a train of Pennsylvania cars equipped with automatic ventilators, and was also represented in the steel car of the New York Central Railroad, built by the St. Louis Car Company. Among those in attendance at the convention were Ross Taylor and George H. Ford.

THE ST. LOUIS CAR COMPANY, of St. Louis, Mo., was represented at the convention by two cars which were shown on the exhibit tracks of the Reading Railroad at Mediterranean and Virginia Avenues. One of these cars was for electric service the other for steam. The former was one of the steel cars which the St. Louis Car Company is building for the direct-current zone of the New York Central; the latter was a handsome dining car constructed for the American Palace Car Company.

THE GOLDSCHMIDT THERMIT COMPANY, of New York, had an exhibit on the steel pier at which were shown samples of sections of locomotive frames, rails, wrought iron pipes and other specimens of its work. The company also made demonstrations at the exhibit tracks every afternoon during the convention. The representatives present were A. M. Guenther and W. R. Hulbert, who had an attractive souvenir. It was in the form of a stick pin representing a thermit crucible.

THE WALTER H. FOSTER exhibit of the Landis Machine Company included a 2-in. double head bolt-threading machine and a Lassiter stay-bolt threading and reducing machine with four spindles. In addition to Mr. Foster the company's interests were looked after by B. D. Jackson and G. R. Willis.

THE BICKFORD TOOL & DRILL COMPANY, of Cincinnati, Ohio, showed a three-speed 4-ft. drill, size No. 1, motor-driven. The company was represented by H. M. Norris.

THE GARVIN MACHINE COMPANY, of New York, had on view a No. 14 motor-driven plane miller, a No. 2 universal miller, a die slotter, a No. 2 automatic tapper, a No. 22 vertical miller, and a No. 14 vertical spindle miller. The company's representatives were George J. Thompson and H. R. Garvin.

J. H. WAGENHORST & COMPANY, of Youngstown, Ohio, showed their well-known blue printing machine in care of Donald Parson.

THE KALAMAZOO RAILWAY SUPPLY COMPANY, of Kalamazoo, Mich., had a fine exhibit of Root scrapers, Moore track drills, Kalamazoo velocipede and hand-car wheels, etc. F. N. Root was in charge.

THE JOSEPH DIXON CRUCIBLE COMPANY, of Jersey City, N. J., had a handsomely equipped pavilion, where it exhibited a wide line of its graphite specialties. C. H. Spotts, L. H. Snyder, J. J. Tucker, H. A. Nealley, W. A. Houston, A. C. Bowles and R. A. Brown represented the company.

THE McCONWAY & TORLEY COMPANY, of Pittsburg, presented an extensive array of couplers and showed its draft gear as applied to car framing. The merits of the apparatus were explained by E. M. Grove, William McConway, Jr., H. C. Buhoup, I. H. Milliken, S. C. Mason and G. W. McCandless.

THE LANDIS TOOL COMPANY, of Waynesboro, Pa., was represented by T. H. King, who explained the merits of his company's No. 16 gap grinder and a 1½-in. universal grinding machine.

THE CHICAGO PNEUMATIC TOOL COMPANY, of Chicago, had a very elaborate display of electric and pneumatic hoists and drills, compressors, etc. Thomas A. Aldcorn was in charge, and during the week J. W. Duntley, president, and W. O. Duntley, vice-president of the company, were also present, together with several works managers and sales agents.

THE KEYSTONE LUBRICATING COMPANY, of Philadelphia, was represented by C. A. Hopper and A. C. Buzby, president and general manager. Mr. Hopper was in charge of the exhibit, which consisted of Keystone grease and model machinery showing the use of Keystone lubrication.

THE UNION SPRING & MANUFACTURING COMPANY, of Pittsburg, showed locomotive and car springs, pressed steel spring plates and journal-box lids. Its representatives were A. M. McCrea, L. G. Woods, C. S. Foller and T. B. Arnold.

THE WATSON-STILLMAN COMPANY, of New York, exhibited hydraulic jacks, rail benders, crank pin presses, bar straighteners and wheel presses. George L. Gillon and E. A. Johnson were the representatives.

THE WEST DISINFECTING COMPANY, of New York, showed a fine line of disinfecting materials and appliances, such as chloro-napthaleum, liquid soap, Taussig fumigating lamps, etc. E. Taussig and C. A. Ekstromer represented the company.

THE STOEVER FOUNDRY & MANUFACTURING COMPANY, of Myerstown, Pa., showed a pipe bending and a pipe threading machine in charge of Ralph McCarty, E. R. Euston and A. A. Schaefer.

H. B. UNDERWOOD & COMPANY, of Philadelphia, had a portable boring bar outfit and a portable rotary planer. A. D. Pedrick, C. O. Ralph and F. E. Emery represented the company.

THE AMERICAN STEAM GAUGE & VALVE MANUFACTURING COMPANY, of Boston, presented Thompson indicators, pop safety valves, steam gages, gage testers, etc. R. B. Phillips, G. Cornett, C. A. Allen and Horace Parker represented the company.

THE ANGLO-AMERICAN VARNISH COMPANY, of Newark, N. J., distributed samples of material and advertising matter through William Marshall and F. W. Fort.

ARMSTRONG BROS. TOOL COMPANY, of Chicago, had a line of lathe and planer tool holders, ratchet drills, tool posts, boring bars, etc. The representatives were Paul Armstrong and John McBride.

AMERICAN STEEL FOUNDRIES, of Chicago, had a large variety of bolsters, wheels, frames and other truck parts, together with couplers for freight and passenger service. Among those looking after the company's interests were W. V. Kelley, R. P. Lamont, W. W. Butler, G. E. Slaughter, D. T. Kelley, G. E. Murray, T. E. Crook, W. F. Schults, I. S. Andrews, D. W. Coll, P. J. Kalman, J. S. Smith, H. P. Shaw, J. R. Stuart, E. H. Bauer, W. E. Fowler, Jr., R. H. Ripley, W. R. Gravener, F. B. Ernst and G. G. Floyd.

THE AMERICAN MASON SAFETY TREAD COMPANY, of Boston, showed numerous varieties of its tread as applied to different conditions. H. C. King and L. H. Myrick were on hand.

THE BALDWIN STEEL COMPANY, of New York, had for inspection a number of Hudson high-speed tools, twist drills, reamers, milling cutters, together with high-speed steels, tool steels, etc. It was represented by C. F. Simmons, J. A. Collom, Edward Milnor and W. L. Stone.

THE LODGE & SHIPLEY COMPANY, of Cincinnati, showed a 24-in. standard engine lathe driven by a 10-hp motor. R. D. Betts and R. G. English were in charge of the exhibit.

THE AMERICAN LOCOMOTIVE COMPANY was represented by W. H. Marshall, H. F. Ball, G. M. Basford, J. D. Sawyer and F. J. Cole.

THE CARBORUNDUM COMPANY, of Niagara Falls, N. Y., had a full array of carborundum specialties. E. J. Eames, W. W. Sanderson, R. B. Fuller, C. C. Schumaker, Charles Nicholson and C. O. Taylor were on hand.

THE CLING SURFACE COMPANY, of Buffalo, N. Y., was represented by W. D. Young and C. F. Chase.

THE COMMERCIAL ACETYLENE COMPANY, of New York, showed its acetylene safety storage method for signal and car lighting, headlights, lamps and other railway appliances. W. P. Hix, R. J. Faure, Oscar F. Ostley and C. N. Neilson cared for the company's interests.

S. F. BOWSER & COMPANY, INC., of Fort Wayne, Ind., were represented by C. A. Dunkelberg, N. T. Simpson and W.

A. Pitcher, who discoursed on the merits of the company's hand and power oil pumps and storage cabinets.

THE BRIDGEPORT SAFETY EMERY WHEEL COMPANY, of Bridgeport, Conn., had a motor-driven 80-in. guide bar grinder, motor-driven tool grinder and various grinding wheels.

THE BUDA FOUNDRY & MANUFACTURING COMPANY, of Chicago, made a prominent exhibit of hand-car wheels, track drills, grinders, jacks, replacers, etc. T. J. Stocks and W. R. Burrows represented the company.

THE FLEXIBLE COMPOUND COMPANY, INC., of Philadelphia, illustrated by tests the advantages of its flexible compounds, flexible black enamels, etc. Thos. H. Downward and S. F. Osbourn were on hand.

THE FOX MACHINE COMPANY, of Grand Rapids, Mich., exhibited the Fox heavy pipe cutter, Thomas core box machine, mitering machine, milling machine, universal wood trimmers, adjustable saw dado, etc. The company was represented by George Schow and S. O. Livingston.

THE DRESSEL RAILWAY LAMP WORKS, of New York, had an attractive display of headlights, signal and marker lamps. The representatives were F. W. Dressel, Robert Black, F. W. Edmunds, H. S. Hoskinson, J. M. Brown and E. W. Hodgkins.

THE ELECTRIC STORAGE BATTERY COMPANY, of Philadelphia, had an exhibit of car lighting batteries and other types, one being for electrified steam railroads. E. L. Reynolds, Chas. Blizzard, E. H. Hunt, A. Taylor and Robert Hull.

THE HESS-BRIGHT MANUFACTURING COMPANY, of Philadelphia, was represented by Henry Hess, who showed a complete axle and wheels mounted on ball bearings.

THE KINNEAR MANUFACTURING COMPANY, of Columbus, Ohio, illustrated the principle of its well-known rolling doors. F. B. Billheimer and F. C. Schmidt were on hand.

THE LANDIS MACHINE COMPANY, of Waynesboro, Pa., had a 2-in. double-head bolt-cutting machine, dies, etc. J. G. Benedict and H. L. Fisher represented the company.

EDWIN HARRINGTON, SON & COMPANY, of Philadelphia, showed the Peerless spur gear hoists, screw hoists, travelers and stay-bolt threading machine. W. J. Somerset, E. Van Note and J. A. Slaughter were on hand.

THE PENN STEEL CASTING & MACHINE COMPANY, of Chester, Pa., was represented by W. S. Bickley and T. Burd Zell, and showed high-pressure steam valves, etc.

THE CLEMENT RESTEIN COMPANY, of Philadelphia, showed, through Norman Miller, steam hydraulic packings.

THE RIVERSIDE METAL COMPANY, of Riverside, N. J., had a display of white metal, german silver, phosphor bronze, nickel castings, etc. The representatives were W. P. McGlynn, H. W. Berroth, L. J. Kane and W. K. McGlynn.

JOHN LUCAS & COMPANY, of Philadelphia, Pa., had a number of comical mirrors for amusement in addition to a display of their coach colors for instruction. The representatives were W. C. McMullin, E. W. Storey and H. A. Clark.

THE MERCHANT & EVANS COMPANY, of Philadelphia, exhibited their Star ventilators and samples of babbitt metals. W. C. Thomas was on hand.

The V. O. LAWRENCE COMPANY, of Philadelphia, which makes the anti-waste grabber and Filson folding vestibule trap, was represented by V. O. Lawrence and N. P. Lane.

JOHN R. LIVEZEY, of Philadelphia, showed granulated and sheet cork for cold storage work and refrigerators, asbestos air cell coverings for steam and exhaust pipes, models of cold storage construction and hard pressed cork for electrical insulation. He was assisted by Harry E. Souder.

A. O. NORTON, INC., of Boston, showed a line of bridge, journal and car jacks in care of H. A. Norton, J. O. St Pierre, B. B. Terrill, F. L. Gormley, F. M. Twombly, A. O. Norton and C. G. Erickson.

THE OIL WELL SUPPLY COMPANY, of Pittsburg, was represented by Joseph C. Bruff, who exhibited railroad globe and angle valves.

THE PANTASOTE COMPANY, of New York, which was represented by John H. High and D. E. Bonner, showed samples of car seats and curtains.

THE STANDARD PAINT COMPANY, of New York, showed ruberoid types of roofing for cars and buildings, insulating papers, Ruberine varnishes, P & B insulating tapes, etc. J. N. Richards, J. H. Thomas, C. Earnshaw, B. C. Beckman, J. G. Satterthwait and E .F. Vandewater were among the company's representatives.

THE STANDARD STEEL WORKS, of Philadelphia, showed a line of forged and rolled steel wheels as well as steel-tired wheels. The company was represented by E. S. Lewis, H. DeH. Bright, F. Carpenter, C. Ridell, E. B. Halsey, H. W. Sheldon and W. P. Evans.

THE RUBBERSET BRUSH COMPANY, of Newark, N. J., had a line of paint and varnish brushes in care of A. L. Holtzman and T. B. Denton.

THE SHELBY STEEL TUBE COMPANY, of Pittsburg, Pa., made its seamless tube exhibit especially interesting. Seventeen seamless steel locomotive bells were each tuned differently and electrically played. H. S. White, H. A. Flagg, J. E. Minetree and C. H. Wood represented the company.

THE BALDWIN LOCOMOTIVE WORKS, Philadelphia, had a booth where visitors were welcomed by Charles Ridell, Chicago; Wm. Vollmer, Philadelphia; E. B. Halsey, St. Louis; H. W. Sheldon, H. DeH. Bright, Philadelphia, and W. P. Evans.

THE AMERICAN BLOWER COMPANY, of Detroit, Mich., presented an interesting exhibit in its booth 229-231. The working model of the A .B. C. "Moist Air" dry kiln showed the method of drying lumber without damage to the product. A complete line of fans—both steam and motor-driven—applicable to any service where air is to be moved, were shown, and the new vertical fully enclosed self-oiling high-speed engine of the "A" type designed to run for long periods without attention. The company was represented by C. W. Old and R. B. Bedford.

THE DEARBORN DRUG & CHEMICAL WORKS, of Chicago, had an exhibit displaying the qualities of their water-purifying preparations. Attending the convention were Robt. F. Carr, vice-president and general manager; George R. Carr, assistant general manager, Chicago; D. E. Cain, manager Denver office; H. G. McConnaghy, New York office, and Frank Demler, of the Philadelphia office.

THE MODOC SOAP COMPANY, of Philadelphia, had an exhibit of Perfectol car and locomotive cleaner, and also gave daily demonstrations on the exhibit tracks.

THE WELLS LIGHT MANUFACTURING COMPANY, New York, was represented by G. H. E. Robinson and Howard Manahan.

THE DUFF MANUFACTURING COMPANY, Pittsburg, showed a complete line of Barrett jacks, Barrett geared ratchet jacks, Duff crane roller and ball-bearing jacks in chage of T. A. McGinley and George A. Edgin.

McCORD & COMPANY, of Chicago, showed a line of locomotive and automobile lubricators, besides the McCord journal box, McCord draft gear, copper gaskets and the Gibraltar bumping post.

BAEDER, ADAMSON & COMPANY, of Philadelphia, showed their line of glue, curled hair, sand and emery papers, emery cloth and garnet paper and hair felt.

THE ADAMS & WESTLAKE COMPANY, of Chicago, showed an Adlake-Newbold axle-lighting equipment in operation, together with an elaborate display of car interior lighting fixtures. The Adlake acetylene lighting system was also shown, with signal lamps and lanterns, car hardware and trimmings. The company was represented by F. B. Jones, E. L. Langworthy, R. M. Newbold, F. N. Grigg and A. S. Anderson.

THE GOLD CAR HEATING COMPANY, New York, showed a complete steam and hot water system in operation for car heating and also its hydro-carbon system of car lighting. Messrs. Ward, Gold, Robbins, Ivers, Weir, Kitchen, Voges, Baumbaugh, Stosks, Feldes and Wilson were in attendance.

RICHARD DUDGEON, of New York, showed a complete line of jacks and pumps. Manager J. W. Nelson was in charge.

THE ROSTAND COMPANY, of Milford, Conn., represented by F. A. Barbey and P. N. Landine, showed five types of the McCarthy baggage rack.

THE NERNST LAMP COMPANY'S lamps were used to light the reception room of the Westinghouse space. For this purpose there was one of its new ceiling type six-glower lamps as a center piece. This lamp is an ingenious modification of the standard six-glower indoor lamp to fit against a ceiling serving as fixture and lamp. Fitted with a large holophane hemisphere its distribution is all that can be desired. This is surrounded by six of the new one-glower 110-watt, 115-cp. lamps just put on the market. The four three-glower lamps lighting the ends of the space differed from the standard a. c. lamps somewhat in appearance. All the lamps for lighting this space are d. c. lamps. This company also had an exhibit showing standard indoor lamps such as are used for offices, shops, stations, warehouses, etc., and outdoor lamps for various places.

THE COOPER HEWITT LAMP COMPANY'S exhibit was in the Westinghouse space. This consisted of four small and two large lamps, all in service for lighting the machinery space of the Westinghouse exhibit. It attracted considerable attention by reason of the peculiar form of lamps and quality of the light. The consumption of energy is less than one-half that of d. c. arcs for the same light, and the lamp requires no renewals except at intervals of several thousand burning hours, therefore, where current is not below ordinary costs it is a money saver. A substitution of these lamps for arcs in cases of "overloaded plant" is often found to be worth the price of the lamps, and its adoption on new work has frequently effected a saving sufficient to more than cover the first cost, to say nothing of lower operating cost or better light. It is doing good work for lighting railroad shops at surprising heights, 40 ft. to 60 ft. over traveling cranes not being unusual.

OFFICERS OF A. R. M. M. & M. C. B. ASSOCIATIONS

The election of officers at the meeting of the American Railway Master Mechanics' Association last week resulted as follows:

President, William McIntosh, Central Railroad of New Jersey.

First vice-president, H. H. Vaughan, Canadian Pacific Railroad.

Second vice-president, G. W. Wildin, Lehigh Valley Railroad.

Third vice-president, F. H. Clark, Chicago, Burlington & Quincy Railroad.

Executive members, C. A. Seley, Chicago, Rock Island & Pacific Railroad; F. M. Whyte, New York Central Railroad; A. E. Mitchell, New York, New Haven & Hartford Railroad.

On June 19 the following gentlemen were elected officers of the Master Car Builders' Association for the coming year: President, G. M. Dow, Lake Shore & Michigan Southern Railroad; first vice-president, R. F. McKenna, Delaware, Lackawanna & Western Railroad; second vice-president, R. W. Burnett, Canadian Pacific Railroad; third vice-president, T. M. Ramsdell, Chesapeake & Ohio Railroad.

The executive committee consists of six, of whom the following were elected this year: D. F. Crawford, Pennsylvania Railroad system; T. H. Curtis, Louisville & Nashville Railroad, and F. H. Clark, Chicago, Burlington & Quincy Railroad. The following gentlemen hold office from last year: J. F. Walsh, Chesapeake & Ohio Railroad; S. N. Hibbits, Lehigh Valley Railroad, and F. P. Hyndman, New York, New Haven & Hartford Railroad.

ENTERTAINMENTS AT THE CONVENTION

An elaborate program of entertainments was provided at Atlantic City for convention week. It included balls, concerts, vaudeville entertainments, progressive euchre parties and the annual baseball game between nines representing the supply men in the East and the West. All were well attended and proved very acceptable. While it would be difficult to discriminate, perhaps the vaudeville entertainment, given in the ballroom on the Steel Pier on Monday evening, June 17, was the most popular. It was followed by a three-act farce entitled "Arabian Nights," and later by informal dancing. The remarkable aggregation of talent was a pleasant surprise to all, and it is evident that the members of the association and supply members comprise a number of talented actors and actresses. Their efforts were highly appreciated by a large audience.

MILWAUKEE MERCHANTS FAVOR FROST FRANCHISE

The members of the Merchants & Manufacturers' Association, of Milwaukee, have voted unanimously in favor of urging the Common Council to pass the Chicago & Milwaukee Electric Railway Company's franchise ordinance over the veto of Mayor Becker. No official announcement of the action taken by the association has been given out, the communication having been sent to the city clerk in a sealed envelope which will remain unopened until the Council meets. President A. C. Frost, of the Chicago & Milwaukee line, was in the city last week, and appeared before the association before that body had decided to present its recommendations to the Aldermen. It has been argued by those who are opposed to the so-called "exclusive" franchise that the proposition advanced by President Frost in his request for the use of Wells Street as far east as Second is not an unreasonable one. For the rights on three additional blocks, he is giving up his privileges on sixteen other blocks, and has agreed to make traffic arrangements with other roads entering the city on Wells Street in exchange for reciprocal rights on their lines. These arguments were presented to the Merchants & Manufacturers' Association by Mr. Frost.

INLAND EMPIRE COMPANY COMPLETING NEW LINK IN SYSTEM

Simultaneous with the inauguration of the summer train schedule on the Coeur d'Alene division of the Inland Empire system the new extension of the line to Liberty Lake will be opened. The Coeur d'Alene division has 42 miles of track, the extension from Liberty Lake junction on the main line to the lake being a fraction over 2 miles. The new summer schedule provides for eleven trains to Liberty Lake, the first in the morning leaving Spokane at 6 o'clock, and going direct to the lake. All other Coeur d'Alene trains connect at Liberty junction up to the 6 p. m. train, with the exception of the Shoshone Flyer. Saturdays and Sundays an extra will leave Spokane at 7:30 p. m. direct for the lake.

Two new trains will be added in either direction between Spokane and Coeur d'Alene, one in the morning and one in the afternoon, thus making practically an hourly service. The morning trains will leave Spokane at 6:30, 8:00, 9:00 (Shoshone Flyer), 10:00, 11:00 a. m.; 1:10, 3:00, 4:25, 5:00, 6:00, 7:00, 11:20 p.m., and on Saturday and Sunday nights an extra at 9 o'clock. The 4:25 afternoon train will be known as "The Campers' Limited," and will make but three stops, Liberty Lake junction, Spokane Bridge and Post Falls, and will run through from Coeur d'Alene to Hayden Lake. Three new depots are under construction at Liberty Lake, Liberty Lake junction and at Dalton Gardens on the Hayden Lake division. The type of structure being followed on the Coeur d'Alene division is similar to the depot recently erected at Hayden Lake, which is of Swiss chalet style, with long umbrella sheds. Two miles of the new double track are completed and in use, and it is expected the remaining 4 miles of the 6 miles between Spokane Bridge and Greenacres will be ready by July 1.

NEW MEXICAN ROAD PROPOSED

It is reported that Dr. J. W. Lim, of Torreon, Mexico, one of the stockholders of the Banco de China y Mexico, and other wealthy Chinamen of Torreon and Northern Mexico, have just secured from the State government the right to build and operate an electric line between Torreon and Matamoros, Coah., a city about ten kilometers from Torreon and situated in the heart of the cotton-producing country of Mexico, known as the Laguna district. Matamoros has a population of about 500 people. The doctor says that the machinery has been ordered from the United States and that the work will begin at a very early date. The engineering is now being done by Lineberg & Rone, a local engineering firm of Torreon.

LEGAL DEPARTMENT*

REASONABLE REGULATIONS AS TO TRANSFERS

The First Appellate Division of the New York Supreme Court has recently decided two cases which liberally recognize the discretionary power of street railways to regulate the issue of transfers. The first decision was by a unanimous court, and there ought to be no dispute among just and reasonable people as to the propriety of the court's determination. It was held (Ketchum v. New York City Railway Company, March, 1907, 103 N. Y. Supp. 486) that a regulation, posted conspicuously and advertised so as to bring it to the notice of the public generally, that passengers would be required to demand transfers at the time of paying fares is reasonable and valid and that a company would not be liable to the penalty prescribed by section 105 of the Railroad Law for refusal to give a transfer where a passenger had neglected to apply for it when paying his fare. The rule is so obviously a fair one that it seems scarcely necessary to quote from the argument of the court. It may not be amiss, however, to give the following brief extract containing the practical gist of the reasoning:

"The evidence shows, and common experience verifies the fact, that at certain hours the defendant's cars are very crowded, and it would be imposing upon the conductors an impossible task to require them to carry in memory every passenger to whom has been given, in the course of a long trip, a transfer, and, although in a given case a conductor might be quite sure that he had given a transfer to a demanding passenger, the heavy penalty imposed by the railroad law in case of refusal, with the impossibility of producing any proof beyond his own recollection, would make it very hazardous to refuse to give a transfer upon demand. If, therefore, the statute must be so construed as to entitle a passenger to demand and receive a transfer at any time during his trip, the company would be practically powerless to protect itself against repeated demands by the same passenger. It does not in our opinion require such a construction, and we consider that it is reasonable to make a rule fixing upon a definite point in each trip when the right to demand a transfer shall be exercised."

The other decision was in Kelly v. New York City Railway Company (May, 1907, New York "Law Journal," June 13, 1907). It was therein held that the regulation of the defendant street railway company for the issue of transfers and permitting the use thereof only in the same general direction of a passenger's initial trip is a reasonable one and does not violate section 104 of the Railroad Law, requiring when street surface railway companies have entered into a contract of consolidation or co-operation that "every such corporation shall * * * give to each passenger paying one single fare a transfer entitling such passenger to one continuous trip to any point or portion of any railroad embraced in such contract, to the end that public convenience may be promoted by the operation of the railroads embraced in such contract substantially as a single railroad with a single rate of fare." The propriety of this decision is not as clear as was that of the other; indeed, two members of the court dissent. The practical positions taken may, perhaps, best be shown by the following tangible illustrations suggested respectively in the prevailing and the dissenting opinions:

"Suppose, for instance, that we are at Union Square and desire to go to the Fifth Avenue Hotel opposite Madison Square. The Boadway cars will take us directly past the hotel by traveling a few blocks, and every consideration of public convenience is served by that line. But we could take a Fourth Avenue car to Forty-Second Street, thence by another car to Broadway, and down Broadway to the Fifth Avenue Hotel, thus making a circuitous route. If the plaintiff's construction of the statute is right, this supposititious case could be complicated by a great variety of transfers. This does not embrace any element of public convenience. It would be merely an indulgence of an individual desire to ride rather than a purpose to make one continuous trip between such points.

"A large portion of the population in the city of New York resides on either side of Central Park, which extends from Fifty-Ninth Street to 110th Street, and the only car line which the defendant has running through such park is at Eighty-Sixth Street, so that there is no way by which persons residing on either side of such park can get to the other side, if they live north or south of Eighty-Sixth Street—traveling by defendant's railway—except by going partly in one direction and then partly in a reverse direction. Thus, if A lives at Seventy-Ninth Street and Broadway and desires to go to Seventy-Ninth Street and Madison Avenue, he must take a car and go south, then transfer east and go north, or else take a car and go north, transfer east and go south, and to say that he is not entitled to such transfer is to nullify the statute by destroying the very object sought to be accomplished by it."

This latter decision was by an intermediate court of appeal, and whether it will be sustained by the court of last resort it is, of course, impossible to say. It seems, however, not improbable that what is apparently the only method of preventing a passenger from riding all day and in all directions for the sum of 5 cents will be judicially ratified as a reasonable rule, notwithstanding the unquestionable force of the consideration that a passenger sometimes is required to travel in a direction opposite to that first taken in order to complete a legitimate, definite trip. The action of the Court of Appeals in an earlier case in denying the right to recover cumulative penalties, in spite of the language of a statute and its own former decisions, indicates that broad views of reasonableness and justice may lead to the upholding of the company's regulation.

LIABILITY FOR NEGLIGENCE

ILLINOIS.—Trial—Instructions—Impeachment of Witnesses—Impeachment — Appeal — Review — Harmless Error — Street Railways—Injuries to Travelers—Care Required.

1. Where the only basis for an instruction on the impeachment of witnesses was in the alleged fact that witnesses who testified for defendant were contradicted by those who testified against it, and that one of defendant's witnesses had made statements regarded by defendant as inconsistent with his sworn testimony, it was improper to change that, if any witness had been "successfully impeached," or had willfully sworn falsely to any material matter, the jury, as a matter of law, might disregard his or their entire testimony except in so far as it had been corroborated, etc., without further defining the words "successfully impeached."

2. Where a witness is contradicted as to a material matter, or evidence is offered showing that he has made statements at another time inconsistent with his testimony as to a material matter, he is not thereby impeached, unless the jury believe from the contradiction or proof of inconsistent statements that the witness has willfully sworn falsely as to the material matter in reference to which he has been contradicted or has made inconsistent statements at another time.

3. Where, in an action for injuries, there was no such contradiction of defendant's witnesses that the jury could have believed that they had been "successfully impeached," defendant was not prejudiced by an instruction that, if any witness had been successfully impeached or had willfully sworn falsely as to any material matter, etc., they might disregard his entire testimony except as corroborated, etc.

4. In an action for injuries to a traveler on a highway by a collision with a street car, the court defined ordinary care to mean such a degree of care under the circumstances in which plaintiff was placed "at the time" as an ordinarily prudent person would exercise under like circumstances. A subsequent instruction declared that, in going across or near defendant's track at the time and place in question, it was plaintiff's duty to exercise ordinary care to avoid injury from the approaching car, and, if he failed to do so, he could not recover. Held, that the first instruction was not objectionable as limiting the time at which plaintiff was required to exercise care to the moment of the collision.—(Chicago City Ry. Co. vs. Ryan, 80 N. E. Rep., 116.)

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INDIANA.—Carriers—Carriage of Passengers—Injuries—Actions—Pleading—Passenger or Employee—Death—Damages—Amount—Accident to Train—Collision—Negligence—Street Railways—Regulation—Ordinance—Crossing Railroad Tracks—Trial—Direction of Verdict for Defendant—Evidence—Competency—Similar Evidence by Other Party.

1. In an action against a carrier to recover for the death of an employee while riding on defendant's car, plaintiff alleged that decedent was employed by defendant, and that after finishing his day's work he was given a ticket by defendant, good on any of its cars to enable him to ride home. Held, that the allegations as to his employment were not inconsistent with the allegation that he was a passenger on defendant's car.

2. In an action against a carrier to recover for the death of plaintiff's intestate, the jury found that he was in defendant's employ; that on the day of the accident he was riding home on defendant's car, after finishing his day's work, on a ticket given him for that purpose by defendant's foreman, in accordance with a custom of defendant; that he did not pay for the ticket, and the ticket was not furnished as a part of the contract of employment; that tickets were furnished employees when sent out on the road on the company's business, and were also furnished on other occasions; that the intestate, when killed, was riding on the car in the same manner as any other passenger; that he had nothing to do with operating the car; and that there was no contract between defendant and the intestate by reason of his using such ticket. Held, that such findings are not in irreconcilable conflict with a general verdict finding that intestate was a passenger.

3. In an action against a carrier to recover for the death of a passenger who was fifty-eight years old, industrious, in good health, earning $10.50 a week, and who left a widow, a minor child, and five grown children, the jury returned a verdict for $5,000. Under the statute, they might have fixed the amount at $10,000. Held, that no abuse of discretion was shown.

4. A street car company is negligent where it runs its car across the track of a steam railroad directly in front of an approaching train, without any effort to stop the car, and without any attempt by the conductor to ascertain whether the way is clear.

5. An ordinance making it unlawful for a street car to cross the track or tracks of a steam railroad until the conductor crosses the tracks on foot and signals the motorman is valid.

6. A refusal to direct a verdict for defendant is not error, where there is evidence tending to sustain the material allegations of the complaint.

7. Where defendant questions his own witnesses about a certain matter, he cannot complain if plaintiff questions his witnesses about the same matter.—(Indianapolis Traction & Terminal Co. vs. Romans, 79 N. E. Rep., 1068.)

INDIANA.—Pleading—Complaint—Motion to Make More Specific—Carriers—Injury to Passenger—Trial—Verdict—Interrogatories—Findings Consistent with General Verdict—Appeal—Harmless Error—Admission of Evidence Cured by Instructions—Instructions—Undue Prominence to Testimony — Depositions —Objections — Necessity for Making Before Trial.

1. Where a complaint against an electric railway company alleged that plaintiff was injured through the motorman negligently starting the car while plaintiff was alighting, it was not error to overrule a motion to make the complaint more specific by stating whether the car had, prior to its sudden start, been stopped or was slowly moving.

2. A street railway company was liable for injuries to a passenger while alighting at a usual stopping place which had been announced by the conductor caused by the motorman negligently starting the car.

3. Where, in an action for injuries to a passenger while alighting from a street car after leaving his seat in response to the conductor's announcement that his destination was reached, there was no finding that he was thrown off on account of the release of the brake, a verdict in his favor was not in conflict with findings that after the car entered a curve it became necessary to release the brakes, that such release gave the car additional speed without application of more current, that the release of a brake usually increases the momentum of a car, that the speed of the car was not excessive, that more power was applied than was necessary, that all street cars have jars and sways natural to their progress when operated in a lawful way, and that cars upon curves are subject to violent motions, lurches, and jerks.

4. In an action for injuries to a passenger while alighting from a street car caused by the motorman starting the car, any error in admitting testimony that at the time of the accident the conductor said to the motorman, "When you stop, why in the devil don't you give people a chance to get off?" was cured by an instruction not to consider the testimony.

5. Where, in an action for injuries to a passenger while alighting from a street car, there was testimony that at the time of the accident the conductor said to the motorman, "When you stop, why in the devil don't you give people a chance to get off?" an instruction that the jury should not consider the testimony was not objectionable, as directing attention to the testimony of a witness whom it was sought to impeach by evidence of contrary statements.

6. Under the express provisions of Burns' Ann. St. 1901, Sec. 443, a motion to suppress depositions must be made before the beginning of the trial.—(Louisville & S. I. Traction Co. vs. Leaf, 79 N. E. Rep., 1066.)

KENTUCKY. — Evidence — Expert Testimony — Street Railways—Injuries to Persons on Track—Violation of Speed Ordinance—Misleading Instructions—Right of Way Over Tracks—Care Required Towards Persons Walking on Track.

1. In an action for the death of one struck by a street car, plaintiff could not show by expert testimony what would be a reasonably safe rate of speed for a car to be operated over such a street as the one in which the accident occurred, it being for the jury to determine from the evidence whether the car was traveling at a dangerous rate of speed or not.

2. In an action for the death of one struck by a street car, that at the time of the accident the company was violating an ordinance limiting the speed of cars was no evidence of negligence toward decedent.

3. In an action for the death of one struck by a street car, an instruction that the company had a right to use its track was not objectionable as tending to lead the jury to believe that the company's right was exclusive.

4. Though street railway companies have no exclusive right to the use of their tracks, they have the right of way, and it is the duty of persons, whether on foot or in vehicles, to give unobstructed passage to the cars.

5. Where decedent was walking along the edge of a street car track, the motorman of a car moving towards him had a right to believe that, upon hearing the bell, he would leave the track in time to avoid being struck by the car, and was not required to stop the car or to take steps to avoid injuring him until it became reasonably apparent that he was not going to get out of the way.—(Ford's Adm'r vs. Paducah City Ry., 99 S. W. Rep., 355.)

MARYLAND.—Appeal—Record—Necessity of Bill of Exceptions — Railroads — Accidents at Crossings — Contributory Negligence—Unobstructed View—Country Crossings—Degree of Care Required.

1. A ruling of the trial court not included in a bill of exceptions will not be considered on appeal, though the prayer upon which the ruling was based is appended to the record and printed therein immediately after a bill of exceptions.

2. It was contributory negligence, barring recovery against an electric railway company for injuries at a crossing, for one to attempt to ride a horse across the track, where he could have seen the approaching car in time to have avoided a collision, but failed to look.

3. Since a higher rate of speed in the movement of electric cars is permissible in the open country than along the streets of a city, more caution is demanded of one crossing tracks in the country than in cities.—(Phillips vs. Washington & R. Ry. Co., of Montgomery County, 65 Atl. Rep., 422.)

MICHIGAN.—Street Railways—Injuries to Travelers—Contributory Negligence.

Where plaintiff, having stopped his horse and looked for an approaching street car at a point where he could see 75 to 100 ft. up the track, and seeing no car, proceeded to cross the track, he was not guilty of contributory negligence as a matter of law in failing to again stop his horse to look for a car, after he had passed an awning on an adjoining store building which obstructed his view, and when his horse's feet would have been within 4 feet of the rail and the horse's head within 2 feet of

the track, and on a line with the projecting car body.—(Hebblethwaite vs. Detroit United Ry., 108 N. W. Rep., 433.)

MICHIGAN.—Carriers—Injury to Passengers—Contributory Negligence—Negligence—Alighting from Moving Car—Trial—Verdict—Inconsistent Findings.

1. A street car passenger is not guilty of contributory negligence in alighting where the car comes to a stop for the purpose of permitting him and other passengers to alight, and while he is alighting it suddenly starts.

2. It is negligence to start a street car while a passenger is alighting therefrom at the express or implied invitation of the carrier.

3. It is not negligence per se for a street car passenger to attempt to alight at a usual stopping place if he has given the proper signal for the car to stop, and at the time that he makes such attempt he believes the car has stopped though it has not, but is moving so slowly that a prudent person under the same circumstances would alight.

4. Where, in an action for personal injuries to a passenger while alighting from a street car, the jury, in their general verdict and answers to special questions, found that the car started when plaintiff was alighting, an affirmative answer to a special question, "Was the car at a full stop when plaintiff stepped or got off?" was not inconsistent, since, the question being ambiguous, it would be inferred that the answer is merely a finding that the car was at a full stop when plaintiff "stepped," and not that it was stopped when he "got off."—Burke vs. Bay City Traction & Electric Co., 110 N. W. Rep., 524.)

MISSOURI.—Master and Servant—Personal Injuries—Assumption of Risk—Question for Jury—Contributory Negligence—Dangerous Conditions—Knowledge of Servant—Action for Injuries—Proof and Variance.

1. In an action for personal injuries suffered by plaintiff through having come in contact with a charged trolley wire while working as a carpenter in defendant's street car house, evidence held to justify submission to the jury of the question whether plaintiff assumed the risk.

2. In an action for personal injuries suffered by plaintiff through having come in contact with a charged trolley wire while working as a carpenter in defendant's street car house, evidence held to justify submission to the jury of the question whether plaintiff was guilty of contributory negligence.

3. A servant, working in proximity to trolley wires not required in the prosecution of the master's business to be kept charged with electricity, is not required to assume that they are so charged.

4. In an action for injuries to a servant, an allegation that plaintiff was ordered to do a certain thing by his foreman was supported by proof that plaintiff and another were ordered to perform the act, without specifying which of the two should do it.—(Cessna vs. Metropolitan St. Ry. Co., 95 S. W. Rep. 277.)

MISSOURI.—Carriers—Injuries to Passengers—Street Cars—Secure Position—Duty of Conductor—Negligence—Petition—Issues—Proof—Insecure Position—Speed—Contributory Negligence—Instructions.

1. Where the conductor of an open street car knew that decedent's position on the end of a seat and in front of an upright stanchion was not reasonably safe, it was his duty to control the running of the car with a degree of care proportioned to the danger to which decedent was exposed.

2. Where a petition charges negligence specifically, the acts charged, or some of them, as constituting negligence, must be proved in order to entitle plaintiff to a verdict.

3. Where the seat in defendant's street car, which deceased occupied at the time of the accident, was insecure, the conductor would be presumed to have had knowledge thereof, and deceased having been thrown from the car because of her insecure and dangerous position in connection with the swaying of the car, it was immaterial to plaintiff's right to recover whether the car was running at an excessive rate of speed or not.

4. In an action for death of a passenger by being thrown from a street car, defendant requested the court to charge that if deceased, of her own volition got off from the car while in motion, and in consequence of her own act in getting off, was thrown to the ground and sustained injuries from which she died, plaintiff could not recover though the car had not sufficient guards to the seats or was unduly crowded or was running at an unusual rate of speed, or though the track was rough and caused jerks and shocks of the car as it proceeded over the same. The court modified the instruction by adding a clause, unless the jury believe that the crowded condition of the car, the insufficiency of the guards on the seats or the running at an unusual speed or the roughness of the tracks, jerks, etc., or all combined, was the proximate cause of the injury. Held, that the instruction in its original form correctly presented defendant's defense of contributory negligence, and that the modification was improper.

5. Where, in an action for death of a passenger by being thrown from a street car, certain instructions presented the theory that if deceased voluntarily placed herself in a position of peril or voluntarily left the car "without the knowledge of the conductor or motorman in charge of the car or before they could interpose to prevent her," the carrier was not liable, such instructions did not cover an instruction that if decedent of her own volition got off the car while in motion and in consequence of her own act was thrown to the ground, and sustained injuries of which she afterwards died, the verdict must be for defendant, whether the conductor or motorman knew or might have known that she was in the act of getting off the car, or whether they took any steps to prevent her doing so.—(Van Horn vs. St. Louis Transit Co., 95 S. W. Rep., 325.)

MISSOURI.—Street Railroads—Collision with Team—Contributory Negligence—Evidence—Negligence—Instructions.

1. Testimony of plaintiff, who was driving on the right side of the street, that, on account of iron pipes lying in the gutter, he was obliged to drive so near the street car track as to be in the way of any passing car, but that, when he heard and saw the car coming 150 ft. behind him, he immediately turned his horses out from the track and in a moment's more time would have been out of the way, does not show contributory negligence.

2. Evidence, in an action for collision of a street car with an unloaded lumber wagon, coupled up short, so that the coupling pole, which alone was struck, projected 10 to 12 ft. to the rear, the accident occurring at night, when it was dark and somewhat misty, but opposite a Welsbach gas light, with one 75 or 80 ft. distant in either direction along the road, the car having a headlight, and the horses being large and white or gray, held sufficient to show negligence of the motorman.

3. The instruction in an action for collision of an electric car with a team, requiring that the motorman should have kept a vigilant watch for vehicles, is proper, not only under the "Vigilant Watch" ordinance of the city of St. Louis, but under the common law.—(Mertens vs. St. Louis Transit Co., 99 S. W. Rep., 512.)

MISSOURI.—Appeal—Review—Acquiescence in Instructions—Carriers—Injury to Passenger—Negligence—Burden of Proof—Instruction—Trial—Erroneous Instruction—Cure by Others.

1. Defendant does not asquiesce in an erroneous instruction, given for plaintiff, putting the burden of proof on defendant, before plaintiff has made a prima facie showing where, after instructions asked by defendant, declaring the contrary rule, have been denied, it asks an instruction containing a statement that such burden is on it, its purpose being to present the issues as favorably as possible to its defense, under the theory as to the burden adopted by the court.

2. An instruction, in an action for injury to a passenger on an electric street car, on the ground of an explosion, causing panic among the passengers, that, if an explosion occurred in the machinery of the car, causing a panic among the passengers, and plaintiff without fault received the alleged injury, then defendant had the burden of proving that the machinery was safe and sound, and that the explosion was caused by inevitable accident, or defects that could not have been known by the exercise of the highest human skill, diligence, and foresight, is erroneous, as making the explosion prima facie evidence of negligence under the doctrine of res ipsa loquitur, notwithstanding there was evidence to show that the explosion was not a dangerous one, but due to the combustion of fuses, such as often happens on electric cars when well constructed and operated, and not sufficient to excite a panic among persons of average intelligence.

3. Error of an instruction in putting on defendant the burden of proof, before plaintiff had made out a prima facie case of negligence, is not cured by an instruction that, if certain facts were found, defendant was not liable.—(Trotter vs. St. Louis & Suburban Ry. Co., 99 S. W. Rep., 508.)

MISSOURI.—Trial—Instructions—Applicability to Issues—Carriers—Injuries to Passengers—Care Required of Carrier—Findings—Contributory Negligence—Question for Jury—Pleading.

1. An instruction as to the liability of a carrier where a car started before the plaintiff had a reasonable time to alight was not erroneous, though the adjective "reasonable" was omitted from the averment of the petition relating to the time given plaintiff to leave the car.

2. Though a car remained stationary for a time, sufficient to have enabled a passenger to alight in safety by the exercise of reasonable diligence, this would not justify the starting of the car while she was in the very act of stepping to the street, and the carrier would be liable for resulting injuries without regard to the violence of the start.

3. In an action for injuries to a passenger, where the evidence showed that the only warning to the passenger was given almost simultaneously with the starting of the car, so that, under the circumstances detailed by the witnesses for either party, it would not affect the carrier's liability, there was no error in an instruction in failing to require a finding that the car was started without any warning being given to plaintiff.

4. Except where the risk involved in stepping from a moving car appears to be so great that an ordinarily prudent person would not incur it, the question of negligence in the act is for the jury.

5. Though the cause of action pleaded is the negligent act of a carrier in suddenly starting a stationary car while plaintiff was stepping from it, she would be entitled to recover where the proof showed that the car was moving, but not enough to enhance the danger of her act.—(Green vs. Metropolitan St. Ry. Co., 99 S. W. Rep., 28.)

MISSOURI.—Street Railways—Operation—Violation of Speed Ordinance—Cause of Injury—Trial—Instructions—Application of Law to Facts.

1. The violation of a speed ordinance by a street railway company is negligence per se, but plaintiff, injured in a collision with a car, cannot recover because of such violation unless it caused the injury and he used ordinary care to avoid the injury.

2. In an action against a street railway company to recover for injuries received in a collision, the giving of an instruction correctly defining the duty of the motorman without applying the law to the facts of the case is error, as it is the duty of the court to tell the jury what they must find to arrive at a correct verdict.—(Campbell vs. St. Louis Transit Co., 99 S. W. Rep., 58.)

MISSOURI. — Carriers — Street Railways — Negligence — Res Ipsa Loquitur—Action—Issues and Proof—Variance—Inspection—Trial—Instruction—Applicability to Evidence.

1. The collapse of a trap door forming a part of the floor of a street car, under the weight of a passenger who was simply walking thereon, resulting in injury to her, was evidence of negligence under the doctrine res ipsa loquitur.

2. Where, in an action for injuries to a street car passenger by a defect in the floor, the petition charged that the floor was rotten, worn, loose, and unfit for use, plaintiff was not confined to proving the defect of rottenness, but the petition was sustained by evidence that the floor was loose and unsafe.

3. Where a petition for injuries to a street car passenger alleged that the floor of the car was unfit for use, proof that the injury was caused by a defect in a trap door which formed a part of the floor did not constitute a variance.

4. In an action for injuries to a street car passenger by a defect in the floor of a car, an instruction that, if the car was inspected on the day it was sent out and was found in a safe condition with respect to a trap door forming a part of the floor through which plaintiff fell, then the allegation of defendant's negligence in maintaining the door was not sustained by the evidence, was properly refused as basing defendant's liability on the question of inspection, regardless of the character thereof.

5. Where, in an action for injuries to a passenger, several qualified physicians who attended her swore that the pleurisy and miscarriage from which she suffered were the direct and proximate consequences of the injury she received in falling through the floor of defendant's street car, instructions that there was no evidence that such injuries were due to the accident were properly refused, though defendant's physicians positively testified that plaintiff's condition was due to tuberculosis and was not caused by the injury.—(Jorden vs. St. Louis & M. R. R. Co., 99 S. W. Rep., 492.)

MISSOURI.—Street Railroads—Actions for Juries—Instructions—Speed—Appeal to Allege Error—Negligence—Actions—Instructions—Street Railroads—Action for Injuries—Instructions—Stopping Car—Trial—Ignoring Issues—Evidence — Conclusions — Objections — Witnesses — Credibility and Impeachment—Inconsistent Statements.

1. In an action against a street railway company for causing the death of plaintiff's son, the court instructed that "defendant had the right to operate its car at the place mentioned in the testimony at a rate of speed not exceeding 10 miles per hour. Before, therefore, you can find against the defendant on account of the excessive speed, you must find either that defendant operated its car in excess of the speed of 10 miles an hour, or at such a speed, which, under the evidence and circumstances given in the testimony, amounted to negligence, and unless you so find, and also further find that such excessive or negligent speed was the cause of the death of plaintiffs' son, the plaintiffs are not entitled to recover on account of such speed." Held, that the instruction was not objectionable as telling the jury that defendant had the absolute right to run its car then and there at the rate of 10 miles an hour regardless of circumstances, and the parties having admitted, to obviate the necessity of introducing an ordinance, that the speed limit was 10 miles an hour, defendant had the right to an instruction that it could run its car 10 miles an hour.

2. Plaintiffs cannot complain of an instruction drawn by defendant which followed the allegations of plaintiffs' petition.

3. Where several acts of negligence are charged, any one of which, it is alleged, caused or contributed to cause the accident, if the jury should find that one particular act was not the sole cause of the accident, they should not for that reason be instructed to disregard it entirely.

4. In an action against a street railroad company for causing the death of plaintiffs' son, the jury were instructed that defendant was not negligent in failing to stop its car after the plaintiffs' son was in a position of peril, unless he was in a position of peril a sufficient length of time to enable those in charge of the car to stop or check it, so as to avoid striking him, in the exercise of ordinary care on their part and with the means and instrumentalities at hand for stopping the car. Held, that the instruction was not objectionable as leaving out of view the duty of the motorman to be on the lookout for danger.

5. In an action against a street railroad company for causing the death of plaintiffs' son, the jury were instructed that if the son tried to run across the street in front of a moving car, and while it was so close to him as to prevent the motorman, in the exercise of ordinary care, from stopping his car so as to avoid striking him, whereby he was struck and killed, defendant was not liable. Held, that the instruction was not objectionable as ignoring defendant's liability for dragging the boy, when the evidence did not show that he lost his life thereby, and, if the evidence had raised such a question, this instruction did not eliminate it; neither was it objectionable as leaving out of view the question of excessive speed, as it follows plaintiffs' theory as shown by pleading and instructions.

6. In an action against a street railway company for causing the death of plaintiffs' son, a witness testified that deceased started to cross the street "and just as he got inside the east-bound track he stumbled; evidently, as I found later, there was a hole where the bricks had been sunken was what caused the child's fall. He stumbled there—" An objection was interposed here to the testimony on the ground that it was a conclusion. Held, that it was properly sustained as relating to the reason stated for the fall of deceased.

7. In an action against a street railway company for causing the death of plaintiffs' son, evidence of a witness who saw the accident from a house nearby that the motorman at the time "evidently was talking to someone on the platform," was inadmissible as being a conclusion.

8. In an action against a street railway company for causing the death of plaintiffs' son, the motorman, on cross-examination, said he was present at the coroner's inquest, but did not testify. Plaintiffs then produced a transcript of the evidence at the coroner's inquest by which it appeared that the motorman was sworn and in answer to questions, stated his name, residence, and business, but when asked as to the accident, said, "I don't care to testify. I might incriminate myself." Held, that it was proper to exclude that statement from the jury as the statement that he had not testified at the inquest was substantially true, and plaintiffs were not entitled to have the jury draw any inference to defendant's prejudice from the motorman's refusal

to testify.—Masterson et ux. vs. St. Louis Transit Co., 98 S. W. Rep., 504.)

MISSOURI.—Justices of the Peace—Pleading—Aider by Verdict—Defects in Petition—Street Railroads—Collisions—Contributory Negligence—Question for Jury—Negligence—Question for Jury—Evidence—Opinion Evidence—Competency of Witnesses—Trial—Requests for Instructions—Statutes.

1. Under Rev. St. 1899, Sec. 3852, providing that no formal pleadings shall be required in a justice's court, but that plaintiff shall file a statement of the facts constituting the cause of action, a statement in an action in justice's court against a street railway company for injuries to a vehicle in a collision with a car, alleging that the company was indebted to plaintiff for damages sustained by reason of a collision on a specified date and place in breaking a vehicle for a certain amount, sufficiently charges that the damage was negligently inflicted by the company as against an objection raised for the first time by motion in arrest of judgment.

2. One driving across a street car track at a time when an approaching car is 350 ft. away is not as a matter of law guilty of contributory negligence, though the paving between the track rails and adjacent thereto had been removed, leaving a space about 6 ins. deep for the vehicle, an ordinary carriage, to pass over.

3. Whether, in an action against a street railway company for damages to a vehicle in a collision with a car, the motorman in charge of the car kept a vigilant watch for the driver and vehicle, and at the first appearance of danger exercised ordinary care to check the speed of the car and avert the collision. Held, under the evidence, for the jury.

4. In an action against a street railway company for damages to a vehicle in a collision with a car, several witnesses testified that the car was operated on the company's tracks, that it was the same color as its cars, and bore its name painted on one side thereof. Held, that the issue whether the company was operating the car was for the jury.

5. A non-expert witness possessing the usual knowledge of time and distance is competent to give his opinion of the speed of a stret car.

6. Rev. St. 1899, Sec. 748, providing that either party "may" move the court to instruct, and the court "may" of its own motion give instructions, does not require the court to give instructions in a civil action where no instructions are requested.—(Hall et al. vs. St. Louis & S. Ry. Co., 101 S. W. Rep., 1137.)

MISSOURI.—Pleadings — Amendment — Departure — Street Railways—Negligence—Personal Injuries—Collision with Vehicle—Contributory Negligence—Question for Jury—Appeal—Questions for Review—Theory of Trial.

1. In an action against a street railway for injuries through negligence, there was no departure between an original petition alleging that the rate of speed of defendant's car was 30 miles an hour, and an amended petition stating that the speed was in excess of 20 miles an hour.

2. In an action against a street railway for injuries received by plaintiff in a collision between the vehicle in which he was driving and defendant's car, the question of plaintiff's contributory negligence held for the jury.

3. In an action against a street railway for injuries received by plaintiff in a collision between the vehicle in which he was driving and defendant's car, the question whether the running of a car approaching a street crossing in a city in the night time at a speed of 25 miles an hour was an act of negligence held for the jury.

4. Where, in an action against a street railway for personal injuries through negligence, defendant tried the case on the theory that it was the owner of and operating the car which caused the injury, its instructions recognizing that its agents were in charge of the car and its defense being that plaintiff was guilty of contributory negligence, it could not on appeal contend that the evidence did not show that it was the owner or in possession and operating the road at the time of the injury.—(Carey vs. Metropolitan Street Ry. Co., 101 S. W. Rep., 1123.)

MISSOURI.—Street Railroads—Injuries to Children—Acts of Motorman—Scope of Employment—Pleading—Instructions—Trial—Instruction—Omission—Request to Charge—Appeal—Evidence—Review.

1. An allegation that defendant was operating a street car in charge of a motorman on a public street, and that the motorman negligently left his post as he approached plaintiff, a child of tender years, near the track, and negligently waved to plaintiff, and so frightened him as to cause him to start to run across the track in front of the car, so that, before the motorman was able to regain his post and stop the car, plaintiff was struck and injured, sufficiently showed that the act of the motorman was within the scope of his employment.

2. In an action for injuries to a child by being struck by a street car while he was playing in the street, an instruction that if plaintiff was on the street north of defendant's track, and as the car approached defendant's motorman stepped onto the step of the front platform and reached towards plaintiff and frightened him, and by reason of plaintiff's want of discretion he was caused to run in front of the car and was knocked down and injured, and the motorman did not exercise ordinary care in so reaching toward plaintiff and causing him to be frightened, etc., plaintiff was entitled to recover, was not objectionable as failing to submit to the jury that the act of the motorman was within the scope of his duties.

3. Where, in an action for injuries to a child in collision with a street car, an instruction submitting defendant's liability was correct so far as it went, and defendant was not requested to charge that the motorman's action objected to must be found to have been within the scope of his duties in order to entitle plaintiff to recover, defendant could not object that such requirement was omitted.

4. The Supreme Court will not weigh the evidence on reviewing an objection that the verdict is the result of passion and prejudice.—(Wahl vs. St. Louis Transit Co., S. W. Rep., 1.)

MISSOURI.—Evidence — Experts — Hypothetical Question — Trial—Instructions—Requests—Duty to Request—Damages —Injuries to Passengers—Negligence.

1. Where, in an action for injuries an expert had previously testified as to the condition of plaintiff's leg, and a hypothetical question was directed solely to the condition of the leg when the doctor examined it, and to procure the physician's opinion as to whether the injury would be permanent, the question was not objectionable, because it did not assume all the facts proved, including the manner in which the injury was inflicted and its treatment.

2. Where a hypothetical question to a medical expert merely assumed that plaintiff's injury was the result of a sudden blow, such as a man might ordinarily get by being suddenly thrown or falling, or as would produce a wound such as would make the scar in question, which condition occurred about a year prior to the witnesses' examination, and was asked only to ascertain whether the condition was permanent, it was not objectionable as assuming that the injury of any part thereof was inflicted by defendant.

3. Where evidence was admitted for a special purpose only it was the duty of the party desiring to limit the evidence to such purpose to request an instruction to that effect.

4. Where plaintiff was injured while boarding a street car, and defendant claimed that the manner of treatment which plaintiff applied to his injury caused blood poisoning, which subsequently developed, plaintiff was not precluded for that reason from recovering for such injuries, unless the treatment given was negligent.—(Rosier vs. Metropolitan Street Ry. Co., 101 S. W. Rep., 1111.)

MISSOURI.—Appeal—Issues in Lower Court—Scope—Review —Harmless Error—Erroneous Admission of Evidence—Damages—Personal Injuries—Measure of Damages—Instructions.

1. Where, in an action against a street railway company for injuries to a person on its track, defendant's counsel in his opening statement stated that the motorman could not see plaintiff within a sufficient distance to stop the car, and that it was a question of the motorman not being able after seeing plaintiff to stop the car in time to avoid the accident, defendant, on appeal from a judgment against it, could not urge that there was a failure to prove that it either owned or operated the railroad or car.

2. Where, in an action against a street railway company for injuries to a person struck by a car, there was substantial evidence on the question of the negligence of defendant in failing to observe plaintiff on the track and to check the car in time to avoid the accident, the error, if any, in admitting the testimony of an expert on the question of the distance a car would move before it could be stopped because of the insufficiency of the hypothetical question propounded, was not prejudicial.

3. The error, if any, in the admission of a deposition on the ground that the party offering it had failed to show the non-residence of the witness, was harmless, where his testimony only tended to prove a fact otherwise established by competent and uncontroverted evidence, and the court could not, under the express provisions of Rev. St. 1899, Sec. 865, reverse the judgment on that ground.

4. An instruction on the measure of damages for personal injuries that the jury will award plaintiff such sum as shall compensate him for the mental and bodily pain and suffering endured by him consequent on the injury, and for the mental and bodily pain "which may be suffered by plaintiff in the future by reason of such injuries, if any, for any permanent injuries suffered by plaintiff, if * * * he has suffered any such permanent injury," does not permit the jury to award compensation for future pain and permanent injury, unless the same is reasonably certain to follow as a result of the injury.—(O'Keefe vs. United Rys. Co. of St. Louis, 101 S. W. Rep., 1144.)

MISSOURI.—Appeal—Reservation of Grounds of Review—Motion in Arrest of Judgment—Master and Servant—Injuries to Servant—Actions—Complaint—Allegation of Negligence—Instruction—Appeal Estoppel to Allege Error—Instructions—Master and Servant—Injuries to Servant—Actions—Assumption of Risk—Appliances—Duty of Master to Furnish—Trial—Refusal of Instruction—Instructions Already Given.

1. Where there is a motion in arrest of judgment which questions the sufficiency of the petition, the petition will be considered on appeal, though after a demurrer to the petition was overruled defendant answered.

2. A petition, in an action for injuries to an employee, while on a work car of defendant street railway company, which described the defective condition of the car, and averred that the defendant was negligent in furnishing the car for the work in the defective condition, is sufficient, without alleging that defendant knew, or could have known by the exercise of reasonable diligence, of the defects complained of.

3. In an action for injuries to an employee, alleged to be due to the defective condition of a car, an averment of the petition that the bearings over the truck did not slide or follow the turn of the car, but were rigid, and thus would cause the car to become derailed, was sufficiently definite to fully apprise the defendant of the issue to be met.

4. Where injuries were averred to be due to the defective condition of a car, and the evidence showed that the defect was in the bearings of the car alone, it was not error to instruct that if the jury found that the car and its appliances and bearings were defective, and that thereby it was caused to leave the track and injure the plaintiff, then he might recover.

5. Defendant cannot complain of expressions in instructions given, when instructions given at its request contain in effect the same expressions.

6. The fact that an employee knew of the defective condition of a car, and consented to ride on it, will not of itself preclude a recovery for injuries received in consequence of such defect, unless it was so glaring as to threaten immediate injury, or such that a person of ordinary prudence would not have used it to ride upon.

7. A master is not an insurer of the safety of his servants, and, where a car had been tested and inspected before it was used, the master was liable only for failure to exercise reasonable care to make the car safe, and was not bound to know of hidden defects in the car not discoverable by the exercise of reasonable care.

8. In an action for injuries to a servant, alleged to be due to the defective condition of a car, it was error to refuse an instruction that defendant was not an insurer of plaintiff's safety, but was obliged only to exercise reasonable care to provide a reasonably safe car, and was not bound to know of hidden defects not discoverable by the exercise of reasonable care, on the ground that it was covered by a given instruction that if the car was reasonably safe on the morning of the day of plaintiff's injury, and became ocut of repair later, so as to cause the accident, plaintiff could not recover unless defendant knew, or by the exercise of reasonable care might have known, of its defects.—(Clippard vs. St. Louis Transit Co., 101 S. W. Rep., 44.)

MISSOURI.—Carriers—Street Railways—Negligence—Injuries to Passenger—Instructions—Riding on Plantform—Evidence—Judicial Notice—Carriers—Injuries to Passengers—Evidence—Trial—Instructions.

1. In an action against a street railway for injuries received by a passenger, by being thrown off the platform of one of defendant's cars by a sudden lurch, an instruction that it is not necessarily negligent for one to ride on the rear platform of a car, though the same is crowded; that if when crowded defendant's car stopped, and plaintiff and others boarded it as passengers without objection by defendant, plaintiff was not negligent in boarding the car and remaining on the platform thereon, unless the danger was so obvious that a reasonably prudent person would have refrained from so doing, and unless after boarding the car plaintiff failed to exercise due care, was not erroneous, as taking from the jury the question whether plaintiff was guilty of negligence in riding on an overcrowded car.

2. It is not negligence as a matter of law for one to board and ride on the platform of a car.

3. It is not negligence as matter of law for one to board a street car without special invitation to do so.

4. The court takes judicial notice that in the operation of street cars they stop at street crossings for the purpose of taking on and letting off passengers, and that such stoppage is in the nature of a general invitation to all persons who desire passage to get aboard, whether the car be crowded or not.

5. In an action against a street railway for injuries received by a passenger through being thrown from the platform of a car by a sudden lurch, an instruction permitting a recovery on the ground of excessive speed when there was no allegation that the car was going at an excessive rate was not erroneous, the petition alleging generally that the injury resulted from defendant's negligence "in the construction, maintenance and operation of said line and car."

6. It is not error to refuse a requested instruction substantially covered by an instruction given.—(Baskett vs. Metropolitan St. Ry. Co., 101 S. W. Rep., 138.)

MISSOURI.—Carriers—Injuries to Passenger—Action—Issues—Questions for Jury—Evidence—Sufficiency—Trial—Non-suit—Evidence—Opinions—Examination of Experts.

1. In an action for injuries to a passenger, where the petition contains a general allegation of negligence, and alleges specifically the failure of the defendant's employees to stop a train before beginning the descent of an incline where the accident occurred, in not providing suitable means nor exercising reasonable care in the use of those furnished, in the failure of the employees to be at their proper posts of duty, and in causing one train to follow another down the incline, there is no presumption of negligence from the accident, but the specific allegations must be proved.

2. In an action for injuries to a passenger, where the petition alleged that the employees of defendant, in violation of a rule of the company and of ordinances of the city, failed to stop a cable train before it began the descent of an incline, and the evidence showed oral instructions to the motormen, and that the grip was likely to be loosened from the cable just before reaching that point, the refusal of an instruction withdrawing from the consideration of the jury that allegation of negligence was proper.

3. In an action for injuries to a passenger, an instruction that there is no evidence that defendant failed to provide proper means to hold the grip of the cable train firmly attached to the cable, and to stop the same when not attached thereto, was properly refused, where there was slight evidence of the first element of negligence named.

4. In an action for injuries to a passenger, evidence held to present a question for the jury whether the servants of the defendant were negligent in not properly using the appliances for controlling the movement of the cable train.

5. In an action for injuries to a passenger, evidence held insufficient to show that either the gripman or motorman of the cable train was not at his post of duty.

6. In an action for injuries to a passenger, where, at the close of plaintiff's case, there was evidence before the jury of the insufficiency of the appliances to stop the car on the incline where the accident occurred with the cable out of the grip, a non-suit was properly refused.

7. In an action for injuries to a passenger, questions to medical experts as to what they would attribute the cause of pains and his inability to sleep, if prior to the accident he was free from pains in the head, was able to sleep well, and was normal in his health, and after a street car collision, sufficient to

throw him out of the car and cause various bruises, he suffered from pains in the head and back, which he had not had prior to the occurrence, were not permissible, as they called for opinions on matters directly in issue.—(Roscoe vs. Metropolitan St. Ry. Co., 101 S. W. Rep., 32.)

MISSOURI.—Appeal—Preservation of Grounds—Exceptions—Scope—Motions—Statement of Grounds—Pleading—Petition—Election Between Counts—Appeal—Harmless Error—Rulings on Pleadings—Pleading—Waiver of Objections—Street Railroads—Collisions—Action—Questions for Jury—Care Required as to Persons on Track—Instructions.

1. Rev. St. 1899, Secs. 599, 603, 612, 613, 619, 640 and 641, contemplate that pleadings, demurrers and motions of like character shall be in writing. Defendant moved in writing that plaintiff be required to elect as to which count of the petition he would proceed upon, and the motion was overruled, and at a subsequent term on the trial he orally renewed the motion, which was overruled and exception taken. No exception to the ruling at the first term was preserved by a bill of exceptions. Held, that the ruling could not be reviewed on appeal, as the oral motion could not become a part of a bill of exceptions.

2. Rev. St. 1899, Sec. 640, provides that all motions shall be accompanied by a written specification of the reasons upon which they are founded, and no reason not so specified shall be urged in support of the motion. Held, that where defendant, in a motion to compel plaintiff to elect as to the count of the petition upon which he would rely, specified certain grounds of the motion, he could not be heard to rely on appeal upon any other ground.

3. In an action against a street railroad for the death of plaintiff's intestate in a collision between his vehicle and a car, the gist of the specifications of negligence in the petition being that deceased was killed through defendant's fault in, first, running in excess of a speed ordinance, and, second, in not stopping the car when a stop was called for and could have been made, there was no such contradiction or inconsistency in the allegations as to require the granting of a motion to require plaintiff to elect as to the allegations on which she would rely.

4. In an action for personal injuries, it is proper to rely in the same count on common law and statutory negligence, so long as the violated duties produce the one injury and the one damage constituting the subject matter of the action.

5. In an action against a street railroad for the death of one killed in a collision between his vehicle and a car, the petition counted on negligence in exceeding a speed ordinance, and in the violation of an ordinance requiring the operatives of a street car to keep a vigilant watch for vehicles and to stop the car in the shortest time and space possible on the first appearance of danger, and a motion to require plaintiff to elect as to which ground he would rely upon was overruled, but the theory as to the speed ordinance was eliminated from the case by the instructions. Held, that the vigilant watch ordinance being merely declarative of the common law, there was no error of which defendant could complain in denying the motion.

6. Where defendant moved to compel plaintiff to elect as between the various grounds of negligence relied on in the petition, but on the overruling of the motion filed an answer and went to trial, there was an abandonment of the motion, the allegations of the petition not being so contradictory as to be self-destructive.

7. In an action for the death of one killed in a collision between his vehicle and defendant's street car, the question of negligence held for the jury.

8. Though one driving a vehicle placed himself in a position of peril on a street railroad track, the railroad was liable for his death in an ensuing collision, where the operatives of the car failed to exercise ordinary care to prevent injuring him, though the conduct of the operatives of the car was not characterized by wilfulness, recklessness or wantonness.

9. In an action for the death of one killed in a collision between his vehicle and a street car, the court instructed that if the motorman saw decedent on his wagon on the track or so near the same as to be in danger of injury, and could have stopped the car without injury to the same or its passengers, and by stopping the car within the shortest time and space possible under the circumstances could have avoided injury to decedent and neglected to do so, in consequence of which neglect to stop, decedent was killed, plaintiff was entitled to recover. Held that the instruction was proper.

10. It was proper to instruct that the negligence of decedent must have directly contributed to the collision, in order to bar plaintiff's recovery, and that though decedent was negligent in going on the track, still, if defendant by ordinary care could have stopped the car with safety to it and its passengers in time to prevent the collision after the motorman discovered decedent's peril, if he did discover it, and thereafter negligently failed to stop the car whereby the collision ensued, plaintiff was entitled to recover.—(White vs. St. Louis & M. R. R. Co., 101 S. W. Rep., 14.)

NEW JERSEY.—Carriers—Passengers—Collision—Negligence—Proximate Cause of Injury—New Trial—Damages—Excessive Damages—Injuries to Person.

1. Plaintiff was injured while a passenger on a trolley car on a siding, in a collision with another which came upon the siding because of the open switch. It was the custom on the trolley line for each motorman to move the switch to suit his purpose and leave it for the next to do the same. Held, that the motorman on the second car was negligent in approaching the switch at such a rate of speed that he was not able to stop after he took the switch until he collided with the car in which plaintiff was a passenger.

2. Where plaintiff was injured by a motorman allowing his car to collide with the car in which she was a passenger, the negligence of the motorman was the proximate cause of her injury.

3. In an action for personal injuries resulting in a verdict for $15,000 for plaintiff rendered eight months after the injury, where the evidence as to whether or not the injuries were permanent, was in conflict, and it is shown that the lapse of a reasonable time will afford an opportunity to determine this question with a fair degree of certainty, a new trial will be granted.—(Stevens vs. New Jersey & H. R. Ry. Co., 65 Atl. Rep., 874.)

NEW JERSEY.—Street Railroads—Injuries to Travelers—Bicycles—Negligence—Contributory Negligence.

1. Plaintiff was riding a bicycle within a foot or two of defendant's street car track. He suddenly turned to cross the track, not at a street crossing, without looking to the rear, and was immediately struck by a car following him on such track. Held, that the motorman was not guilty of negligence in failing to anticipate that plaintiff would cross the track, and in failing to ring the gong or stop the car after plaintiff started to cross in time to prevent a collision.

2. Where plaintiff, while riding a bicycle along a street car track, and within a foot or two therefrom, attempted to cross the same immediately in front of a moving car, which was following him, he was guilty of contributory negligence in failing to look behind him before attempting to cross the track.—(Harbison vs. Camden & Suburban Ry. Co., 65 Atl. Rep.)

NEW JERSEY.—New Trial—Personal Injuries—Inadequate Damages.

In an action for personal injuries a verdict for the plaintiff for substantial damages will not be set aside as inadequate when it appears that all the substantial elements of damage were in dispute as to their extent, and it appears that the verdict may be the result of the application of good judgment to such conditions as might be fairly found from the evidence.—(Killen vs. North Jersey St. Ry. Co., 65 Atl. Rep., 836.)

NEW JERSEY.—Street Railroads—Care of Pedestrian—Obstructions to View.

1. It is the duty of a foot passenger crossing a street containing a car track to use his powers of observation while in a place of safety to discover approaching cars which may put him in danger.

2. If obstacles intervene to prevent observation, reasonable prudence requires delay until such observation as is requisite has been made.—(Hageman vs. North Jersey St. Ry. Co., 65 Atl. Rep., 834.)

NEW JERSEY.—Carriers—Injury to Passengers—Negligence—Question for Jury.

1. It appeared in evidence that a passenger boarded an open car and attempted to get upon the front platform, and was told by the conductor to get off and turned around and went along the run-board of the car, and then the car gave a sudden jerk when they put on full force, and the passenger fell to the ground and was injured. Held, in the absence of evidence to the contrary, that it was for the jury to say whether the defendant's negligence was established by the testimony.

2. The verdict for the plaintiff set aside; it appearing by the clear preponderance of evidence that the accident happened in an

entirely different way, and that the passenger's own negligence contributed directly to the happening of the accident.—(Budner vs. Public Service Corporation of New Jersey, 65 Atl. Rep., 8893.)

NEW JERSEY.—Carriers—Injury to Passengers.

It is negligence in the conductor of a trolley car which has come to a stop at a street corner, for the purpose of taking on passengers, to start it until he has exercised due care to ascertain whether all the persons there waiting to take it have safely boarded the car.—(Speer vs. West Jersey & S. R. Co., 65 Atl. Rep., 896.)

NEW YORK.—Street Railroads—Injuries to Infants—Contributory Negligence—Duty to Look and Listen—Instructions.

Plaintiff, an infant 6½ years old, but with sufficient age and discretion to appreciate to some extent the necessity for caution in crossing the street car track, was injured in attempting to cross in front of a car which was approaching him at a distance of not more than 15 ft. He attempted to cross between street crossings in daylight when the car was running slowly, and did not look in the direction of the car before attempting to cross. The court charged that there was no hard and fast rule requiring a person to look up and down the street when about to cross the track of a street surface railroad, and that, if the car was a sufficient distance away that a person exercising ordinary care might get across in safety, then the failure to look was not evidence of negligence. Held, that such instruction was erroneous and inappropriate, as plaintiff's failure to look was at least some evidence of negligence.—(Peterson vs. Interurban St. Ry. Co., 103 N. Y. Sup., 8.)

NEW YORK.—Damages—Personal Injuries—Evidence.

In an action for injuries to a passenger, the only evidence of damage with reference to lost time was that plaintiff at the time of the accident operated a small grocery store with the assistance of his wife; that for a period of four weeks after the accident he was unable to attend to his business, during which period it was run by the wife, assisted by a boy, who was paid $5 a week and board. There was no evidence as to the cost of the board, and plaintiff testified that he would have had to pay a person doing such work as plaintiff did in operating the store $15 per week. Held, that the evidence was insufficient to sustain a recovery for lost time except to the extent of $5 per week.—(Friedman vs. Brooklyn Heights R. Co., 102 N. Y. Sup., 526.)

NEW YORK.—Street Railroads—Collisions—Actions—Contributory Negligence.

In an action against a street railway company for injuries to a carriage and horses in a collision with a northbound car, the driver testified that, after stopping to let a southbound car pass, he drove onto the northbound car track without looking for a car, and that there was nothing ahead of the northbound car to prevent the motorman from seeing the carriage. Plaintiff, sitting on the back seat of the carriage, testified that he saw the northbound car approach a block away, and knew that the carriage stopped to let a southbound car pass, and that he did not say anything to the driver. Held to show, as a mater of law, contributory negligence, precluding a recovery.—(MacGuire vs. New York City Ry. Co., 102 N. Y. Sup., 750.)

NEW YORK.—Carriers—Injuries to Passengers—Warning of Danger.

The duty of a subway company to inform persons boarding its trains of the existence of a space between the car platform and the platform of the station was fulfilled, and the company was guilty of no negligence, where the guard on the train uttered the words, "Watch the step!" in such a manner that a person paying ordinary attention to what was going on about him would naturally hear the warning.—(Wertheimer vs. Interborough Rapid Transit Co., 102 N. Y. Sup., 706.)

NEW YORK.—Street Railroads—Collision with Vehicle—Contributory Negligence—Evidence.

The driver of a vehicle, who, when 10 or 15 ft. from an electric street railroad track, could see no car approaching within a distance of 500 ft., was not guilty of contributory negligence as a matter of law in attempting to cross the track.—(Heitz vs. Yonkers R. Co., 102 N. Y. Sup., 964.)

NEW YORK.—Street Railroads—Operation—Collisions with Vehicles—Contributory Negligence—Care Required—Signal Given.

1. Plaintiff, while driving on the tracks of defendant in the street and knowing that a car was approaching, turned from the tracks sufficiently to allow the car to pass, but before it did so turned again upon the tracks, without taking any precaution for his safety, and was struck by the car. Held, as a matter of law, that the plaintiff was guilty of negligence, precluding a recovery.

2. Whether notice was given of the approaching car was immaterial, because plaintiff knew it was approaching.—(Robinson vs. Crosstown St. Ry. Co. of Buffalo, 103 N. Y. Sup., 58.)

NEW YORK.—Master and Servant—Injuries to Third Persons—Negligence of Servant—Scope of Employment—Carriers—Street Railroads—Injuries to Passengers—Res Ipsa Loquitur—Trial—Joint Defendants—Reception of Evidence—Effect.

1. Plaintiff, a passenger on an open street car, was injured by the pole of a wagon belonging to defendants S. being driven into the car in a collision at a street crossing. The driver of the wagon disobeyed instructions, and permitted a boy to drive the team prior to the collision. The boy drove the team at a trot toward the crossing, and, seeing he was unable to stop in time to prevent the collision, called to the driver, who seized the reins, which had been at all times within his reach, but was unable to stop in time. Held, that the boy at the time of the accident, though not within the employ of defendants S., was engaged in their business, and that they were therefore liable both for his negligence and the negligence of the driver.

2. Where an open street car approached a street crossing at a high rate of speed, and was driven over the same without reducing the speed, resulting in a collision with an approaching team, so that the pole of the wagon penetrated the car near the rear, and injured plaintiff, a passenger, the circumstances of the accident were sufficient to raise a prima facie case of negligence of the carrier under the doctrine "Res ipsa loquitur."

3. Defendant railway company and defendant S. were joint defendants in an action for injuries to a passenger. Each interposed a separate answer and appeared by different counsel. Plaintiff offered evidence to charge both defendants with negligence, and rested, and, after a motion for non-suit by each defendant had been denied, the railway company examined its witnesses and renewed its motion for non-suit, which being denied the railway company took no further part in the case, after which defendant S. examined his witnesses, some of whose testimony tended to show negligence on the part of the railroad company. At the close of the evidence counsel for all the parties summed up the case. A verdict was returned against both defendants. Held, that the railway company having withdrawn from the case after the denial of its second motion for non-suit, the testimony subsequently given by its co-defendant could not supply defects in the evidence as against it, and should have been disregarded.—(Bamberg vs. International Ry. Co. et al., 103 N. Y. Sup., 297.)

NEW YORK.—Appeal—Review—Dismissal of Complaint—Master and Servant—Electric Railroads—Negligence—Personal Injuries—Change in Running Time—Evidence—Duty of Railroad—Question for Jury—Contributory Negligence.

1. On appeal from a judgment dismissing the complaint at the close of plaintiff's evidence, plaintiff is entitled to the most favorable inferences properly deducible from the evidence.

2. In an action against an electric railroad for injuries to a motorman received in a collision, it was properly held, on motion for a non-suit, that evidence that, though the published schedule running time between two points was 1 hour, yet the all-night car which plaintiff was operating when injured had for about a year been making the trip during certain hours of the night in 45 minutes, and that defendant's assistant superintendent, who directed the movements of cars, when asked by plaintiff for instructions as to making the trips in 45 minutes referred the latter to the conductor, who instructed plaintiff to make the trips in 45 minutes tended to show that defendant had changed the running time.

3. In an action against an electric railroad for injuries received in a collision between the car of which plaintiff was motorman and a work car, evidence that for several days prior to the accident the conductor of the work car had seen plaintiff's car arrive ahead of the published schedule time, which, according to defendant's rules, it was such conductor's duty to follow, did not tend to show knowledge on the part of the conductor of the work car that the running time had been changed by defendant.

4. Where, while making repairs in its line, an electric railroad

began to operate its cars in opposite directions over the same track, it was charged with the duty of guarding the safety of its employees by giving notice of a change in the running time of its cars.

5. In an action against an electric railroad for injuries received in a collision between the car whereof plaintiff was motorman and a work car, resulting from a change of the running time of plaintiff's car, the question of defendant's negligence in failing to notify its employees of the change was for the jury.

6. In an action against an electric road for injuries received in a collision between the car whereof plaintiff was motorman and a work car, the fact that plaintiff failed to inform his conductor that the headlight of his car had gone out, and that, being unable to adjust it, he had replaced it with a red lantern, did not show contributory negligence on plaintiff's part; it not appearing what the conductor would or could have done that was not done by plaintiff.—(Baldwin vs. Schenectady Ry. Co.)

NEW YORK.—Street Railroads—Negligence—Contributory Negligence—Knowledge of Danger.

Plaintiff was riding near the defendant's track in a one-horse open grocery wagon driven by his servant, when the wagon was struck by the car of defendant and he was injured. Held error to refuse to instruct the jury that, if the servant saw the car approaching, the question of the warning given by the motorman was unimportant.—(Kerin vs. United Traction Co., 102 N. Y. Sup., 423.)

PENNSYLVANIA.—Street Railroads—Rights of Public on Track—Collision with Traveler.

1. The right of the public to use the track of a street railway company is subordinate only to the right of the company to have a clear track.

2. In an action by husband and wife against a street railway company to recover for personal injuries by collision with a street car while they were riding at night in a buggy, the question of defendant's negligence was for the jury.—(Barto et ux. vs. Beaver Valley Traction Co., 65 Atl. Rep., 792.)

TEXAS.—Trial—Instructions—Charge on Weight of Evidence —Appeal—Assignments of Error—Sufficiency—Negligence —Physical Injury from Fright—Recovery.

1. An instruction, in an action against a street railway company for injuries to a passenger while boarding a car, that if the jury believe from the evidence the passenger attempted to board, and while holding on with one hand, with one foot on the running board, the car was suddenly started, throwing her to the ground, she was entitled to a verdict, was not a charge on the weight of the evidence, in that it assumed that the passenger was holding to the car with one hand, with one foot on the running board, at the time of the accident, for it required the jury to find such fact before a verdict in her favor could be rendered.

2. Where, in an action against a street railway company for injuries to a passenger, the uncontradicted evidence showed that the passenger was holding to the car, with one foot on the running board, with the other lifted above it, in her effort to enter the car, when it was set in motion, and there was nothing to show that her fall was caused otherwise than by its sudden starting while she was boarding it, an instruction that, if the passenger attempted to board the car, and in so doing, and while holding on with one hand to the car, with one foot on the running board and attempting to mount the car, it was suddenly started, throwing her to the ground, she was entitled to a verdict, was not a charge on the weight of the evidence.

3. An assignment that the court erred in refusing an instruction will be overruled, where no evidence is stated in appelant's brief, under the assignment, showing the applicability of the instruction, though it contained a correct principle of law.

4. Where a physical injury results from a fright caused by the wrongful act of another, and the wrongful act is the proximate cause of the injury, the person injured may recover for the damages sustained.—(El Paso Electric Ry. Co. vs. Furber, 100 S. W. Rep., 1041.)

TEXAS.—Street Railroads—Injury to Person on Track—Discovered Peril—Instruction—Liability of Company—Issue as to Injury—Necessity for Instructions.

1. In an action against a street railway company for injury received in collision with a street car, testimony that plaintiff, on driving into the street along which the track extended, looked but saw no car coming; that, as he drove up the rack a car struck his wagon; that the car was 35 or 40 ft. away when the motorman saw plaintiff was not going to stop; that he immediately reversed the car, and did all he could to stop it, but that it could not be stopped within that distance; and that if the car had been equipped with sand appliances he could have stopped it in time to have avoided the collision—was sufficient to require the giving of a charge on discovered peril.

2. Contributory negligence of one struck by a street car in attempting to cross the track in front of a moving car will bar recovery, if the motorman could not have stopped with the appliances at hand in time to have avoided the collision, though he could have stopped in time with the appliances that ought to have been provided but were not.

3. Contributory negligence of one injured, while attempting to cross a street failway track in front of a moving car, will prevent recovery, if the motorman did not actually see plaintiff's peril in time to have stopped the car, though he could have seen him in time in the exercise of ordinary diligence.

4. Where plaintiff sued a street railway company for injuries received in collision with a car, and there was testimony that the car pushed the wagon in which plaintiff was riding 6 or 8 ft.; that, after the car and wagon stopped plaintiff alighted upon his feet, and at no time fell to the ground; that he said he was not hurt, but that his team was nearly killed—the court should have instructed affimatively upon the negative side of the issue as to whether plaintiff was injured.—(Dallas Consol. Electric St. Ry. Co. vs. Conn, 100 S. W. Rep., 1019.)

VIRGINIA.—Carriers—Injuries to Passengers Alighting from Street Car—Negligence.

Where a passenger testified that the street car did not stop long enough to enable him to alight in safety, that as he was in the act of stepping to the rear platform the car suddenly started, that he was "rushed" out on the platform by the momentum, that the conductor "grabbed" him as he was attempting to seize the handhold, and that in that manner he was thrown from the car and injured, but this theory was rendered highly improbable by the construction of the car and other physical facts, he did not show a right to recover.—(Berkley St. Ry. Co. vs. Simpson, 56 S. E. Rep., 332.)

VIRGINIA.—Pleading—Objection to Evidence—Variance—Waiver—Trial—Instructions—Form—Appeal and Error—Harmless Error—Instructions—Trial—Instructions—Application to Evidence—Carriers—Injury to Passenger—Con tributory Negligence—Questions for Jury.

1. Va. Code 1904, Sec. 3384, provides that, if at the trial there appears to be a variance between the evidence and allegations, the court, if justice will be promoted, may allow the pleadings to be amended, or direct the jury to find the facts, and, after such finding, if it considers the variance such as could not have prejudiced the opposite party, shall give judgment according to the rights of the case. Held that where no objection was made to the admissibility of evidence and no motion made to exclude on account of a supposed variance, the objection must be considered on appeal as waived.

2. Instructions should be concrete, and should not enunciate merely abstract propositions of law.

3. The giving of an instruction enunciating merely an abstract proposition of law, instead of being concrete, is no ground for reversal, unless it appears that it was calculated to mislead or confuse the jury.

4. Where, in an action against a carrier for injuries to a passenger, the evidence for plaintiff showed the accident to be the result of the negligence of the motorman in prematurely starting the car when plaintiff was alighting, and the defense was that plaintiff stepped from the car while it was moving, an instruction that, though plaintiff was guilty of contributory negligence, yet, if the jury believed that the conductor knew of such negligence and could have avoided the accident, plaintiff's negligence would not defeat a recovery, was reversible error, as involving a hypothesis having no foundation in the evidence and tending to deprive the defendant of the defense of contributory negligence.

5. Where the operatives of a street car negligently carry a passenger beyond his destination, such conduct does not absolve him from contributory negligence in jumping from the car while it is in motion.

6. It is not negligence as a matter of law for a passenger to alight from a moving street car; but the question is for the jury under all the circumstances of the particular case.—(Newport News & O. P. Ry. & Electric Co. vs. McCormick, 56 S. E. Rep., 281.)

FINANCIAL INTELLIGENCE

WALL STREET, June 19, 1907.

The Money Market

A decidedly firmer tendency developed in the local money market during the past week, rates for all classes of accommodation ruling 1/4 to 1/2 per cent higher than those prevailing at the close of last week. The inquiry from stock commission houses was extremely light, owing to the inactivity in the securities market, and there was also a noticeable falling off in the demand from the railroads and other corporations. Nevertheless, there was no pressure of funds upon the market, and even at the higher rates the supply was very moderate. There was a disposition on the part of the financial institutions to strengthen their position in view of the heavy drafts soon to be made upon their resources. Last Saturday's bank statement revealed a further substantial loss in cash which carried the surplus reserve of the Clearing House institutions to the lowest point recorded in any corresponding period for the past ten years, and there are indications of a still further loss in cash during the current week. A feature has been the pronounced strength in the foreign exchange market rates for prime demand sterling, making a new high record for the year at 4.87.35. Under ordinary conditions, the advance in money rates and the recent heavy exports of gold would have been sufficient to bring about a decidedly easier exchange market, but those factors failed to have the slightest influence upon the course of the exchange market. The fact of the matter is that very little exchange has been sold against the gold exported, bankers not being disposed to draw long sterling bills owing to the uncertainty regarding the crops. The demand for gold at Paris appears to be as urgent as ever, and during the week $5,500,000 gold has been shipped to that center, making the total exports to date $15,900,000. Money at Chicago and other Western centers, however, is rather easier, and the rates of exchange at the interior points to a fairly heavy movement of funds in this direction, which will partly offset the week's loss in cash resulting from gold exports. Government disbursements for pensions, etc., are likely to be large from now on. A favorable development, and one that will have a very important bearing on the local money situation during the summer, is the shipment of gold from the Klondike to San Francisco, which in turn will doubtless be transferred to New York by telegraph, thus making the receipts from that source immediately available in New York. The first shipment amounting to $1,000,000 was made this week. Present indications are that the market will rule at about the present level until the close of this month, when the usual flurries in rates are to be expected as a result of the half-yearly interest and dividend disbursement. These payments are estimated at $175,000,000, the largest on record, and in addition provision must also be made for the $29,000,000 4 per cent bonds to be sold by the City of New York on the 28th inst. After July 1, payment to the Government on account of the $30,000,000 special deposits will be made, but this amount, as well as the moneys disbursed for interest and dividends on July 1, will soon be returned to the banks.

The bank statement made public on last Saturday was rather disappointing. Loans increased $1,689,500 and deposits decreased $4,369,200. The loss in cash amounted to $2,683,200, but as the reserve required was $1,217,300 less than in the preceding week, the surplus reserve was decreased by $1,465,900. The surplus now stands at $4,514,900, as compared with $7,073,375 in 1906, $7,209,500 in 1905, $38,869,975 in 1904, $10,099,575 in 1903, $12,158,250 in 1902, $6,611,350 in 1901 and $17,498,750 in 1900. Money on call loaned at 2 per cent and at 3 1/2 per cent, the average rate for the week being about 2 1/2 per cent. Money for fixed periods ruled at 4 per cent for sixty days, 4 1/4 per cent for ninety days, 4 1/4 per cent for four months, 5 per cent for five and six months and 5 3/4 and 6 per cent for seven and eight months.

The Stock Market

There was no material change in the position of the stock market during the past week. Dealings were upon an extremely small scale and prices showed no decided tendency in either direction. Speculation was again purely professional, the volume of outside business being unimportant. At times the market displayed a strong undertone, but every advance was met by fresh selling by bearish operators, and the net result for the week was a moderate loss in values. The chief influence at work was the resumption of the gold export movement to Paris, notwithstanding the heavy increase in the gold holdings by the Bank of France. During the week $5,500,000 gold has been shipped to the French capital, and as the position of exchange both here and at Paris favor French bankers, there is every indication of further shipments of the yellow metal later in the week. The result of this outflow of gold has been to materially reduce the reserve of the local banks, and to cause more or less apprehension regarding the immediate future of our money market. Rates for money in the local market have advanced 1/4 to 1/2 per cent during the week, and should shipments of the yellow metal continue, a further hardening in interest charges will undoubtedly result. In addition to the drain upon the resources of the local banks by gold exports, preparations must soon be made for paying the July 1 interest and dividends, which promise to break all previous records, and also for the payment of the $30,000,000 special Government deposits on July 10. Taking these matters into consideration, to say nothing of the lesser demand for money, the monetary situation at present is not at all encouraging.

The statement by Chairman Knapp, one of the most conservative members of the Interstate Commerce Commission, in which he took a very optimistic view of the future of the railroads and their relation to the Government was well received, and brought about a decided improvement in values. Sentiment was also improved by the decision of the Adams Express Company to disburse about $24,000,000 to its stockholders in the shape of a scrip dividend. Crop news was also more encouraging, but the effect of these favorable developments were only temporary, and at the close all of the improvements were lost. The failure of the Central Railroad of New Jersey directors to increase the dividend was interpreted to mean that there would be no increase in the Reading dividend, action on which was scheduled for late in the week.

The local traction shares were weak. Interborough-Metropolitan continued the downward movement, despite the statement made in usually well-informed quarters that payment of the preferred stock dividend would be continued for the balance of the year at least. Brooklyn Rapid Transit also shared in the general weakness.

Philadelphia

Extreme dullness characterized the market for local traction shares during the past week. Trading included a very small number of issues, none of which displayed any degree of activity. Prices, however, ruled firm. Philadelphia Rapid Transit, which has been the leader of the group, was traded in for less than 5000 shares at from 23 to 24 3/8. American Railways fell a fraction to 48 5/8, and Philadelphia Company common eased off to 39 7/8. Union Traction lost a point to 57, but subsequently recovered on light transactions. Philadelphia Traction and United Companies of New Jersey each advanced a point to 92 1/2 and 243 1/2 respectively. Railways General also improved at the close, the price rising 3/4 to 5 3/4.

Chicago

Further progress is reported in the reorganization of the Chicago Union Traction Company, and it is expected that within another week all differences will be satisfactorily adjusted. The Chicago City Railway Company has authorized an issue of $10,000,000 twenty-year first mortgage bonds, of which $6,000,000 will be made available at once, the remaining $4,000,000 to be held in reserve. Of the $6,000,000, one-half the amount will be used to take up $3,000,000 5 per cent three-year

notes which have been called for redemption on July 1, and the remainder will be used for equipment and other purposes of rehabilitation.

Trading in the traction shares was considerably more active during the week, and prices for all of the shares of the street railways ruled decidedly stronger. City Railway stock advanced 7½ points to 157½. West Chicago rose 7 points to 34, and North Chicago advanced to 42. Chicago Union Traction sold at 3½ and 3⅝, and the preferred brought 17. Other transactions included Chicago & Oak Park Elevated at 3½ and 3⅛, preferred at 17¼, and South Side Elevated at 83¾ and 83.

Other Traction Securities

Very little interest was manifested in the Boston market. Boston & Worcester held firm, with sales at 23 and 23½. Massachusetts Electric common and preferred each dropped a point to 15 for the first named and 56 for the latter West End common sold at 86 and 86½ and the preferred at 101¾ and 101. In the Baltimore market a fairly large number of issues was traded in, but the individual totals were small. United Railway issues were heavy, the 4 per cent bonds selling at 85¾ to 85, the incomes from 50½ to 50¼, and the refunding 5s from 79¼ to 78¾. United Railway stock sold at 11⅜ and 11, and Norfolk Railway & Light stock brought 17¼. Other transactions included Norfolk Railway & Light 5s at 95¼, and Knoxville Traction 5s at 104½.

But little activity was shown in tractions on the Cleveland Stock Exchange the past week. A few small blocks of Cleveland Electric sold at 48 and Forest City at 89. In fact, the Exchange made a record for light business in all securities.

Security Quotations

The following table shows the present bid quotations for the leading traction stocks, and the active bonds, as compared with last week:

	June 12	June 19
American Railways	48	48
Boston Elevated	133	a134
Brooklyn Rapid Transit	53½	52¾
Chicago City	150	155
Chicago Union Traction (common)	3	3
Chicago Union Traction (preferred)	17	14
Cleveland Electric	46	47
Consolidated Traction of New Jersey	71	71
Detroit United	63	63¼
Interborough-Metropolitan	16	16
Interborough-Metropolitan (preferred)	46	44½
International Traction (common)	45	—
International Traction (preferred), 4s	68½	—
Manhattan Railway	134	129¼
Massachusetts Elec. Cos. (common)	15	15
Massachusetts Elec. Cos. (preferred)	56	56
Metropolitan Elevated, Chicago (common)	22	22
Metropolitan Elevated, Chicago (preferred)	63	63
Metropolitan Street	80	81
North American	68	66
North Jersey Street Railway	40	40
Philadelphia Company (common)	39	39½
Philadelphia Rapid Transit	23½	24⅛
Philadelphia Traction	91¼	92
Public Service Corporation certificates	64	64
Public Service Corporation 5 per cent notes	92	92
South Side Elevated (Chicago)	83	83
Third Avenue	105	105
Twin City, Minneapolis (common)	91½	92
Union Traction (Philadelphia)	*57¼	58

* Ex-dividend. a Asked.

Metals

The "Iron Age" says that the pig iron markets are dull throughout the country and in some localities are distinctly weaker. Under more liberal offerings by steel works, both East and West, the steel market has weakened perceptibly. The demand for steel rails for delivery during the year 1908 from our own railroads has been to some extent held up, owing to the uncertainty as to the new specifications.

Copper metal remains practically unchanged, the large selling agencies quoting 25½c. for Lake and 25¼c. for electrolytic.

DETAILS OF THE PUEBLA TRAMWAY, LIGHT & POWER COMPANY'S ACQUISTIONS

The details are announced of the acquisition by the Puebla Tramway, Light & Power Company of the tramway system in Puebla, which is one of the largest cities in Mexico, and has a population of about 150,000. The company's concessions in the city are perpetual and give the sole right to operate tramways within the city for a term of fifty years, while the suburban franchise does not expire till 1988. The company intends to extend its present mileage (being 16 miles) to a distance of 40 miles, and to convert the whole system into electric traction, beginning with the belt line in the city and the suburban line to Chaluba.

The company has also acquired the entire electric lighting plant now operating in the city, and has secured an exclusive contract for the city street lighting till 1929, and negotiations are now pending for the extension of this contract. The electric lighting company in 1905 was supplying some 12,000 lamps, from which the net profit was $70,500 (gold). The company has also entered into a contract on advantageous terms with the Fortezuela Power Company for supplying power up to 2000 hp for twenty years.

Among the company's assets is one of the most valuable water powers in the Republic of Mexico. This power will develop at least 20,000 hp in the dry season, and the cost per horse-power for development it is stated will not be over one-half of the average cost of such installations. This power is situated at Tuxpangom, in the State of Vera Cruz, near the city of Orizaba, about 80 miles from Puebla. The transmission lines will pass through a country in which it is expected there will be a large demand for power in the future.

The company is incorporated in Canada and has a capital stock of $5,000,000 and an authorized bond issue of $6,000,000.

A TRAFFIC RECORD IN BROOKLYN

The Brooklyn Rapid Transit Company experienced one of the busiest days in its history on Sunday, June 16. The recent unfavorable weather deterred riding for pleasure, and so when Sunday proved so favorable all the lines to the beaches and pleasure resorts were crowded from early in the morning until long after midnight. Though the company planned a very liberal allowance on all lines and pressed into service all the available equipment, it was severely handicapped. No official figures of the day's business have been announced, but the returns are understood to have been about $80,000. About 4 o'clock in the afternoon the power station of the company in Kent Avenue succumbed under the heavy strain and a number of the machines had to be shut down temporarily. Passengers were not seriously inconvenienced by this, however, for the company called on the Edison Company for assistance, and after the short delay incident to interconnecting the lines there was no further trouble.

The company this year is making even a more systematic effort than ever before to suppress the rowdy, and with good effect. President Winter says of this work:

"The special policemen employed by the company are carefully selected and regularly in the service. The work cut out for them is to preserve order and to protect so far as possible the passengers of this company and the public generally while on our property from the disorderly element. Window jumping is a specific violation of the law and has been the occasion of many complaints, public and private, against this company. In its efforts to stop the rowdy practice and otherwise guard the comfort and safety of passengers, the company is hiring special police and paying them out of its own pocket.

"Our only object in employing these policemen is to provide some measure of safety and comfort for our patrons. We want to make it possible for women and children to go to and from Coney Island without being insulted and trampled down. The only way we can accomplish this is to police our cars in the most thorough manner possible. For that purpose we have hired a large force of special police, with the advice and endorsement of the city officers. Without these special police doing effective service one can easily imagine what the situation would quickly become."

THE SAN FRANCISCO SITUATION

An indication of the speedy termination of the San Francisco strike, if strike it can be called, is the action of the United Railroads in discharging from its employ 200 men whose two months' contracts, consummated last April, expire soon. Many of the men asked to be allowed to continue in the employ of the company, but the policy of the United Railroads is to give local men the preference. By dispensing with the services of these men the old carmen and others are given the opportunity to go back to work on a wage scale ranging from 25 cents to 33 cents an hour. Operating the cars now are scores of ex-union men, who, disgusted at the condition of union affairs, have gladly returned to work. Every line of the United Railroads is now running.

PROPOSED SINGLE-PHASE ROAD IN THE ADIRONDACKS

It is reported that the Paul Smith Electric Light, Power & Railroad Company, which is the owner of a 7-mile spur from Lake Clear Junction to Paul Smith's, is proposing the equipment of the line by electric power. A single-phase locomototive will be used with catenary overhead construction. The potential of the trolley wire will be 5500 volts and the locomotive will be equipped with mercury arc rectifiers which will deliver direct current to four G. E. 57 motors. Twelve 40-amp. rectifier tubes will be used with the necessary transformers. This locomotive, it is expected, will be able to haul three Pullman cars on a level at the rate of 30 m. p. h., Current will be taken from the power plant of the Paul Smith Company, which is developing a water power at Union Falls, 18 miles distant, from which power will be transmitted at 22,500 volts. It is hoped to have the line in operation this summer.

TRANSIT MATTERS IN NEW YORK

The Rapid Transit Commission has decided upon the principal conditions which will be incorporated in the form of contract for the construction of the Fourth Avenue and Coney Island subway. Acting on the suggestion of Mr. Rives, counsel to the Commission, the Commission decided to omit the clause which makes the contractor responsible for damages to abutting property on the entire route south of Flatbush Avenue. In other streets, however, such as Ashland Place and Flatbush Avenue, this clause will be incorporated in the contract. Mr. Rives explained that south of Flatbush Avenue such a condition in the contract was unnecessary inasmuch as Fourth Avenue is a wide street and there is very little danger that any of the abutting property will be injured by the tunnel excavating. The Commission also decided how the excavating is to be done. South of Flatbush Avenue along the entire route the street will be opened. It was explained that the small grass plots which are located in the center of Fourth Avenue can be used as open ditches through which the excavations will be hauled to the street. By this arrangement traffic will not be interferred with, as Fourth Avenue is almost 100 ft. wide. In Ashland Place and the other streets north of Flatbush Avenue the excavating will be done under cover. Chief Engineer Rice informed the Commission that the contract had been divided into fourteen sections, and that the estimated cost of construction for each would be approximately $1,500,000. This led to some discussion if it were not possible to economize to some extent.

The Bradley Contracting Company was the lowest bidder for each of the three remaining sections of the subway loop to connect the bridges in Manhattan upon which bids were opened last Thursday. All told there were thirteen bidders. The bid of the Bradley Company for the first section from Pearl Street to Park Row was $998,328; for the second, Delancey Street, from Center Street to the Bowery, $1,518,302; for the third, from the Bowery to Norfolk Street in Delancey, $1,229,136. The aggregate bid by the same firm for the pipe galleries in the three sections was about $120,000. The total cost of the loop will be $8,900,000. Two franchises were voted by the board to the Long Island Railroad. They cover two stretches of track each a mile and a half long. The tracks are to be used as cut-offs connecting the main line with the Montauk division at Glendale, so as to give quick access to the East River tunnels at Long Island City.

Chief Engineer Rice, of the Rapid Transit Commission, has told the members that it was a paramount necessity to improve the subway service between Ninety-Sixth and 103d Streets. Between these two points there were, he said, only two tracks, and this compelled the running of expresses and locals on the same track. He recommended that an additional track be built between those points, and said that the work would cost $850,000 and take sixteen months to complete. The Commission authorized the construction of the track. Chief Engineer Rice has also been authorized to extend the ventilation system of the subway on the Broadway branch north of Ninety-Sixth Street, at a cost not to exceed $280,000. The city has already spent $390,000 for ventilating the subway.

CHICAGO TRACTION NOTES

The Chicago City Railway has authorized a bond issue of $10,000,000 to be used in rehabilitating the system under the supervision of the board of engineers, of which Bion J. Arnold is chairman. The directors decided to place $6,000,000 of the issue on the market at once and hold the remainder in reserve. The issue is made up of twenty-year first mortgage 5 per cent bonds. It is said that arrangements have been made with the First Trust & Savings Bank to take up the whole of the $6,000,000 issue.

The management of the Illinois Tunnel Company has been changed, and it is probable that the tunnels, which have lain practically idle so far as freight transportation is concerned, will become an important factor in the handling of freight between railway stations and wholesale and retail establishments in the down-town district. J. Ogden Armour and Eastern capitalists are now in control. Samuel McRoberts, treasurer of Armour & Company, has been made president to succeed Albert G. Wheeler. The tunnel system embraces about 50 miles of tunnels under the down-town district, together with about 1200 cars of various types and about eighty locomotives, the majority of them electric. In constructing the tunnel there were issued about $17,000,000 of 5 per cent bonds, and there is $5,500,000 floating debt. The interest charges are more than $1,000,000 per year, and last year the earnings were about $225,000. The immediate result of the change in management will be to finish the tunnels now in the course of construction and to make connections with the basements of retail establishments and complete connections with various sources of freight. For this purpose it is said Mr. Armour and E. H. Harriman have agreed to raise $4,000,000.

The ordinance to allow the Chicago, Milwaukee & St. Paul Railroad to electrify its Evanston branch has again been brought before the local transportation committee. As agreed upon, the ordinance provides a 5-cent fare within the city limits and prohibits the use of the third rail.

The protective committee of the Chicago, West Division Railway Company and the North Chicago City Railway Company met in joint session Thursday, June 13, and agreed to accept a compromise proposition satisfactory alike to Judge Peter S. Grosscup and to the Union Traction interests, with which the underlying companies have been in conflict over the reorganization program. The action of the underlying committee puts at rest the possibility of law suits and condemnation proceedings, which the continuation of the controversy would have entailed. It insures the acceptance of the ordinances by the Chicago Railways Company, the new company that is to be formed out of the five now operating in the North and West Sides, and it also means the rapid rehabilitation of these lines, bringing the service up to the high standard required in the ordinances.

The Western representatives of the Chicago Union Traction Company and some of its underlying companies, who were in New York last Saturday, have returned to Chicago after having held several conferences there. It is understood that their trip to New York at this time had to do chiefly with the consideration of a plan of agreement under which the minority holders of Chicago West Division and North Chicago City Railway Companies would be willing to deposit their shares as the majority holders of the North and West Companies and the Chicago Union Traction Company have already done, preparatory to the acceptance of a new ordinance and a reorganization of the Chicago Union Traction Company through the Chicago City Railways Company. If the modifications are accepted the stock will be deposited and the ordinance formally accepted by the Chicago Railways Company in behalf of the companies which it will succeed.

IMPROVEMENTS PLANNED BY THE BUFFALO & LAKE ERIE COMPANY

The Buffalo & Lake Erie Traction Company, whose car house and twenty-two cars were recently destroyed by fire at Blasdell, has contracted with the General Electric Company for a new power plant which will be built near Athol Springs. Plans are also being made for a modern new car house. The company has also closed a contract with the Cincinnati Car Company for twenty-five cars.

NEW YORK CAR HOUSE DESTROYED BY FIRE

The car houses of the New York City Railway Company in Madison Avenue, between Eighty-Fifth and Eighty-Sixth Streets, were completely destroyed by fire early Sunday afternoon, June 16, entailing a loss estimated from $150,000 to $200,000. The fire was discovered at 12:40 o'clock in the southeastern end of the car houses, where about forty electric automobiles belonging to the New York Transportation Company were stored, and in less than 15 minutes the structure was aflame. Fortunately, most of the cars of the company were in operation at the time of the fire, so that there were only about a dozen cars in the car houses. Traffic on the Madison Avenue line was at a standstill practically the entire afternoon, but in order to relieve the congestion as much as possible the company operated extra cars on the Lexington, Third and Eighth Avenue lines.

THE CLEVELAND SITUATION

A postal card canvass is being made by the publicity department of the Cleveland Electric Railway in order to ascertain the sentiment of the people in various portions of the city. After that is done a good idea will be obtained as to where work in opposition to Mayor Johnson is needed. Whether the question is brought into politics or not a strong effort will be made to defeat him this fall.

A permit has been granted the Cleveland Electric to relay the track on East Ninth Street, so that the freight cars of the interurban roads may reach their station. Only a short stretch of this track was taken up, but the road has not been used since the company decided to cease operation on it with the other two streets.

Legal action has been taken to compel the Cleveland Electric to pave between its tracks for a certain distance on Detroit Avenue. The company objects to doing this work at its own expense when the city authorities threaten not to renew its franchise on this street next February, when it expires. The company will perhaps fight this through the courts rather than to put the extra expense on the street.

Active work has been continued through the week by the Cleveland Electric in its postal card campaign and the replies are said to be very gratifying both in number and substance. The company has not asked the aid of any political party in its fight against Mayor Johnson, but is making an independent fight against his re-election. With the opposition of the Republican party, and a split that occurred in his own party when County Clerk Charles P. Salen advised against allowing him to dictate the nominations on the Democratic ticket, it would seem that his fight will be a hard one.

W. B. Colver, president of the Low Fare Railway Company, has been given a permit to begin the construction of a line a quarter of a mile long from Woodland Avenue to Quincy Street. This, like the Sumner Avenue route of the Low Fare Company, lies along the side of a cemetery, where the consents of property owners are not necessary or may be given by the city. This grant will allow extensions toward the down-town district in case the Low Fare Company gets the right to build a road on Quincy Street.

The case of Edward S. Isom against the Low Fare Railway Company, appealed from Common Pleas Court, was taken up in Circuit Court Monday. The Judges are Harrison Wilson, of Sidney; S. A. Widlman, of Toledo, and Morris H. Donahue, of New Lexington. Mr. Isom has applied for an injunction against the company to prevent the construction of a road on the old Central Avenue-Quincy Street route, on the ground that the company did not have consents of the property owners, and that consents could not be transferred from the Forest City Railway Company to the Low Fare Railway Company. Judge Phillips sustained these contentions.

IMPROVEMENTS OF THE UNION ELECTRIC COMPANY

The Union Electric Company, of Dubuque, Ia., does not propose to enter immediately into contracts of importance, though the money which is realized from the sale of the stock will be sufficient to finance the improvements and extensions for a period of three or more years. These improvements will consist largely of the purchase of additional rolling stock, transformers, meters and lamps required through the growth of the light and power business, heavier rails for some of the track now in operation, permanent improvements at company's park, and at a future date the construction of three or four additional miles of track.

THE CINCINNATI, NEWPORT & COVINGTON LEASE

In order to comply with the requirements of the Ohio laws in the lease of the Cincinnati, Newport & Covington Light & Traction property, those interested in the Columbia Company will shortly incorporate the Columbia Gas & Electric Company of Ohio. The lease will be made to this company and assigned to the Columbia Company of West Virginia. The lease is for ninety-nine years, and will be dated April 1, 1907. The lessee agrees to guarantee the interest on all outstanding bonds, the 4½ per cent dividend on the preferred stock and a graduated scale on the common stock, beginning with 3½ per cent the first year and increasing to 6 per cent in the sixth year, which is the rate to be paid thereafter. The first quarterly dividend on the common stock will be paid on July 15.

Holders of ten shares or more of the original railroad stock may subscribe for bonds of the Columbia Company on the basis of 90 per cent of the face value of such bonds to the extent of 50 per cent of their holdings and the same amount of common stock as a bonus. Those who have less than ten shares of stock may subscribe for one $500 bond, paying for it $450, and receiving $500 stock as a bonus.

A statement made to the stockholders shows that the bond issue of $25,000,000 of the Columbia Company will be used for the following purposes: $9,000,000 for the purchase of the Cleveland gas properties, $6,000,000 to build a pipe line to Cleveland, $6,500,000 to build a pipe line to Cincinnati, $1,000,000 to acquire gas fields in West Virginia, and $2,500,000 to provide a guaranty fund and take care of future developments.

RAILWAY ENGINEERING AT UNIVERSITY OF ILLINOIS

The Bulletin of the University of Illinois, descriptive of its courses in railway engineering and administration for 1907-08, has just been issued. As already announced in these columns the university has recently made railway engineering and administration the subject of special instruction, which is divided up into four courses: (1) Railway civil engineering; (2) railway mechanical engineering; (3) railway electrical engineering; (4) railway administration. The first two are intended primarily for those who intend to enter the service of steam roads in the departments of way and of motive power, the third for those who will find employment in electric railways, and the fourth to prepare men for service in all departments of railway work other than engineering and legal. Each course occupies four years. It is understood that the position of professor of railway engineering at the university is still vacant and that candidates are being considered. The man selected for this position will be the head of the newly-formed railway engineering department and will have general charge of the engineering work.

HANDLING FREIGHT IN PENNSYLVANIA

In some instances the electric railways of Pennsylvania will enter into contracts with outsiders to handle the freight business allowed under the new law. This is the case at Scranton, where the Quick Delivery Express Company has entered into a long-term contract with the American Railway Company for the exclusive right of carrying freight over the street car lines from Pittston to Forest City. At present several quick delivery cars are operated on certain lines, but from this time on great quantities of freight will be thus transported over every line of the Scranton Railway Company. One of the features of the enlarged scheme is to erect stations in every town along the lines, all of which will be connected with the main tracks by switches. The central station will be in this city, and when the service is in full operation 100 men will be employed.

VARIOUS RAILROAD PROJECTS HEADED FOR SACRAMENTO

Northern California has been the field for some time of a number of railway projects, some under construction and others building, and of these lines no less than eight appear to be headed for Sacramento, the capital of the State. These are in addition to the four Southern Pacific steam lines and half dozen steamship lines centering in Sacramento. Beginning on the north the first new railroad is the main line of the Western Pacific, building from Ogden, Utah, to San Francisco. This company, which it is rumored may use electric power for part or all of its system, is now working 10,000 teamsters and graders on its lines through Nevada, Plumas, Butte, Yuba and Sacramento Counties, and promises to be running construction trains into Sacramento to Twentieth and J Streets by Nov. 1 next.

The second railway is that of the Northern Electric Company, previously mentioned in the STREET RAILWAY JOURNAL at different periods. This company expects to have construction trains running to its main depot at Eighth and K Streets, Sacramento, by Aug. 1.

The third railway is the Vallejo & Northern Electric line, headed by President Melville Dozier, Jr., which has already applied for a franchise to cross the river at the foot of P Street. This line will run from Vallejo through Fairfield and Woodland to Sacramento with branches to Suisun and other points, tapping one of the richest parts of Northern California.

Number four is the Sacramento Southern steam railway, owned by the Southern Pacific, which has several hundred men under Chief Engineer Wheeler now working on the levees and grades near the Johnston place, 20 miles down the river. This line will tap the main Southern Pacific line a mile this side of Antioch, and run 45 miles, following the river to this city, giving a route of almost exactly 100 miles from Sacramento to Third and Townsend Streets, San Francisco, without a single ferry en route. When this line is completed it is expected that the company will have no difficulty in shortening the distance between Sacramento and San Francisco to 2½ hours. Number five is the Central California Traction Company's railroad building now from Stockton via Lodi and Elk Grove to this city, which also proposes to run lines into Calaveras and Mariposa Counties. This railroad, which is already in operation this side of Lodi, will enter the city on the eastward over its private right of way, between J and M Streets, through what is known as the Smith tract. Number six is the Lake Tahoe & Eastern Electric Line, which has just been financed in New York, and which will begin construction some time this summer on its line from Sacramento to the eastern shore of Lake Tahoe via Placerville, a distance of about 100 miles. Number seven is the Santa Fe, which is now making preparations to extend its line from Stockton to this city as soon as the labor market lets up a little. This line will probably run from Antioch, which is already tapped by the Santa Fe, requiring about 45 miles' construction to reach Sacramento. Number eight is the Grass Valley & Midland, which has just put a corps of surveyors in the field running from Grass Valley to Marysville. At a point about 10 miles west of Grass Valley it is proposed to run a branch line into Sacramento direct, tapping another rich and fertile region.

THE CONESTOGA COMPANY PERFECTING ITS PLANS FOR IMPROVEMENTS

The boards of directors of the Conestoga Traction Company, the Edison Illuminating Company and the Columbia Electric Light Company and the executive committee of the Susquehanna Railway & Light Company held meetings June 12 for the transaction of routine business and to arrange for extensions and improvements. A dividend of 5 per cent, payable on July 1, was declared on the preferred stock of the Lancaster County Railway & Light Company. It was announced that an agreement has been signed with W. J. Hayes & Company, who constructed and now operate the Philadelphia, Coatesville & Lancaster road, who also operate a line between Coatesville and Parkesburg, and partly constructed a line between Parkesburg and Christiana, whereby they agree to sell their property to the Susquehanna Railway & Light Company. The executive committee of the latter company has passed resolutions directing its officers to proceed with all possible speed to improve the line between Coatesville and Christiana, to reconstruct that part of the line between Parkesburg and Christiana, and to build the remainder. This line between Christiana and Coatesville will be operated by the Conestoga Traction Company in connection with the Lancaster & Eastern Company. It is expected that within a few months through cars will be run between Lancaster and Coatesville. Between the latter place and Philadelphia there are several lines in operation. For these extensive improvements, and also the enlargement of the Engleside power plant, and the erection of a new car house, financial arrangements have been made.

A NEW ISSUE OF BONDS AT BIRMINGHAM

The stockholders of the Birmingham Railway, Light & Power Company have ratified the action of the directors in calling for the issuance of $35,000,000 of bonds for the retirement of outstanding bonds and securing funds for most extensive developments. Principal among the new improvements will be the building of a $1,500,000 power house at North Birmingham on a tract of 23 acres already obtained. A large number of new cars will be bought for the interurban service.

ANNNUAL CONVENTION OF A. I. E. E.

The annual convention of the American Institute of Electrical Engineers will be held June 25-29, at Niagara Falls. The Institute headquarters during the convention will be at the Cataract Hotel. The following program has been adopted:

TUESDAY, JUNE 25

President's address, "The Properties of Electrons," by Samuel Sheldon; "Protective Apparatus Engineering," by E. E. F. Creighton; "Practical Testing of Commercial Lightning-Arresters," by Percy H. Thomas; "A Proposed Lightning Arrester Test," by N. J. Neall; "Interaction of Synchronous Machines," by Morgan Brooks; "The Heating of Copper Wires by Electric Currents," by A. E. Kennelly; "Deflocculated Graphite," by E. G. Acheson.

WEDNESDAY, JUNE 26

High-Tension Transmission Committee.—"Choke Coils vs. Extra Insulation on the End Windings of Transformers," by S. M. Kintner; "Protection of the Internal Insulation of a Static Transformer Against High-Frequency Strains," by Walter S. Moody; "Transmission Line Towers and Economical Spans," by D. R. Scholes; "Lightning Rods and Grounded Cables as a Means of Protecting Transmission Lines Against Lightning," by Norman S. Rowe; "The Transmission Plant of the Niagara, Lockport & Ontario Power Company," by Ralph D. Mershon; "Location of Broken Insulators and Other Transmission-Line Troubles," by L. C. Nicholson; "A New Type of Insulator for High-Tension Transmission Lines," by E. M. Hewlett; "Some New Methods in High-Tension Line Construction," by Harold W. Buck; "Switchboard Practice for Voltages of 60,000 and Upward," by S. Q. Hayes; "Some Power Transmission Economics," by F. G. Baum; "One-Phase High-Tension Power Transmission," by E. J. Young; "Commutating Pole Direct Current Railway Motors," by E. H. Anderson.

THURSDAY, JUNE 27

Topical Discussions.—(a) "Single-Phase vs. Three-Phase Generation for Single-Phase Railways," by A. H. Armstrong. (b) "The Choice of Frequency for Single-Phase Alternating-Current Motors," by A. H. Armstrong. (c) "Twenty-Five vs. Fifteen Cycles for Heavy Railway Service," by N. W. Storer. Report of the committee on a code of ethics; "The Attitude of the Technical Schools Toward the Profession of Electrical Engineering," by H. H. Norris; "The Concentric Method of Teaching Electrical Engineering," by Vladimir Karapetoff; report on the proposed revision of the standardization rules by the standardization Committee.

FRIDAY, JUNE 28

"Track-Circuit Signaling on Electrified Roads," by L. F. Howard; "Regeneration of Power with Single-Phase Electric Railway Motors," by William Cooper; "Notes on Transformer Testing," by H. W. Tobey; "Inductive Disturbances in Telephone Lines," by Louis Cohen; "Fractional Pitch Windings for Induction Motors and Alternators," by C. A. Adams, W. K. Cabot and G. Æ. Irving, Jr.; "Power Factor, Alternating-Current Inductive Capacity, Chemical and Other Tests of Rubber-Covered Tires of Different Manufacturers," by Henry W. Fisher; "The Vector Diagram of the Compensated Single-Phase Alternating-Current Motor," by W. I. Slichter; "Zigzag Leakage of Induction Motors," by R. E. Hellmund.

ALLIS-CHALMERS RAILWAY EQUIPMENT USED IN TRACTION SYSTEMS

Since its advent in the electric railway field the Allis-Chalmers Company has equipped six complete electric traction systems aggregating a total of 318 miles of trackage. Of these 150 miles are already completed and in daily operation. Descriptions have been published in this paper of several of these roads, but a summary may prove of interest. These six systems are as follows: (1) The Toledo, Port Clinton & Lakeside. This road has a trackage of 46 miles, two 800-kw engines and generators, 50-foot cars equipped with quadruple 50-hp motors, and three sub-stations of 400 kw each. (2) The Cincinnati, Milford & Loveland Traction Company. The total trackage of this company with extension now under construction is approximately 40 miles. The power station is equipped with two 500-kw engines and generators, transformers, rotary, etc. There are three sub-stations, and the cars are propelled by 40-hp motors. (3) The Winona Interurban Railway Company. This road runs from Warsaw and Winona Lake to Goshen, Ind., with an extension to Peru, Ind., giving a total trackage of approximately 77 miles. The power station is equipped with two 600-kw engines and generators, transformers, rotaries, etc., to provide for a transmission voltage of 33,000 volts, on which the system is operated. Seven sub-stations of 300 kw each, all complete, and sixteen cars equipped with quadruple 75-hp equipments are provided. The cars are 60 feet over-all, and are designed for a speed of 56 m. p. h. (4) Indianapolis, New Castle & Toledo. This system, which is now nearly completed, extends from Indianapolis to New Castle, Richmond and other cities in Indiana, with the intention of ultimately reaching Toledo, Ohio. The total trackage now under construction is 90 miles. The power station consists of two 1000-kw steam-driven units, transformers, rotary, etc. The transmission voltage used is 33,000. There are ten 60-foot cars equipped with 75-hp equipments, and four sub-stations of 400 kw each. (5) The Indianapolis, Crawfordsville & Western. This system will operate from Indianapolis westward to the city of Crawfordsville, Ind., and is intended to connect with the McKinley syndicate lines in Illinois. It will be 45 miles in length. The power station consists of two 700-kw engine and generator sets with transformers, etc. Transmission voltage is 33,000 volts. There are three sub-stations of 300 kw each. Ten cars fitted with quadruple 75-hp equipments are provided. (6) The Milwaukee Northern Railway. This line will operate from Milwaukee to the town of Port Washington, Wis., over a trackage approximately 25 miles in length. The power house consists of three 1000-kw twin tandem gas engines and generators, and complete auxiliaries, including transformers for 22,000-volt transmission. This installation will constitute the largest in America of gas-engine-driven electrical units used for traction purposes. Eight sub-stations with complete equipments, including switchboards, are included.

SPECIAL MESSAGE ON ELECTRIC RAILWAYS IN CONNECTICUT

Governor Woodruff, of Connecticut, sent to the Legislature last week a special message dealing with trolley legislation. The Governor deplores the present method by which each company secures a separate grant, some with more or less liberal stipulations, and favors a general statute to give eminent domain to the electric railways for right of way only. The Governor is of the opinion that the power of eminent domain is essential to securing right of way for a street railway corporation; that power should be embodied in a general statute in which all street railways of the present day, as well as those to be chartered in the future, can operate.

"In some charters," says the Governor, "the right is given not only for right of way to operate a railway, but to establish and maintain upon private lands and upon public grounds lines of poles and wires, and underground conduits and wires and cables; the board of directors being allowed to be the judges of what is necesary for the conduct of their business in that particular. I cite that because I believe it against public policy to permit any corporation to exercise powers of such wide latitude, and because I believe that the Railroad Commissioners should have the power of supervision in such cases. I believe also that there should be a more careful provision of law concerning the location of power houses and that such matters differing from right of way should not be left subject to power of eminent domain."

The Governor has drawn the following bill in accordance with his ideas and has urged that the Assembly pass it at this session:

THE BILL PROPOSED

State of Connecticut, General Assembly,

January Session, 1907.

An Act Concerning the Taking of Land by Railway Companies.

Be it enacted by the Senate and House of Representatives in General Assembly convened:

Section 1. In this act "street railway" or "railway" means a railroad or railway including poles, wires or other appliances and equipments connected therewith of a class operated by motive power other than steam and usually constructed on the public ways and places; but it shall not apply to a railroad company operating its railroad or a part thereof under the provisions of section 3697 of the general statutes.

Sec. 2. When any company shall have been chartered by the General Assembly for the purpose of operating street railways, such company may construct and operate its railway with one or more tracks and all necessary equipments and appliances upon private lands permitted by said company's charter and the amendments thereof, but before such company shall proceed to construct such railway or lay additional tracks, it shall cause a plan to be made showing the lands through which it proposes to lay its tracks, the location of the same as to grade and the center line of the proposed construction of such railway, and such changes as are proposed to be made in said private lands, and the boundaries of its proposed location shall be shown thereon. And said plans shall be presented to the Railroad Commissioners with a petition for their approval of said location. Before the Commissioners shall approve the layout and location of any railway or the taking of any real estate for the purposes of said railway or any change or alteration of the same, they shall give reasonable notice to all persons having an interest in said real estate to attend and be heard, and the appraisers as hereinafter provided for shall cause a like notice to be given to all persons interested in said real estate. If any person resides out of this State or is a femme covert, infant, or cestui que trust, or is non compos mentis, any judge of the Superior Court may prescribe the notice to be given to said person.

If the layout and location of said railway is approved by the Railroad Commissioners the railway company may take as much real estate as said Commissioners may have found necessary for the proper construction and security of said railway, but said Commissioners shall first prescribe the limits within which real estate shall be taken for said purposes, and no railway shall lay out or finally locate its road without the written approval of the location by said Commissioners. Said Commissioners may on application of any railway company and after due notice and within the limitations and methods heretofore set forth amend or change any order as to location and layout approved under the provisions of this act.

Sec. 3. When a railway has secured its location and layout and the approval of the taking of lands as provided in section 2 of this act, said company shall have the right to take land in the manner provided in section 3657 of the general statutes.

Sec. 4. Except as herein provided, no railway company shall exercise the right of eminent domain, and this act shall be an amendment to all charters granted or hereafter granted to railway companies.

Sec. 5. This act shall take effect from its passage.

STREET RAILWAY PATENTS

[This department is conducted by Rosenbaum & Stockbridge, patent attorneys, 140 Nassau Street, New York.]

UNITED STATES PATENTS ISSUED JUNE 4, 1907

855,492. Conduit for Electric Railways; John S. Alexander, New York, N. Y. App. filed March 14, 1904. The conduit comprises a pair of insulated clamps which grip the conductors. The clamps have a removable upper portion whereby the conductors may be easily removed and replaced.

855,601. Electric Railway Switch; Edward F. Winfield, Los Angeles, Cal. App. filed July 7, 1903. Electromagnetic means for closing the switch when the car is a definite point from the switch, and means intermediate of said point and the switch for causing the switch to open when the car takes more than a definite amount of the electric current.

855,723. Electric Regulating Device; James F. McElroy, Albany, N. Y. App. filed July 10, 1905. A dynamo-regulating device including a motor and contacts in the motor circuit adapted to be closed by a magnet set to act at a voltage greater than that required by the motor when exerting the maximum torque imposed by the devices which it operates.

855,727. Electric Signaling System; Edward L. Orcutt and Richard Sheldon, New York, N. Y. App. filed Sept. 1, 1906. Provides a signaling circuit on the train adapted to be governed by a controller which is operated by the track rail circuit.

855,876. Ratchet Brake Mechanism; Joseph M. Bosenbury, Decatur, Ill. App. filed Aug. 25, 1906. A vertical brake staff has a horizontal bevel gear wheel meshing with a vertical bevel gear wheel to which the brake lever is attached.

855,966. Electric Signaling Device; Edward L. Orcutt, New York, N. Y. App. filed Sept. 1, 1906. Comprehends an electric train-stop device having circuits including only the usual track rails by which the alarm circuits, etc., are operated in the engine cab.

855,967. Electric Signaling Device; Edward L. Orcutt, New York, N. Y. App. filed Sept. 1, 1906. Modifications of the above.

855,968. Electric Signaling Device; Edward L. Orcutt, New York, N. Y. App. filed Sept. 1, 1906. Further modifications.

855,971. Railway Signal; Charles C. Phillips, Owensboro, Ky. App. filed Aug. 6, 1906. A sector-shaped semaphore arm swings in a circular casing under the influence of separate operating locking magnets.

856,010. Electropneumatic Braking Device for Railway Cars; Ragnar Wikander, Westeras, Sweden. App. filed Dec. 26, 1906. Provides an electropneumatic braking device in which only one valve body will be required and in which an automatic adjustment of the braking pressure can be effected by means of each of the two controlling systems.

856,087. Rail Joint; Charles L. McVoy, Pensacola, Fla. App. filed Jan. 16, 1907. The webs of the rails are thickened at abutting ends and the base, web and tread of the rails interlap at different points.

856,094. Electrical Signaling Device for Railroads; Edward L. Orcutt, New York, N. Y. App. filed Oct. 13, 1905. Relates to that type of railway signal in which the track rails are energized by an alternating current and means for displaying signals in the locomotive cab.

856,095. Electric Semaphore; Edward L. Orcutt, New York, N. Y. App. filed Sept. 1, 1906. Details of construction of a semaphore for use in the above system.

856,125. Concrete Tie; Manley E. Woodbury, Bowling Green, Ohio. App. filed March 11, 1907. Consists of a plurality of trapezoidal sections having their adjacent ends spaced apart and their upper faces formed with seating grooves for the reception of the rails, and brace rods connecting the rails and serving to maintain the tie sections in spaced relation.

856,127. Rail-Bond; James J. Brennan, Fort Wayne, Ind. App. filed Sept. 24, 1906. Consists of two terminals having upon their inner face a longitudinal recessed lug adapted to receive the rift-pin which is adapted to be expanded by contact with the bottom thereof and a flexible portion connecting the terminals and secured thereto by soldering.

856,179. Electric Signal; Robert Pfeil, Grunewald, Berlin, Germany. App. filed Jan. 19, 1906. An electrically-operated signal having manually operated means for controlling the setting of the circuit and means dependent upon the conditions to be indicated by the signal for causing the motor to return the signal to corresponding position.

856,184. Means for Keeping Switch and Signal Apparatus Free from Snow and Ice; Francis G. Shaw, Boston, Mass. App. filed Nov. 8, 1906. Relates to the construction of a housing for the parts containing a gas burner.

856,186. Brake Head and Shoe; Charles P. Smith, Canton, Ohio. App. filed March 16, 1907. Details of construction.

856,188. Brake-Shoe; John J. Tatum, Baltimore, Md. App. filed Sept. 11, 1906. A brake-shoe provided in its wearing face with recesses adapted to receive the attaching and guide lugs upon the back of another shoe, and a locking means at the rear of the first-mentioned shoe for securing the latter thereto.

856,192. Car Replacer; William F. Brann, Des Moines, Ia. App. filed May 7, 1907. Details.

PERSONAL MENTION

MR. W. P. BRENNING has been appointed assistant master mechanic of the Alton, Granite & St. Louis Traction Company.

MR. J. JORDAN has been appointed general manager of the Cleveland, Painesville & Eastern and the Cleveland, Painesville & Ashtabula Railroads.

MR. P. L. DORONS and MR. A. F. BENTLEY have been elected first and second vice-presidents, respectively, of the Belton Traction Company, of Belton, Tex.

PROF. ALBERT S. RICHEY, head of the department of electric railway engineering at the Worcester Polytechnic Institute, was married June 14 to Miss Holman, of Worcester.

MR. E. E. LYTLE, president of the Pacific Railway & Navigation Company, of Portland, Ore., has been elected president of the United Railways Company, of which he recently acquired control.

MR. HERMAN E. LA BREEQUE, of the Portland Railway, Light & Power Company, has resigned to become assistant superintendent of the Jersey Central Traction Company, of Keyport, N. J.

MR. FRANK ARNOLD has resigned as manager of the Oswego Traction Company, of Oswego, N. Y., to become general manager of the Fort Dodge, Des Moines & Southern system, of Des Moines, Ia.

MR. W. W. STREET has been appointed to succeed Mr. Thomas Woods as superintendent of transportation of the Illinois Traction Company. Mr. Street, who was superintendent of the Tri-City lines and East St. Louis terminals, will be succeeded by Mr. C. W. Cain.

MR. A. L. GILLETTE, for the past two years superintendent of motive power of the Escanaba Electric Street Railway, of Escanaba, Mich., has resigned to accept the position of superintendent of the Sterling, Dixon & Eastern Railway. Mr. Gillette has been identified with electric railway operation for about fifteen years.

MR. SAMUEL MARTIN has returned to New York from Rio de Janeiro, Brazil, where he has been directing the construction of rolling stock equipment for the Trazano de Medeiros & Company. Mr. Martin was connected with the subway division of the Interborough Rapid Transit Company before going to South America.

MR. FRANK R. HENRY, auditor of the United Railways Company of St. Louis, has been elected second vice-president of the American Street and Interurban Railway Accountants' Association, to fill the place made vacant by the recent resignation of Mr. C. F. Bryant, formerly comptroller of the Connecticut Railway & Lighting Company.

MR. L. C. BRADLEY, who recently resigned as general manager of the Scioto Valley Traction Company, of Columbus, Ohio, to become connected with J. G. White & Company, of New York, has been appointed by that company to the position of superintendent of the Eastern Pennsylvania Railways Company, of Pottsville, Pa., which is controlled by Messrs. White & Company.

MR. W. B. BROCKWAY, of Ford, Bacon & Davis, and Mr. ROBERT N. WALLIS, treasurer of the Fitchburg & Leominster Street Railway Company, contribute interesting articles to the May issue of the "Journal of Accountancy." The title of Mr. Brockway's article is "Reporting a Street Railway Examination from the Client's Point of View," that of Mr. Wallis is "Accounting of Depreciation by Electric Railways."

MR. HARRY C. YOUNG has resigned as general passenger agent of the Lake Shore Electric Railroad, with headquarters at Norwalk. Mr. Young came to the Lake Shore about a year ago, after a number of years in the passenger departments of large railroads. The duties of the general passenger agent's office have been divided for the time. Mr. John Miller, who has been with the company for several years in the auditing and passenger departments, has been made traveling passenger agent, reporting to Mr. A. C. Henry, the auditor of the company, who will exercise a general supervision over this part of the work.

MR. E. H. RICHARDS, who for several years was division superintendent of the Brockton division of the Old Colony Street Railway, and who has recently been associated with the Newport division of the system as superintendent, has resigned to accept a similar position with the New Bedford Street Railway Company. Mr. Richards entered street railway service as a conductor on the Bridgewater-Taunton line. He was at one time assistant to present Superintendent Conway at the Campello car houses, and afterwards succeeded him as division superintendent of the road when Mr. Conway was transferred to Quincy. Leaving this position, Mr. Richards was associated with the Boston & Worcester Railway, and was then manager of the Taunton-Attleboro-Providence line.

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DATE ON WRAPPER shows the month at the end of which the subscription expires. The sending of remittances for renewal prior to that date will be much appreciated by the publishers.

Of this issue of the Street Railway Journal, 8000 copies are printed. Total circulation for 1907 to date, 214,050 copies, an average of 8232 copies per week.

The New York State Convention

The Street Railway Association of the State of New York is one of the oldest, if not the oldest, organization of street railway companies in this country, and its meetings have not only always been enjoyable as social gatherings, but noteworthy on account of the value of their technical features. The twenty-fifth annual convention, which was held this week at Bluff Point, Lake Champlain, constituted no exception to the creditable history of the body, and testifies to the loyalty to the traditions of the association shown during the past year by the members and executive committee. It was somewhat of an experiment to hold a convention of this kind at a summer hotel in a comparatively inaccessible portion of the State, but the results justified the decision of the committee in this particular. With the exception of the time required by all the members to make the trip, Bluff Point proved a very satisfactory point of meeting, and during the weather which we have experienced during the past week was a very satisfactory substitute for city surroundings. The site also attracted to the convention a great many ladies and made the social features of the convention most attractive.

All of the papers presented were of a high order and will be found elsewhere in this issue. It should be remembered in this connection that the association also conducts quarterly meetings, and as those during the past year have been devoted to subjects connected with repair shop and maintenance of way practice, these topics were considered somewhat sparingly at the annual meeting. Especial interest attaches to the account of the inter-pole motor, which also formed the subject of an interesting paper by Mr. Anderson at the Niagara Falls meeting.

Exposed Track Construction

The prominence given to American track construction by recent events has formed the basis for a number of articles in different British engineering papers criticising the methods used in this country. It is well known that while the street railway companies abroad employ a rail with a flat base, like that used in this country, the steam railroad companies in Great Britain and quite generally those on the Continent use a chair construction. The standard English steam railroad rail has a double head, weighs 90 lbs. per yard and is carried in 40-lb. chairs screwed to the ties. Rail-chairs were generally used for street railway track construction in this country fifteen or twenty years ago, but for a different purpose. They were designed to lift the rail so that a 4½-in. to 5-in. rail could be used with 7-in. paving. The English chair, on the other hand, holds the rail only slightly above the tie, and is intended primarily to give a broader bearing surface on the latter.

There is no question that track construction for heavy traffic is a subject upon which engineers can well devote considerable attention. The best form of sub-structure in paved streets has not yet been satisfactorily settled, but the problems connected with it are not so great as those connected with exposed track. With the city road the question of track construction is principally that of durability. With exposed track in which rails are spiked to ties it will be more a problem of the cohesive strength of the structure if the present tremendous increase in speeds and weights of cars continues. It is very questionable, however, whether the desired results cannot be secured by the improvement of details of the present practice rather than by any very radical change.

High Temperature Feed Water for Boilers

In steam engineering a marked feature in Great Britain of late has been the attention that has been directed upon the heating of feed-water. A hot feed has from time immemorial been recognized as good for a boiler for structural reasons, because the boiler is not so much exposed to stresses of contraction and expansion. The economy of transferring to the feed-water the heat in the exhaust steam or from waste gases that were going away without further utilization of their heat is also generally recognized. But the abstraction of 1000 thermal units from either waste product was considered only as equivalent to the saving of the fuel otherwise necessary to be burned to give 1000 heat units, or as enabling a boiler to do just 1000 units more work. It was not regarded in any sense as equivalent to 1100 heat units—the view that is now held quite widely, and not from any belief in perpetual motion, such as might be inferred from the foregoing manner of statement. What is tacitly accepted is, that M. Normand, the celebrated French engineer, recently deceased, was probably right when he claimed, for feed heating to the full temperature of the boiler, a result in better efficiency and economy not at first thought possible. For Normand took the feed-water, and, whatever it lacked of boiler temperature, he gave to it by the aid of the steam from the very boiler into which the feed-water was about to pass. He claimed an economy from the practice and has been supported by others since. Not that he had any impossible conceptions as to getting out more than he put in. What he did believe was that he enabled the boiler surfaces to act better as heat transmitters, that perfectly hot and mobile water takes up heat more rapidly from the boiler plates and thus in some helps its efficiency and economy. The ideas have so far spread that two years ago the final full heating of feed-water was laid down as an essential stage in steam raising in a paper by Booth and Kershaw before the Institution of Electrical Engineers in London. This fact and the work of the Testing Bureau of the United States Government upon increasing boiler efficiency and capacity, referred to last week, are significant of the thought being devoted to the possibilities of improvement in steam generation.

In this connection it may not be amiss to call attention to the fact that the dryness of superheated steam has led some engineers to leave out provision for drips in plants where the mains do not carry saturated steam. When the temperature of the steam is kept at three or four hundred degrees above that normal to its pressure, as is not infrequent in European practice, it is doubtless safe to forego the use of drips and separators, but unless the operating conditions are remarkably well controlled condensation is almost sure to set in at some inconvenient time.

With the superheats used in this country, which commonly do not exceed 150 degs., it would be unwise to take chances on water being carried through the superheater to the engines or turbines, and, in any event, it is certainly safer to provide at least one separator with appropriate drain connections close to the throttle valve of each unit in the engine room. The condensation sure to develop when no steam is flowing will then be taken well in hand, and in warming up the steam piping before starting a unit or group of machines, the entrained water will be prevented from getting into the prime movers. The economies of superheating cannot be enjoyed without paying a certain toll, and the careful pipe arrangement and installation which insure good service in a saturated steam plant must not be relaxed at any point when dealing with the more nearly perfect gas represented by a superheated steam supply.

Track Layouts at Joint Surface Terminals

The general extension of through service in territory where dense traffic prevails requires special trackage facilities at points where different systems are joined if the business is to be handled with the least possible delay. A certain amount of hindrance to fast travel is inseparable from stops to change crews on through runs, especially if passengers are transferred between local and interurban cars at the same time. If a large city system occupies one side of a joint surface terminal, and a high-speed interurban line the other, it frequently becomes difficult to pass cars through on the proper schedules, on account of the inevitable irregularities of traffic in the congested thoroughfares of the larger road. A flexible track layout in such cases may often be worth all it would cost to install and maintain it.

Local conditions must obviously determine the detailed arrangement of tracks, but as far as possible these arrangements should provide for a number of fundamental needs. It is imperative that at all times the main line in each direction shall be free for inward or outward movements of cars hauling passengers on regular schedules. The higher speed cars with longer runs are preferably given the right of way past local cars which are being held at the end of their routes on the joint terminal tracks. It is destructive of good running time between distant cities to allow the movement of a fast, through interurban car to be blocked in the last three or four miles of its run by a local car of inferior power, though as the congested district is neared the interurban car cannot, of course, expect a clear track ahead unless such runs are brought into the terminal cities by less crowded routes on side streets.

The provision of a clear route at the junctions of important systems requires at least one extra track for bypassing local and through cars. This track may take the form of a middle siding with double connections at each end leading to the through tracks, or it may consist of a stub arrangement which will allow locals to be held clear of the main line pending the execution of through movements. The details cannot be properly worked out unless all the conditions are set forth, but, as a rule, the plan of spreading the through tracks to allow for one or more middle sidings with appropriate cross-overs affords the flexibility needed at all times, with special consideration of Sundays and holidays. Inspection of actual track layouts at joint surface terminals often leads to the conclusion that the arrangement of cross-overs and switches is needlessly complicated; but if dead mileage is to be cut down to the lowest possible amount, if local cars are to be brought to the end of their runs with the utmost dispatch and reversed quickly for the return trip, if passengers are to be transferred across short-width platforms without confusion and in perfect safety, if through cars are to make merely a way-sta-

tion stop at the connecting points of the two systems, and if provision is to be included for the reversal of certain through cars without interference with the locals, it is clear that several hundred feet of extra track and probably over half a dozen judiciously placed cross-overs will be absolutely essential to smooth, clean operation.

On a large city system lay-overs must be allowed for cars which fall behind their normal running time, and this means the occupation of track space at the end of the routes. Lines operated upon long headway may find it possible to economize in the extra track installed where the systems join for car interchange, but as the traffic increases and the intervals diminish below fifteen minutes it becomes more and more difficult to hold cars on the main line without delaying those following. The danger of accident is also greater where no third track arrangement is provided. At important joint terminals one or more extra cars are usually held in reserve by each of the connecting roads to fill in gaps in the schedules, and these require a track space free from the routine movements of regular cars. When the traffic is heavy an inspector or starter from each company is sure to be needed to handle cars and men with promptness, and if a flexible track layout is at his command, with the telephone and signal facilities desirable, free movement is assured even in times of emergency.

Acceleration in Heavy Service

In the comparison of railway motive powers acceleration is the point upon which the fundamental difference between electricity and steam arises. It is safe to say that one of the most valuable qualities of the electric motor when applied to any class of railway service is its uniform torque throughout each complete revolution of the armature. Increased capacity for traffic springs from the quicker and more sustained acceleration of the electric locomotive and the motor car as measured against the slower and less even rise in speed of the steam locomotive under the same general conditions of loading and track. A larger volume of train movement in a given time can be handled on a given railroad section with electricity on account of the absence of smoke and steam, and independence of weather conditions which handicap the largest boiler in the production of the latter; but when all the points of advantage are set down, it is doubtful if all the other advantages of electric motive power added together balance the value of quick acceleration.

There has been no lack of appreciation of acceleration in electric railway circles during the past decade, and, as a result, the cost of securing high rates of speed increase has sometimes been overlooked. The best acceleration for a given service is a very difficult matter to determine, and it is well to bear in mind the limitations of the problem in these days of electrification on an increasingly large scale. High acceleration is intensely valuable to the engineer whose schedules are cut close to the physical limits of his motive power, but it is essential to realize that in very heavy service the demands of high acceleration are severe in the way of momentary power station output. The larger the number of train units, the less will be the immediate drain upon the power plant on account of acceleration beyond the modest standards of steam locomotive practice. An acceleration of 1 mile per hour per second is ordinarily regarded as slow work by an electric railway engineer accustomed to the currents demanded by small cars of moderate weight, yet such a rate applied to an electrified steam railroad division using motor-driven locomotives weighing from 75 to 100 tons and motor cars weighing from 40 to 60 tons means a very heavy momentary power station demand unless the traffic reaches a density which compares closely with street railway service on short headway in a large city.

A modern electric locomotive weighing 90 tons may be expected on direct current with four gearless motors to deliver a tractive effort in starting of about 30,000 lbs., assuming 25 per cent adhesion and allowing part of the weight to be carried on pony wheels. Assuming 10 lbs. per ton for train friction and a 400-ton train hauled, the total tractive effort available for acceleration becomes 51 lbs. per ton, or slightly over 0.5 miles per hour per second. Four motors going into multiple with this torque demand about 3750 amperes on that part of the acceleration line where the resistance is being cut out. It is clear from these figures, which represent values well within heavy modern practice, that the accelerations possible in elevated railway service and with the light cars operated on crowded city streets are scarcely desirable in steam railroad electrification under present conditions. Ample power station capacity is, of course, absolutely essential in heavy service; but with trains of the weight mentioned an acceleration of about ½ mile is certainly excellent work. The total energy consumption for a given run tends to decrease as the rate of acceleration increases, but the power station investment needed to back up fast acceleration with a comparatively small number of trains is something which it does not pay to overlook. An acceleration of 1.25 or even 1.5 miles per hour per second may be essential in urban rapid transit subway or elevated train service, but the fluctuations of thirty or forty such trains, composed, as they are, of smaller and lighter cars than are used in steam railroad service, are small considerations in relation to the total power demands and gradual load variations exhibited on a great city system operating from one to two thousand cars at any given moment. Here it is more a question of the comfort of passengers, coupled at times with the possible stripping of gears. Station distances are short, and the acceleration period is a large percentage of the total time of the runs. In heavy interurban service the question of voltage drop enters the case, and with increased emphasis since the price of copper became so high; and here, as in electrified steam service, more moderate rates of acceleration become desirable. The whole acceleration problem is a relative one, but the influence of high rates upon investment needs to be considered at practically all points in heavy service. Given duplicate power stations and storage batteries in the sub-stations, the question becomes less suggestive of limitations. Detailed studies of acceleration under specific conditions are certain to become instructive as heavy electric traction extends its field.

PAPERS PRESENTED AT THE NIAGARA FALLS MEETING OF THE AMERICAN INSTITUTE OF ELECTRICAL ENGINEERS, JUNE 25-28

THE CHOICE OF FREQUENCY FOR SINGLE-PHASE ALTERNATING-CURRENT RAILWAY MOTORS

BY A. H. ARMSTRONG

Owing to the success attending the several installations of single-phase alternating-current railway motors in this country and abroad, and the suitability of this type of motive power for the electrification of certain steam lines, the question has been raised whether the 25-cycle frequency thus far universally used is the frequency best adapted to alternating-current motor design and operation, or whether the benefits obtained by the use of a lower frequency are sufficient to justify its introduction. This paper is intended to open a discussion on the relative merits of 25 cycles and a lower frequency, and will touch briefly upon the advantages and disadvantages of the present standard of 25 cycles and any proposed standard of a lower frequency.

All the alternating-current railway motor installations thus far made in this country have employed 25 cycles, and, with one exception, the service has consisted of the movement of single-car units at maximum speeds of approximately 50 miles an hour at intervals of one hour headway over a single-track line. That is, all alternating-current roads have been designed to take care of interurban passenger business with the incidental movement of express matter and miscellaneous freight.

It has been found that the alternating-current single-phase commutator motor can be developed to a commercially successful stage at a frequency of 25 cycles, and although some benefits in respect to weight, efficiency and commutation are to be obtained with the adoption of a lower frequency, the advantages have not as yet seemed great enough to justify the standardization of a new frequency suitable to alternating-current commutator motor operation alone. Recognizing the enormous commercial advantage of offering an alternating-current railway motor which could operate from existing power plants, the manufacturers have perfected alternating current equipments for interurban service for the standard frequency of 25 cycles already universally in use for this class of work.

The introduction of a new frequency calling for the design and establishment of a complete new line of generating, transmitting and receiving apparatus is a most serious matter and one that should not be undertaken without very careful consideration of all factors, both commercial and engineering, entering into the case. With the coming electrification of steam roads there is a demand for motors of increased capacity, and the possible limitations of 25-cycle design in large alternating-current motors of certain types is more keenly felt, hence the inquiry at this time into the question of the proper frequency to be adopted when the alternating-current motor is selected as the type of motive power for steam road electrification.

The various points to be considered may be classed under the following heads:

The effect of frequency on design of motor equipment; the effect of frequency on coefficient of adhesion; the effect of frequency on generating and distributing systems; commercial considerations; and locomotive design and selection of motive power.

THE EFFECT OF FREQUENCY ON DESIGN OF MOTOR EQUIPMENT

Taking the weight of a direct-current motor as 100 per cent, it is probable that the values in the following table hold approximately true:

COMPARATIVE WEIGHT OF DIRECT-CURRENT AND ALTERNATING-CURRENT MOTORS

Direct Current	25-Cycle Alternating Current	15-Cycle Alternating Current
One-hour capacity 100.........	150	130
Continuous capacity 100........	125	120

These figures apply to motors designed to give in all cases the same output and heating at the same speeds, but with an admitted superiority in commutation in motors of direct-current commutating-pole design. While the weight of the 15-cycle alternating-current motor is less than that of the 25-cycle motor, this will be partly offset by an increase of 30 per cent in the weight of the step-down transformer on the car. Although the car transformer weighs but approximately 20 per cent of the complete equipment, including control and motors, an increase of 30 per cent in its weight will practically offset the reduction in motor weight when recourse is had to 15 cycles. Therefore, while there are other advantages in superior commutation, higher efficiency, etc., obtaining with the use of 15 cycles, there is no material reduction in weight of the complete alternating-current motor and control equipment.

Until recently the commutation of alternating-current motors has been considerably poorer than that of direct-current railway motors in use. Various expedients, such as high-resistance leads, lower frequency, etc., have been suggested to improve the commutation and reduce the losses and heating at the brushes. Recent improvements in alternating-current motor design have resulted in the production of a single-phase motor which compares very favorably in commutation with any of the standard direct-current railway motors now in operation, although inferior in this respect to the commutating-pole type of direct-current railway motor. In fact, the commutation of the alternating-current single-phase motor has been so improved and the commutator losses so reduced with a frequency supply of 25 cycles as to make it unnecessary to adopt any of the above-mentioned expedients to eliminate commutator troubles.

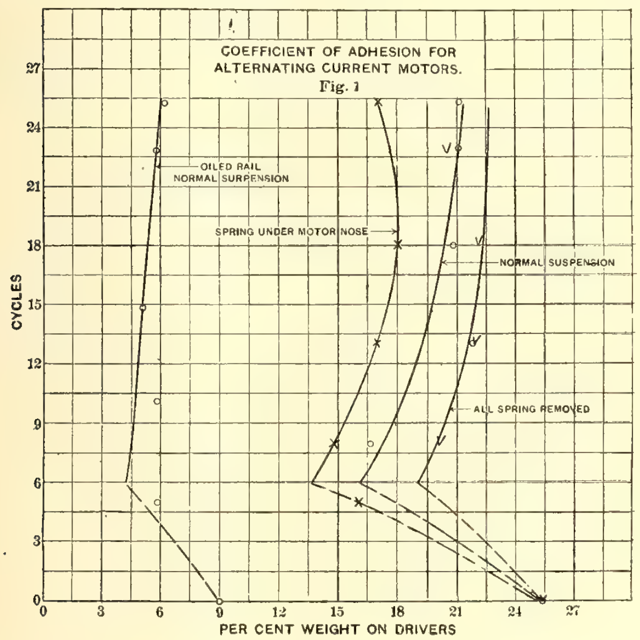
Where it becomes necessary to design motors for the greatest output per cubic foot of space allowable, as in the case of very large motors designed for locomotives under the restrictions of 4-ft. 8.5-in. gage and reasonable wheelbase, it is possible that the adoption of a lower frequency than 25 cycles permits a greater latitude in design of alternating-current single-phase motors of certain types.

THE EFFECT OF FREQUENCY ON COEFFICIENT ADHESION

The torque delivered to the driving wheels by the alternating-current commutating motor is of a pulsating charac-

ter, and its effective value is somewhat less than in the case of the uniform torque imparted by the direct-current motor. Experiments show that the effective torque is a function of the frequency of motor supply, and also depends upon the construction of the truck and the method of motor suspension. The values given in Fig. 1 express the relation between tractive effort and frequency for periods from 25 cycles down to zero; that is, direct current. The values given will hold true only with the combination of truck springs, motor suspension, etc., in the test, and the use of stiffer or lighter springs, more rigid or flexibly suspended motor, the use of springs between gear and axle, etc., might give results differing considerably in degree from those submitted herewith.

The three curves given represent normal motor suspension, additional spring suspension under the motor nose, and, with springs removed, giving practically rigid suspension except for the spring of the armature shaft, gear teeth, etc. While the tests are incomplete, they indicate a slight reduction in the coefficient of adhesion with lower frequency; but so far as can be determined this reduction is not a serious matter in the consideration of 25 cycles or a lower frequency, say, 15 cycles. With normal motor suspension, the coefficient of adhesion as obtained with 25 cycles alternating current was 82.5 per cent of the value obtained under the same conditions with the same motor supplied with direct current.



THE EFFECT OF FREQUENCY ON GENERATING AND DISTRIBUTING APPARATUS

The question of generator design at 15 cycles is a serious one, and presents many difficulties which can only be partly overcome at an increased cost of the apparatus perfected for 25 cycles. In fact, while certain capacities of low frequency turbo-generator units may be constructed fairly comparable with 25-cycle units, it is very probable that the adoption of 15 cycles or less would seriously handicap the standardization of a complete line of such units, and will in any case increase the cost of those units which it is possible to construct. The steam turbine has shown itself a most excellent prime mover, and the adoption of 15 cycles is seriously handicapped by the difficulties opposing the successful contruction for this frequency of a complete line of generator units of all sizes.

Both step-up and step-down transformers are handicapped at 15 cycles by an approximate increase in cost of 30 per cent over that of 25-cycle design. This applies to step-up and step-down transformers used throughout the low-frequency system.

COMMERCIAL CONSIDERATIONS

Perhaps the benefits of standardization both to the customer and to the manufacturer have not been appreciated to any greater extent than in the electric railroad industry. The universal adoption of 25-cycle, three-phase supply feeding into the distributing system of railway networks constituted so strong a claim in favor of adopting this frequency when developing the alternating-current railway motor as to outweigh certain known benefits to be secured with a lower frequency supply. The great field for alternating-current motors of 150 hp capacity and smaller is on interurban lines acting as feeders to the surface, elevated and subway lines of large cities. And the ability of such motors to run from the same alternating-current generating and distributing systems without requiring the introduction of frequency-changer sets constitutes a strong argument in favor of continuing the present practice of installing 25 cycles on such lines.

The type of apparatus adopted for new installations must necessarily be largely dependent upon the apparatus already installed for similar purposes in its neighborhood, and it is a question whether, when considering the electrification of steam roads in and about large cities, engineers can afford to neglect this same principle and cut loose from standards already established and universally in use. Furthermore, steam railroad electrification often commences in station and signal lighting and car shops, and 25 cycles is already largely in use for such work. Small motors and transformers are much higher in price at 15 cycles; there is no line developed, and the station and car lighting is most unsatisfactory at this frequency.

LOCOMOTIVE DESIGN AND SELECTION OF MOTIVE POWER

One of the principal arguments in favor of the electric locomotive is that it permits the concentration of a very large amount of power on the driving wheels. In this respect the electric locomotive equipped with alternating-current series compensated motors does not compare favorably with other types of motors of both alternating-current and direct-current design. Furthermore, the successful exploitation of these other types of motive power do not demand the adoption of a frequency less than 25 cycles, and hence it is pertinent to inquire if, with our present knowledge of the art, the alternating-current, single-phase motor of the series compensated type possesses qualifications which make it so superior to other types of electric motors as to justify the introduction of an odd frequency of benefit only to that one type of motive power. The writer feels much gratified at the success attending the development and operation of the various alternating-current roads already completed, and it should be pointed out that this very success has been attained with a frequency of 25 cycles.

Admitting the coming of steam-road electrification, we have not had any demonstrations or even convincing figures submitted which would prove beyond doubt the desirability of adopting 15 cycles and the alternating-current series compensated motor to the exclusion of direct-current motors of all types and voltages, three-phase induction motors, or even single-phase, alternating-current motors of other types which can be built in large capacities at 25 cycles.

In the opinion of the writer, it becomes, not the choice of the best frequency for the alternating-current, series compensated type of motor, but a question of the proper selection of motive power for the exacting demands of locomotive construction designed for hauling trains of any weight at both high and low speeds over roadbeds of any gradient. The question of frequency might well be left in abeyance until the coming of fuller knowledge of the operation of electric locomotives equipped with motors of different types. Considered from the engineering standpoint of alternating-current series compensated motor design alone, the use of 15 cycles offers advantages in the betterment of commutation, efficiency and output per pound of motor which may justify its adoption, provided that type of motive power is best suited to the needs of the problem in hand. Taking into account, however, the commercial interests involved, and considering the serious claims that may be advanced in favor of other types of electric motors for which a frequency of 25 cycles is well suited, it appears to the writer that much stronger claims for recognition must be brought forth before the adoption of 15 cycles can be seriously considered.

TWENTY-FIVE VERSUS FIFTEEN CYCLES FOR HEAVY RAILWAYS

BY N. W. STORER

At the regular meeting of the Institute, on January 25 of this year, a paper was presented by Messrs. Stillwell and Putnam dealing with the electrification of steam railways and referring briefly to the question of the adoption of a standard frequency for single-phase railways. This question aroused a great deal of interest and was discussed at greater length than any other feature of the paper. The authors, while enumerating the advantages of both 25 and 15 cycles, drew the conclusion that the advantages were greatest on the side of the lower frequency, and this opinion was concurred in by most of those who discused the matter. Many good points were brought out, but all were more or less general; and while it is obviously impossible for the Institute to standardize at this time a frequency for railways using alternating current, a free and full discussion of the matter can hardly fail to produce good results and to furnish more definite information than was available at the time the paper was presented. The arguments in favor of 25 cycles may be reduced to the following: (1) It is a standard frequency which is in use in a great many plants throughout the country. (2) It is probably better suited for general power distribution and is certainly better for lighting than 15 cycles; therefore, any railroad having a 15-cycle plant for operating its road would be somewhat handicapped in power for lighting and shop purposes. (3) The higher frequency is better suited for speeds of steam turbines of small size, it being at present uneconomical to build turbo-generators for less than 2000 kw at 900 r. p. m., which is the maximum available for 15 cycles. (4) Transformers are lighter and cheaper for 25 cycles.

The principal arguments in favor of 15 cycles are: (1) An increase of from 30 to 40 per cent in the output of a motor of a given size and a consequent reduction in the total number of motors required to operate a railway and in the cost of equipment. (2) Better performance of the 15-cycle motors, including higher efficiency, higher power factor and better commutation. (3) Less dead weight to be carried on cars and locomotives. (4) Lower line losses.

The first argument in favor of 25 cycles, namely, that it is a standard frequency in use in a great many plants of the country, is certainly a good one. It is undoubtedly a very serious matter to consider the introduction of a new frequency for any purpose whatsoever. There are, as is well known, a number of frequencies in use at the present time for which there is no justification except that they are in use, and there is no class of service of which we know that cannot be handled with equal efficiency by one of the standard frequencies, with the exception of the alternating-current railway systems. Railway electrification, if developed as every electrical engineer hopes it will be, will mean an undertaking of such magnitude as to make it practically independent of other electrical interests, so that if a frequency differing from the standards now in use will be advantageous it should be adopted.

The second argument in favor of 25 cycles, namely, that it is better suited for power and lighting purpoes than 15 cycles, may be granted without admitting that it is a particularly valuable point. Satisfactory lighting can be obtained with 15 cycles by using a low-voltage lamp having a large filament with high thermal capacity. This will be entirely suitable for ordinary railway lighting. Fifteen-cycle induction motors, while not having as wide a range of speed as is possible with 25 cycles, can undoubtedly be used to accommodate practically any class of service required of them, and the fact that the single-phase commutating motor is more satisfactory on the low frequency may make the low frequency even more satisfactory for shop purposes than the high frequency. In the discussion of the Stillwell-Putnam paper one speaker called attention to the fact that railway companies would probably sell a large amount of power along their right of way to consumers for various purposes, and stated that 15-cycle current would be unsuitable for such service. In reply to this, it is only necessary to call attention to the fact that the voltage on any railway circuit is so variable as to make it absolutely unsuitable for lighting purposes, and it would, therefore, be necessary to introduce a motor-generator set to get good results. This might just as easily be made a frequency-changer to supply current at either 25 or 60 cycles, as might seem best for that particular locality. While this unquestionably destroys some of the simplicity of the scheme, it is undoubtedly what would be necessary in order to give satisfactory service, even if 25 cycles were in use on the railway, unless a separate generator were used for the lighting circuits. It seems, therefore, that the 15-cycle current would be little or no handicap to the railway company in this respect.

The third argument, namely, that the higher frequency is better suited for speeds of steam turbines, is undoubtedly true, but it affects a very small proportion of the work. Heavy railroads will require in practically all cases larger generators than 2000-kw units. In cases where they do not, high-speed turbines can be used and frequency-changers employed. At the same time, we must admit that the last word in regard to steam-turbine design has not yet been spoken, and it may shortly be an easy matter to make comparatively small units for use with 15-cycle generators.

The fourth argument, that transformers are lighter and cheaper for 25 than for 15 cycles is undoubtedly true. There will be a difference of probably 25 per cent in the cost of the transformers for any given service. This difference must be offset by the difference in the cost of the motors.

The meat of the entire argument for the lower frequency is in the greater output of the motors for a given size and weight. It was well shown in the Stillwell and Putnam

paper that the cost of car equipments and locomotives would far overbalance the cost of power houses and transformer stations; and while I do not wish at this time to give a mass of estimates as to the saving, I will adhere to the statement previously made that the output from a motor of a certain size will be increased from 30 to 40 per cent by the use of 15 instead of 25 cycles. This has been proved by tests on several different motors.

A well-known 100-hp, 25-cycle motor operates with full load at a speed of 620 r. p. m., and in the regular one-hour test on the stand has a temperature rise of 89 degs. C. in commutator and 75 degs. C. in armature, other parts of the motor being well below 75 degs. C. This motor operated at the same speed on 15 cycles carried a load of 113 hp with a maximum rise in temperature in commutator of 76.5 degs. C. and in armature of 72.5 degs. C. It is safe to say it is good for 115 hp with the limiting temperature of 75 degs. C. in armature. This same motor with a larger number of turns on the field and run on 15 cycles carried at the same speed of 620 r. p. m. a load of 135 hp with a rise in temperature in commutator of 76 degs. C., in armature of 75 degs. C. and in field coils of 76.5 degs. C. It is quite safe to rate this motor at 135 hp on 15 cycles.

A larger motor carried a load of 225 hp with a temperature rise of 71 degs. C. in commutator and 76 degs. C. in armature, other temperatures being well below 75 degs. C. This motor, operated at the same speed under identical conditions on 15 cycles with a load of 300 hp, rose 73 degs. C. in commutator and 81 degs. C. in the armature. With new field coils having more turns the motor will carry at least 325 hp and probably 340 hp with a rise in temperature not exceeding 75 degs. C.

While these results are all based on the one-hour test, the continuous capacities will have the same increase on 15 cycles. The inference to be drawn from these results is, of course, that the temperature rise being the same for both frequencies, the losses must be approximately the same, and since the output is greater on 15 cycles, the efficiency must, therefore, be much higher. Further, the tests are all based on 25-cycle motors modified only in field coils. If the motors are designed especially for the low frequency, the results will be still better.

A comparison of the weights of car equipments for 25 and 15 cycles indicates that there will be an advantage in favor of the lower frequency, even with the same number of motors. For instance, a four-motor equipment of 100 hp, 25-cycle motors, with oil-insulated transformer, will weigh approximately 30,000 lbs. Such an equipment for 15 cycles would weigh approximately 28,500 lbs. The difference is small, but it is in favor of the lower frequency. If two 15-cycle motors of 200 hp each, such as are now building, be furnished, the weight of equipment will be reduced to approximately 23,000 lbs., or a reduction of 23 per cent in the weight of the car equipment. While it is perfectly practicable to furnish two motors for a 400-hp equipment for operation on 15 cycles, it will be necessary to furnish three or four motors for 25 cycles on account of the great increase in the size of the motor. It is, therefore, absolutely necessary that the 25-cycle equipment weigh considerably more than that for 15 cycles. In the case of smaller motors aggregating 280 hp it is possible to furnish a two-motor equipment operating on 25 cycles. There would, however, be a difference in weight of at least 1500 lbs. in each motor in favor of the 15-cycle equipment of the same capacity. This would offset the increased weight of the 15-cycle transformers by at least 1000 lbs. In every case, therefore, even where the same number of motors are in use for both frequencies, the 15-cycle equipment will be lighter, and on account of the smaller motors the motor trucks will also be lighter, the amount of saving here depending upon the size of the motor.

The greatest gain from the use of 15 cycles is to be found in heavy railroading where locomotives are used. In building locomotives it is desirable, on account of the weight, cost and maintenance charge, to concentrate the power in as few motors as possible consistent with weight on the drivers and the tractive effort desired. We have found that in virtually all cases the weight of useful apparatus on the drivers, even with 15 cycles, is sufficient to give the necessary adhesion without adding dead weight; therefore, the use of 15 cycles means that in practically all cases for the locomotive a smaller number of motors can be used than is possible with 25 cycles. It is frequently the case that three motors which are sufficient with a certain size of driver for 15 cycles would have to be replaced by four motors having the same dimensions. It would sometimes happen that three motors necessary for 25 cycles could be replaced by two of the same dimensions for 15 cycles. In the case of locomotives of very high speed the extra weight entailed by the use of higher frequency motors, and consequently heavier mechanical parts, would increase the weight of the train to such an extent as to call for a considerably larger output from the motors, simply to haul the extra weight. Such a case we have in mind in a high-speed passenger locomotive which has recently been built. This locomotive is designed to haul a 400-ton train both on heavy grades and at high speeds on level track. The locomotive as built for 15 cycles weighs approximately 140 tons and has four motors, each with a nominal rating of 500 hp. With a 400-ton train behind it this locomotive would thus have to handle a total of 540 tons. A 25-cycle locomotive built to handle a 400-ton train at the same speeds and on the same grades would require six motors of approximately the same dimensions, and these extra motors, together with the extra weight of mechanical parts, would bring the total weight of the locomotive up to approximately 185 tons. The total weight of train would thus be 585 tons, or an increase of about 8 per cent. The capacity of these motors would be in the neighborhood of 375 hp, which would be just about sufficient to handle the extra weight. It must be seen at once that the motors for this locomotive would cost 50 per cent more and the mechanical parts also considerably more. The only parts of the equipment which would cost less would be the transformer and preventive coils, and the control equipment would be enough more expensive to counterbalance this.

In this connection it may be of interest to give a brief description of the locomotive as built. It is of the articulated type, each half of which has two pairs of drivers and a four-wheel truck similar to the standard American type of steam locomotive, the two halves being coupled back to back. The drivers are 72 in. in diameter with 7 ft. 6 in. between centers of axles. On each axle is mounted a gearless motor having a nominal rating of 500 hp and a continuous capacity with forced ventilation of about 375 hp. The motors, weighing approximately 19,500 lbs., are spring-supported, mounted, and connected to the drivers in exactly the same way as the motors on the single-phase locomotive for the New York, New Haven & Hartford Railroad; this feature has been described so many times that it is unnecessary to repeat it. The frame of the locomotive is of the standard steam locomotive type placed outside of

the wheels. It is of cast steel connected at the front and rear and at three places between the ends by heavy cast-steel girders. The truck, which is of the standard steam locomotive pattern, has 36-in. wheels, with a wheel-base of 6 ft. 2 in.

The electrical and other equipment in the cab is mounted on a raised platform which is about 2 ft. above the floor-line and occupies the middle of the cab, allowing for a passageway on either side. There are numerous windows along the sides of the cab which afford excellent light for the inspection of the apparatus. The equipment is extremely simple and accessible. The main transformer, which is designed for 11,000 volts, is mounted above the truck with the top just below the platform in the cab. Directly above the transformer is located the electropneumatic switch group to which the various taps in the transformer are carried. Back of the switch group are the preventive coils used in passing from step to step on the transformer, and from these preventive coils runs a single lead to the reverser switch group, which is placed directly above the main motors. On this raised platform are also placed the motor-driven air compressor, the motor-driven blower for furnishing air for ventilation of the motors and transformer, and the air reservoirs. Suspended from the structural work between the platform and the Z-bars in the roof of the cab are the oil circuit-breaker in the high-tension circuit leading to the transformer, the small switches used in connection with the auxiliary motors, and the 20-volt battery which is used for operating the valve magnets in the controller. The high-tension current is collected from the overhead wire by the standard type of pantagraph trolley. It will be noted that on account of the large drivers and the comparatively high position of the apparatus in the cab that the center of gravity of the locomotive is higher than usual in electric locomotives. The riding qualities of the locomotive are exceptionally good. The weight of the locomotive, as stated, is 140 tons, there being 50,000 lbs. on each driving axle and 40,000 lbs. on each truck.

In the case of geared locomotives for heavy freight service, there is still the advantage in favor of 15 cycles. Where the same number of motors is used for both frequencies, it will be necessary to use larger wheels for the 25-cycle locomotive. Low-speed locomotives are especially at a disadvantage with 25 cycles. It is possible to make a geared motor with a capacity of 400 to 450 hp for slow-speed freight service with 15 cycles, while with 25 cycles a 300-hp motor is as powerful as it is practical to use. This means that in the freight service we have virtually the same condition as in passenger service, namely, that about one-third more motors will be required to perform the service. The locomotive will weigh from 10 to 35 per cent more.

An examination of the efficiency curves for 15-cycle motors compared with those for 25 cycles will show differences in the losses in the motors alone which will mean a considerable difference in the capacity of the power station. This, when added to the power required to haul the extra weight, and the increased line loss due to the higher frequency, will make a difference of 5 to 15 per cent in favor of the 15-cycle equipment. Without giving estimates or long tabulated statements, I leave it to the judgment of the members of the Institute to decide whether it is not advisable, with these facts staring us in the face, to recommend a new frequency. It is well known that when the advent of the first successful single-phase railway motor was announced by Benj. G. Lamme in his historic paper before the Institute in 1902, the frequency which he advocated was 2000 alternations per minute, or 16 2/3 cycles per second. It was believed at that time that this frequency was the best suited to meet the many requirements of power plants for railway apparatus. However, owing to the experimental nature of the undertaking, it was deemed advisable to use the standard frequency of 25 cycles temporarily until the commercial success of the system was assured. At the same time, it was realized that the practical difficulties to be overcome in the single-phase system would be much greater with the higher frequency. Moreover, in the first equipments sold the motors were of comparatively small size, so that the space occupied by them was not limited. Furthermore, the number of motors in an equipment was fixed by conditions other than dimensions and weight, four-motor equipments being selected in nearly every case, partly on account of the prevailing fad for four-motor equipments and partly because most of the equipments were built for operation on both alternating current and direct current. At any rate, aside from the greater difficulties met with in the design of the high-frequency motor in order to secure good performance, the question of frequency was of comparatively small importance. Since that time some fifteen or twenty roads have been put in commercial operation with single-phase current at 25 cycles, and it has been proved beyond doubt that the single-phase motor is a thoroughly practical and commercial machine. At the same time, as was anticipated, all our experience goes to show the advantage to be gained by the use of a lower frequency. This frequency need not be fixed at exactly 15 or 16 2/3 cycles. As far as the motor operation is concerned, a variation of one or two cycles either way will have comparatively little effect; but we believe, for the sake of using proper ratios between this and existing frequencies, that 15, which is one-fourth of the standard 60-cycle frequency, or 16 2/3, which is two-thirds of the standard 25-cycle frequency, should be adopted for use, especially on heavy railroads. While this will undoubtedly make it necessary for the manufacturing companies to keep a larger variety of apparatus in stock (as there is no doubt that 25-cycle railways will be operated for a long time to come), the advantage to be gained from the lower frequency in the wider use of apparatus will far outweigh any slight disadvantage of this kind.

The mistake made by the blacksmith when he made the template which fixed the gage of the standard railways at 4 ft. 8.5 ins. is a matter of tradition. It is recognized as being one of the most far-reaching mistakes ever made, inasmuch as it has ever since placed a limit on the capacity of the railroads of our country, both by limiting the capacity of steam locomotives and the size of cars, and last, but not least, the capacity of electric railway motors and locomotives. What an enormous benefit would be gained from even a paltry increase from 4 ft. 8.5 ins. to 5 ft. What powerful machines could be built for a gage of 6 ft. But the mistake has been made, and it would cost so much to rectify it that the boldest of our railway magnates is staggered by the suggestion.

Electrical engineers have an enormous responsibility in deciding upon matters of detail, such as frequency, which will have an effect that will far outlast anyone who has a voice in the matter; and it certainly behooves us as engineers to consider carefully before recommending the continuance of the present standard frequency of 25 cycles, where it imposes such a handicap on the capacity of our transportation systems.

SINGLE-PHASE VERSUS THREE-PHASE GENERATION FOR SINGLE-PHASE RAILWAYS

BY A. H. ARMSTRONG

The introduction of the alternating-current, single-phase railway motor calling for a single-phase secondary distribution system makes it pertinent to inquire into the question of power generation and primary distribution for such systems. While the simplicity of single-phase generation and distribution is unquestioned, it is not always possible or desirable in these days of general power distribution to install a generating station and primary distribution system capable of taking care of alternating-current railway load alone to the exclusion of synchronous converters and other receiving machinery requiring three-phase input.

As the use of either single-phase or multiphase generators seems to be open to certain objections, various meth-

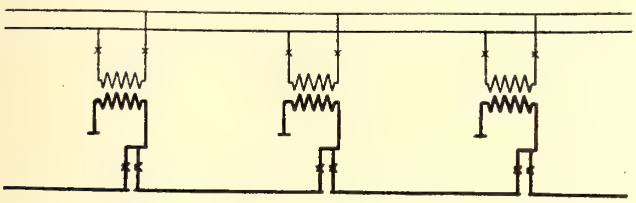


FIG. 1.—SINGLE-PHASE PRIMARY AND SECONDARY DISTRIBUTION

ods of distribution are presented herewith, with some of the advantages and disadvantages pertaining to each.

SINGLE-PHASE GENERATION

Single-phase generation and transmission makes it impossible to use synchronous converters, self-starting synchronous motors, or induction motors starting under load. It is poorly adapted to general power distribution and is largely limited in its application to alternating-current railway operation alone; its use is, therefore, open to grave objections of a commercial nature where there exists any possibility of selling power or in any way utilizing it for general converter and motor work.

The single-phase generator has an unbalanced armature

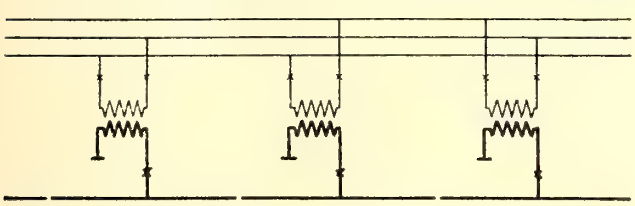


FIG. 2.—THREE-PHASE PRIMARY AND SINGLE-PHASE SECONDARY DISTRIBUTION

reaction which is the cause of considerable flux variation in the field pole-tips, and, in fact, throughout the field structure. Such generators must, therefore, be constructed with thinner laminations and oftentimes poorer mechanical construction to minimize eddy currents, resulting in increased cost of the generator. The large single-phase armature reaction results in a much poorer regulation than that obtained with three-phase generators; it calls for increased amount of field copper and more liberal design which, with the larger exciting units required, brings the cost of the single-phase generating unit throughout considerably in excess of that of a three-phase unit of the same output and heating.

The difficulties of single-phase generator construction appear to increase with any reduction in frequency, and the adoption of any lower frequency than 25 cycles may result in serious difficulties in construction for a complete line of machines of the single-phase type, especially of the two or four-pole turbine-driven type, where the field flux is very large per pole.

Against the difficulty of single-phase generator construction, its greater cost and poorer efficiency, there is the great advantage of simplicity in the entire generating, primary and secondary distribution system for single-phase roads. This advantage is so great that it justifies considerable expense; looked at from the railway point of view only, the single-phase system throughout may be considered as offering the most advantages.

THREE-PHASE GENERATION

Three-phase generation and distribution is in almost universal use. Many single-phase railways receive power from such systems, and the commercial advantages resulting from the use of such generators may in certain cases justify

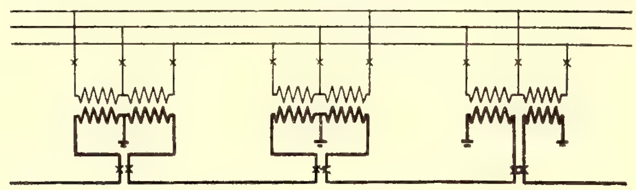


FIG. 3.—THREE-PHASE PRIMARY AND SINGLE-PHASE SECONDARY DISTRIBUTION

the complication of single-phase secondary distribution obtained from a three-phase source. As these commercial advantages are in many cases controlling, various combinations of three-phase-single-phase connections are presented herewith.

THREE-PHASE GENERATION AND PRIMARY DISTRIBUTION TO MOTOR-GENERATOR SETS FEEDING INTO THE SINGLE-PHASE SECONDARY DISTRIBUTION

This system has all the advantages of obtaining power from a three-phase distribution which may also feed synchronous converters and general power load, and is independent of the frequency of the generating system, being equally adapted to 60 or 25 cycles. Its disadvantage lies

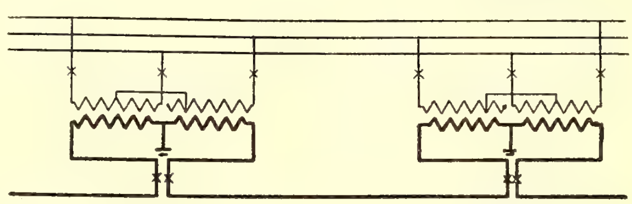


FIG. 4.—THREE-PHASE PRIMARY AND TWO-PHASE SECONDARY DISTRIBUTION

in the cost of the motor-generator sub-station, but it is the only system which will give perfect balance on a three-phase distribution system.

THREE-PHASE GENERATORS OPERATING ALTERNATING-CURRENT RAILWAY LOAD ON ONE LEG, THUS CALLING FOR BOTH PRIMARY AND SECONDARY SINGLE-PHASE DISTRIBUTION

Commercial considerations of possible future synchronous converter or power load may justify the installation of three-phase generators designed for single-phase output for railway load and three-phase output for general power distribution. This system is open to the objection of serious unbalancing due to railway load on one phase only, and this unbalancing may be so great as to cause undue heating in synchronous converters, synchronous motors and induction

motors fed from the unequal potentials of all three legs of the three-phase generator. Tests have been made which indicate that receiving apparatus may have its capacity reduced from 30 to 50 per cent with normal heating with the unbalancing caused by single-phase railway load fed from a three-phase generator in commercial operation.

A three-phase generator run as single-phase is open to all the objections of excessive armature reaction, poor regulation, pulsating flux in field structure noted above for single-phase generators, and such generators must be rated single-phase at two-thirds or less of their output when operating on balanced three-phase load.

THREE-PHASE GENERATION AND PRIMARY DISTRIBUTION TO SUB-STATION, FEEDING SUCCESSIVE TROLLEY SECTIONS WITH SEPARATE PHASES

Where the length of the road is sufficient to permit sectionalizing the trolley into three sections, or multiples of three, having an equal load on each section, this method provides for balancing the three-phase load, thus securing full output of the generator, non-interference with power load, etc. Each sub-station must contain two sets of transformers connected to separate phases, so that adjacent sub-stations may feed like phases into a common trolley section extending between them. The installation of a single transformer in each sub-station would necessitate the sectionalizing of the trolley midway between sub-stations, hence losing half the effective value of the copper as obtained with the trolley sectioned at the sub-stations and two adjacent sub-stations feeding a common trolley section.

This method of securing a balanced three-phase load is open to the objection of complication and possible ineffectiveness, with serious disarrangements of schedule such as take place in railway operation during different periods of the day and season.

TWO-PHASE GENERATION, GENERATING STATION LOCATED IN CENTER OF SYSTEM AND FEEDING ONE PHASE EACH WAY

So long as the load is balanced upon the two primary distribution systems, this method of connection is capable of good results; but operation under the necessities of commercial service shows it to be very difficult to balance the load upon the two phases, thus resulting in considerable unbalancing and extreme voltage variation on the less loaded leg. This same criticism holds true of the third method.

THREE-PHASE GENERATION AND PRIMARY DISTRIBUTION TO TRANSFORMER SUB-STATIONS CONNECTED THREE-PHASE-TWO-PHASE AND FEEDING SECONDARY DISTRIBUTION IN SUCH MANNER THAT ADJACENT SUB-STATIONS FEED LIKE PHASES INTO A COMMON TROLLEY SECTION

This method of connections is capable of giving good results in operation, although occasional series unbalancing may occur in the primary distribution with a disarrangement of schedule or improperly proportioned trolley sections. Each sub-station must contain two transformers for regular service, and possibly one spare, which, together with the necessary switchboard arrangement, increases the complexity and cost of such sub-station compared with simpler arrangement possible with straight single-phase distribution.

There are other methods of connection, such as independent transmission lines to several outlying sub-stations, thus giving the generating station operator the opportunity to balance the load on the several phases of the generators; but the methods outlined are those commonly proposed for single-phase secondary distribution used in connection with three-phase generation and primary distribution.

GENERAL CONCLUSIONS

The matter of proper selection of generating apparatus for single-phase roads seems to be closely connected with questions of a commercial character relating to a possible future load requiring a three-phase input. From a purely engineering standpoint, and considered from the point of view of the railway load only, the single-phase system of generation and distribution is to be recommended. The possible installation of generators having a lower frequency than 25 cycles would help this decision, owing to the unfitness of such a low frequency for general power distribution work.

Of the several methods of single-phase combinations proposed, the motor-generator set best protects the three-phase distribution system where power is purchased from foreign distributing systems, and such a method presents many advantages which may outweigh its increased first cost. Where the railway company finds it expedient to generate and distribute its own power from three-phase generators, the use of a single leg for the railway load or the installation of three-phase-two-phase transformer sub-stations—both seem to offer advantages justifying their recommendation, and the choice between the two may perhaps be left to the needs of local requirements.

COMMUTATING-POLE DIRECT-CURRENT RAILWAY MOTORS

BY E. H. ANDERSON

To appreciate the development and reasons for the existence of a commutating-pole railway motor, it is well to discuss in some degree some other developments. In the beginning, railway motor designers had many difficulties to contend with.

The question of gearing was possibly foremost, whether it should be single or double reduction or possibly gearless. All these were tried with more or less success. The pendulum swung back and forth from this point, but it has settled partly and is still settling. The small motor (automobile) is now more usually double reduction; however, in some cases, single reduction is used where weight is not of importance. The usual railway motor has settled down to single reduction. In the larger railway motor, where the work approaches that of a locomotive, it is often questionable whether single reduction or gearless should be used. When powers are small, as in the case of single-car units, the motor is naturally provided with single-reduction gearing. Then, again, for large locomotives and high speeds, obviously the motor should be of gearless construction, this being especially true in the light of what may be done with gearless bipolar motors of direct-current design.

Possibly insulation is next in order, various methods having been tried. The conductors have been covered with a variety of materials, but double or triple cotton-covered insulation has practically become standard. The slot insulation has been through various changes; for wire-wound machines it has settled down to a good varnished cambric with a protecting tape of cotton, although an all-asbestos insulation of armature coils is promising. Where bars are used as armature conductors, it is possible to insulate them entirely with mica. This type of insulation has been fully

developed and may be considered as standard. The field insulation has long been in a state of evolution, but is pretty well standardized on a basis of mica in metallic shells for the larger ribbon-wound field-coils, and varnished cambric for the smaller fields wound with wire. Here also an all-asbestos insulation is promising.

The present method of lubricating the bearings with oil has resulted from a process of elimination, many forms of grease-cups, oil-cups, wicks, etc., having been tried; in fact, the preferred lubrication at one time was grease. With the advent of interurban trolley roads came greater speeds, giving rise to many more car-miles per day, and complaints arose of short life of bearings, injury to armatures, etc. The methods of lubrication underwent many changes, but are now well established as wool-waste and oil; no doubt a good solution of a difficult and important problem.

During this period of development the armature was changed from a smooth to a slotted core, and much thought was given to the size of commutator, number of segments, turns per coil, etc., in the effort to produce successful operation of the commutator. With all forms of copper brushes there was most destructive sparking and enormous local currents in coils short-circuited by the brush during commutation. The carbon brush was tried and found to be the greatest improvement yet discovered in producing successful commutation. The greater contact resistance decreased the local currents to reasonable values, yet the energy lost by the greater contact resistance in the main circuit was small. The carbon brush thus opened up possibilities in design not before thought of.

The inductance of coils was reduced by placing two in

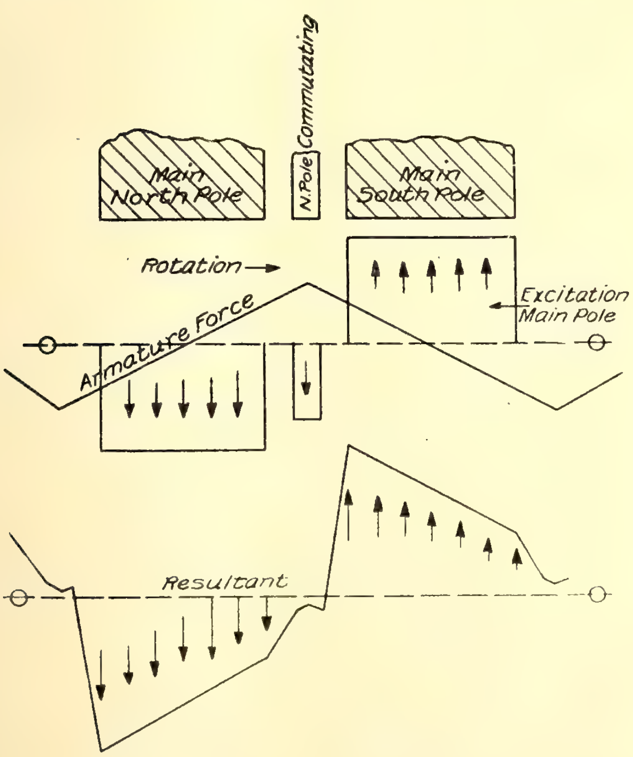


FIG. 2.—DISTRIBUTION OF MAIN FLUX IN THE POLE FACES

one slot instead of one, thus saving insulation and reducing the diameter of the armature. Later came the three coils per slot armature, this being the standard for many motors to-day.

As motors had to be built to fill a restricted space, not only for large power and small diameters, but with good commutation at higher potentials, it gave rise to the four and five coils per slot armature. Many coils per slot necessarily increased the slot width, and this in time called for a laminated-field pole structure in order to limit eddy-current losses. In the meantime the operator was demanding higher potentials, more work from the motors and better commutation, and the commutation had not kept pace with

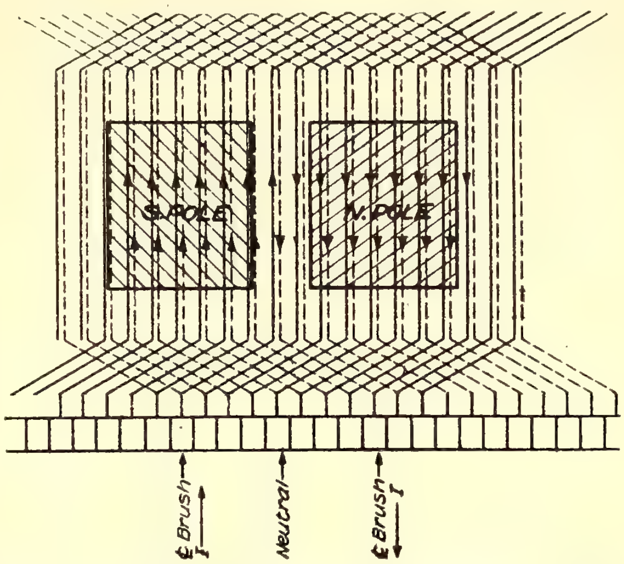


FIG. 1.—D. C. SERIES DRUM ARMATURE, THIRTY-THREE SLOTS AND ONE COIL PER SLOT

other developments; in fact, was becoming more troublesome as compared to other difficulties, largely on account of higher operating potentials. Some means had thus to be adopted for radically improving commutation, and the following pages deal more particularly with this subject.

The armature in its simplest conception is a drum, divided into four sections for four poles; under a north pole is a broad distributed sheet of current running parallel to the shaft; under a south pole is also a broad distributed sheet of current, but in a reverse direction.

This distributed armature current produces a magnetizing force which changes the distribution of the main flux in the pole-faces, as shown in Fig. 2. It will be seen that in the center of the pole there is no distributing effect, but in the center between poles there is the maximum magnetizing effect from the armature. This is where the conductors are commutated by the brush and the direction of the current reversed in passing from the zone of one pole to the zone of the next.

The magnetizing effect of the armature, being a maximum midway between poles, produces a flux through the air space to the frame. The conductors in motion cut this flux, producing a voltage in the coil to be commutated.

The combined result of armature and field magnetizing effect is to cause a flux to leak from the pole-tip over into the armature just where the conductors are being commutated.

The two leakage fluxes are alike and add to produce voltage in the coil which is being commutated. Thus there is a potential between commutator bars, and when these are short-circuited by the brush a local current is caused to flow in the coil under commutation. This local current adds to the line current already there. Any conductor carrying current has lines of force interlinked about itself caused by the current in the conductor. The conductors, imbedded in and surrounded on three sides by iron, have a good opportunity of surrounding themselves with a lot of

leakage flux. The interleakage of leakage flux is similar to the inertia in mechanics.

The combined current (line and local) has still greater interleakage of leakage lines and becomes more difficult to reverse. The reversing has been done heretofore by the increasing resistance of contact between the brush and the commutator bar as the latter is passing out under the brush, the rate of change of current ever increasing. This causes the reactance or kicking voltage to become higher and higher. As the bar leaves the brush, the change in current in the coil becomes so rapid that an appreciable voltage is induced and arcs through the air from the bar to the brush, or vice-versa, thus producing what is commonly known as sparking.

The object is, then, to remove the sparking by counteracting one, or all, of its causes. Should we place midway between the main poles another coil, having the same magnetizing power as the armature, but so connected as to magnetize in the reverse direction to the armature, there would be nothing to cause a leakage flux from the armature to the frame. Then, again, should we further excite this coil so as to overcome and balance the combined effect of armature and field forces, commonly known as distortion and leakage of the main flux from the pole-tip, we would annul this troublesome cause of sparking. After the above two effects are taken care of, there remains a force necessary to produce a potential sufficient to reverse the current in the armature coil.

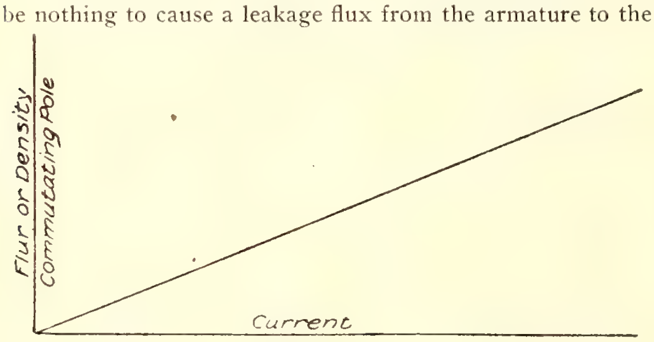


FIG. 3.—RELATION BETWEEN COMMUTATING-POLE DENSITY AND CURRENT

To produce this potential there must be such a density of flux as will generate this required voltage by the conductors cutting same in revolving. The width of such magnetic density should be sufficient to embrace the conductors commutated by the brush when running in either direction or rotation.

The commutating voltage produced by the flux of the commutating pole is the accelerating force required to change the direction of current in the armature coils one by one as they come under the brush. It must be sufficient to accomplish this in the time that the coil, being connected to two adjacent commutator bars, is under the brush. When the commutator bar leaves the brush the current is already reversed, flowing in proper direction, and is of the proper amount, so there is no tendency to spark. Commutation may then be said to be perfect.

As stated before, an armature coil imbedded in iron is surrounded by a leakage flux, which is caused by the current in the coil, and may be said to have magnetic inertia or momentum. This is similar in mechanics to a revolving shaft bearing a mounted fly-wheel. The voltage induced in the coil by the flux from the commutating pole may be likened to a constant counter torque, this counter torque serving to slow down the revolutions, stop, and cause an increase in speed in the opposite direction.

It is evident that there may be a particular armature current, speed of motor and flux from commutating pole wherein the above described conditions will obtain. It will also be appreciated that the voltage induced by the commutating pole flux will vary directly as the speed; furthermore, the time that the coil is under the brush is shorter as the speed is higher, and vice-versa; also that the time required to reverse a current is inversely as the voltage. The conclusion is that the action is entirely automatic throughout the entire range of speed with the particular condition of current and commutating-pole density.

The next question is: Can the action be automatic for varying current as well as speed? The commutating pole may be excited by the main current of the motor, being connected permanently in series with the armature. The commutating-pole flux will then vary almost directly as the current, which is the desired result. When the current is half, the commutating-pole flux is half, and the commutating voltage corresponding thereto. Thus the action is entirely automatic for variation in current or speed, or both.

Fig. 3 shows that the relation between commutating-pole density and current should be a straight line, rising and falling directly with the current. It is well understood that an absolutely straight line between current and density cannot be obtained when a more or less saturated iron circuit carries the flux, but it can be approached sufficiently close for all practical purposes by careful design and experience in these matters. In a series motor the density of the whole iron circuit increases as the load comes on, and there is an increasing stability in commutation which serves to offset, partly, if not entirely, the lack of commutating-pole density on high load. The combined effect is to produce perfect commutation at all loads.

Since the commutation is automatically taken care of for variations in speed and current, it is possible to change the voltage impressed on the motor through quite a range without sparking. This is thoroughly borne out by motors of 50 to 250 hp, recently constructed in this country.

The only limitations in raising the voltage are: Armature speed and strength of binding wire; volts between bars, and insulation.

This brings us naturally to the question: What effect will this commutating pole have on designs for voltages higher than are now general for railway service?

Railway-motor commutators before being connected to the armature winding are tested from bar to bar with 400 to 500 volts, alternating current, which means a maximum of 40 per cent more, so that actual jumping of current from bar to bar on a clean commutator would not occur at less than 500 volts per segment. An ordinary commutator of 111 segments and four poles would, under these conditions, be good for 13,000 volts between brushes. The actual jumping of current across side micas of a clean commutator is not the limiting condition.

Our limiting condition is the voltage per bar which will maintain an arc already established. The allowable voltage per segment is largely dependent upon the condition of the commutator. The condition of commutator depends upon the deteriorating tendencies, such as sparking and other causes, like poor carbon brushes, hard side micas, etc.

If the sparking be eliminated, the etching of the commutator bars is largely reduced. The carbon brushes are required to carry only the line current, instead of the line and a large amount of local current; therefore, the brushes are not disintegrated so rapidly. The carbon brush has less mica to wear off, because the bars are not burned away.

The result is that the carbon brushes work better, and the commutator stays in a very much better condition. The conclusion from the above is that much higher average volts per segment may be used with commutating-pole motors than with motors not having commutating poles.

The usual non-commutating-pole railway motor, 40 to 50-hp, has a commutator about 9.5 ins. in diameter, with 111 to 125 segments. The average potential between segments is approximately 18 volts. Large motors, operating on 650 volts normal, have 155 to 165 segments, and the average potential between segments is approximately 17 volts. If the average volts between segments on commutating-pole motors be assumed as 24, and the number of commutator bars per inch of circumference as 5, we have the following possible voltages on various sizes of motors and commutator diameters:

H.P.	Diameter of Commutator	Maximum Volts Motor
40	9	850
75	11	1040
100	13	1230
150	14.5	1370
200	16	1510
250	18	1700

The above may be said to apply only as far as tendencies are concerned. Not all these various voltages would be practicable. It would be better, for various reasons, to adopt 1200 volts as the higher standard.

The propositions requiring higher potential than 600 volts are usually 30 to 50-ton cars with speeds of 40 to 60 miles per hour. These call for a motor of 75 hp or larger, so the sizes naturally fall where 1200 volts can be made with reasonable cost.

The commutating-pole motor, on 600 volts, makes possible commutation and general operation in service many times better than that of the non-commutating pole motor. On 1200 volts the commutation is decidedly better than with a non-commutating pole type motor on 600 volts. The 1200-volt motor requires proportionally more insulation than the present 600-volt motor. This extra insulation requires more diameter and more external dimension.

We have the possibility of 1200 volts per motor, the motor having four poles. Should the motor be bipolar and the speeds high enough to make the design possible, we may have 2500 volts per motor. Then again, if there should be two windings on one core, a commutator on each, and these windings connected in series, we have the possibility of a 5000-volt motor. Then again, should we have a double-track railway and the rail neutral, we might have 10,000 volts direct current between the two trolley wires.

It will be appreciated that more voltage means more insulation, more space, and more cost. It will also be seen that the control, car lighting and operation of auxiliary apparatus require special consideration.

The non-commutating pole motor has inherently a higher iron density, which serves as a compensating feature, improving commutation. The commutator pole compensates for armature reaction and takes care of troubles due to lack of compensating features; a lower iron density may, therefore, be utilized and lower iron losses obtained.

The absence of sparking makes the commutating losses very much less. The rating on the hourly basis may not be much greater than with the non-commutating pole motor. On account of core loss and commutator loss being considerably less, and these prominent features in heating, the commutating-pole motor has naturally a higher continuous rating; it is not only capable of taking large fluctuations of voltage and current, but will have a greater all-day service capacity. This latter feature becomes more pronounced as the distance between stops is greater.

There are several ways of making use of higher direct-current potentials. The most prominent of these are the following:

1.—City service, 600-volt trolley; maximum speed 25 to 30 miles per hour, with stops and schedules incident to city service; and interurban service, 1200-volt trolley; maximum speed 50 to 60 miles per hour, with few stops and high schedules. The motors would be wound and insulated for 1200 volts. Two motors would be connected in multiple, and the two groups of a four-motor equipment handled in series and in parallel.

2.—City service, 600-volt trolley; maximum speed 25 to 30 miles per hour, with stops and schedules incident to city service; suburban service, 600-volt trolley; maximum speed of 30 to 60 miles per hour, with stops and schedules incident to suburban business; and interurban service, 1200-volt trolley; maximum speed 50 to 60 miles per hour, with few stops and high schedule speed. The motors would be wound for 600 volts with a relatively low armature speed and insulated for 1200 volts.

On a 600-volt trolley two motors are connected in multiple, and the two groups handled in series and parallel.

On a 1200-volt trolley two motors are connected in series, and the two groups of four-motor equipment handled in series and parallel.

The armature speed and commutating features should be so designed that if one wheel slips and one motor has 1200 volts or so across its terminal, its armature speed will be reasonable and the commutation good.

Interurban cars with four axles and four motors usually accelerate at 1 to 1.5 miles per hour per second; this requires about 100 to 150 lbs. per ton, which is 5 to 7.5 per cent coefficient of traction. These are low coefficient values for interurban roads and are seldom met with; however, should slipping occur, the motor design should be such that no damage to equipment will result. In the city the dirty street may give a low condition of traction, but under these conditions the motors may be used in multiple or operated as any four-motor equipment is now handled.

Summing up, the advantages of commutating-pole railway motors as compared with non-commutating pole type are as follows: Sparkless commutation even on heavy overloads; flashing at commutator largely reduced and probably eliminated; less wear on commutator; cleaner and safer motor because of reduced carbon and copper dust from brushes and commutator; marked reduction in heating of commutator; greater current density in brushes; increased life of brushes; increased efficiency and free running capacity because of lower core and commutator losses; possibility of successfully using higher voltages; greater facility in design of large motors, especially as regards commutation, and possibility of increasing service capacity of motors by blowing.

REGENERATION OF POWER WITH SINGLE-PHASE ELECTRIC RAILWAY MOTORS*

BY WILLIAM COOPER

The conditions necessary that an electric motor may operate successfully in regenerating or restoring power to the supply circuit are: The counter pressure generated by the motor must be greater than the impressed pressure of

the supply circuit; the value of this excess counter pressure must be under control and maintained in suitable relation to the impressed pressure; and there must be at the time other power-consuming devices connected to the supply circuit.

There is no difficulty in producing the first condition; the second is the one that is difficult to fulfil. There are two methods of regulating the counter to the impressed pressure; one is to increase the counter pressure and the other to reduce the impressed. The third condition, except in isolated cases, will be taken care of by the operating load.

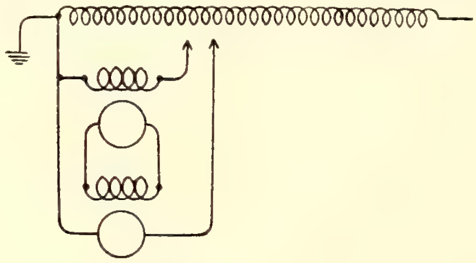


FIG. 1.—REGENERATION WITH SINGLE-PHASE MOTOR

Practically all variable-speed railway motors are of the so-called series type, and as this type of motor is the only one having the proper characteristics for general railway work, it alone will be considered.

The operation of a series dynamo electric machine as a series generator on a constant-potential circuit is a problem which many have grappled with, but none has solved. The machine must be given a shunt characteristic of a greater or less degree to make such operation possible. A machine having the shunt characteristic predominant is unfit for use as a railway motor, and as this characteristic must be predominant to operate successfully as a generator, it is at once evident that the motor must be changed in some manner before it can be used as a generator.

And this is not the only condition which the motor must fulfil to operate successfully as a generator in restoring power to the supply circuit. The motor must operate satisfactorily while the armature current is varied through a wide range with a constant field. This is evident from a very casual observation of the conditions.

Assume that the car or locomotive being driven by the motor under consideration has attained a balanced or free running speed under the conditions. The motor is then developing only sufficient torque to overcome the train resistances. The motor, being a series machine, has the same current in the field and armature. Under these conditions a very slight increase in the field current would increase the counter electromotive force of the armature to a value greater than the impressed electromotive force of the supply circuit.

Now assume an ordinary series motor in which the armature current cannot be increased materially above the corresponding field strength without disturbing the commutating conditions; it follows that the motor acting as a generator can only give a retarding force approximately equal to the train resistance. This added to the train resistance would give a total retardation so small that it could not be called a braking effect. From this it is obvious that the armature current must exceed the field current at times in order to produce a retarding effect which can be utilized in bringing the train to rest, or in holding the train on a grade. This, then, is another condition which the ordinary series railway motor does not readily fulfil.

From the foregoing it would seem that a motor, to operate successfully as a regenerator of power, must have the following characteristics: It must be capable of operating through a wide range of variation between field and armature current, and it must be provided with some means of producing a shunt characteristic.

The first characteristic exists to the fullest extent in a motor having some means of compensating for armature reaction, as well as a means of maintaining a constant commutating condition. This characteristic also exists to a limited extent in a motor having either one of these functions.

The second characteristic is not so easily provided. In the direct-current motor it can be obtained by providing the motor with both a shunt and series winding, either of which has sufficient capacity to operate the machine either as a shunt-wound generator or as a series motor.

Another method of furnishing the shunt characteristic is to provide a means of separately exciting the motor field independent of the line or motor voltage. There are several ways of doing this. In the case of four-motor equipments, one method is to use one motor as a generator to excite

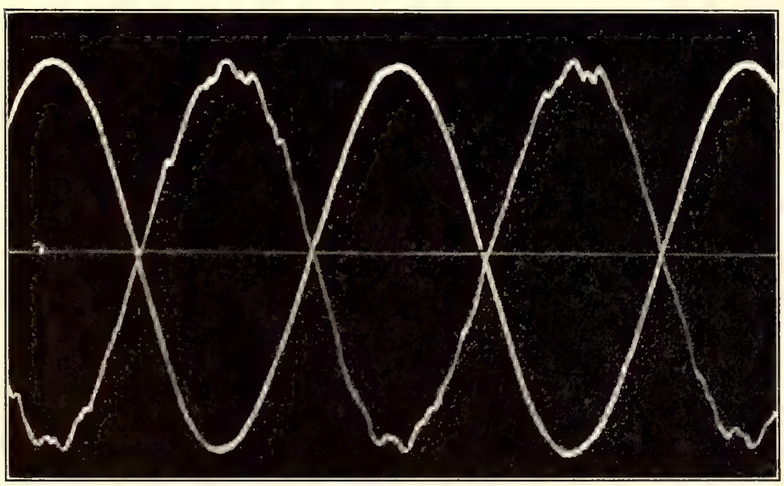


FIG. 2.—OSCILLOGRAM OF GENERATED AND TRANSFORMER ELECTROMOTIVE FORCES. THE GENERATED ELECTROMOTIVE FORCE IS THE CURVE WITH THE IRREGULAR TOP

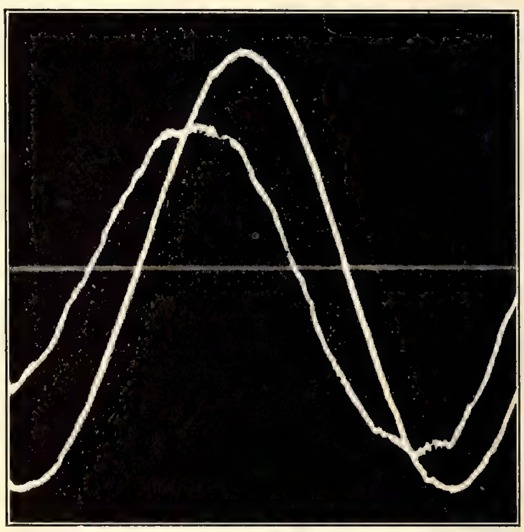


FIG. 3.—OSCILLOGRAM OF CURRENT AND ELECTROMOTIVE FORCE OF GENERATOR. THE LOWER CURVE IS THE CURRENT. POWER FACTOR 80 PER CENT LAGGING CURRENT

the other three motors which will operate as generators, being connected to the supply circuit.

Storage batteries may also be used to excite the fields, but this arrangement has its disadvantages in being complicated.

The great difficulty encountered in operating direct-current motors as regenerators of power is that the impressed pressure is a constant, and the means at hand for meeting it are very limited. As the ordinary series motor will not permit of any very great variation of armature current with a constant field, and as only a very limited number of combinations of the motors is possible, the range through which an equipment can be operated regeneratively is, under the most favorable conditions, very limited.

In the single-phase, alternating-current motor of the series type these necessary characteristics are inherent. Without entering into a description of this motor, the design of which is well known, it is sufficient to say that the machine is provided with a compensating winding to neutralize the armature reaction, and also has preventive leads between commutator and armature windings which assist in commutation. This construction yields the first characteristic; the second is easily obtained in connection with the transformer used in the voltage control of the motor.

The method of producing this result is to use one of the motors of the equipment as an exciter for the others. By providing the transformer with suitable voltage taps, the value of the field current of the exciter may be varied through a wide range, as well as the generated voltage of the restored power. In this respect the conditions are very much more favorable than in the case of the direct-current motor, in which the only variations that can possibly be made are in the series-parallel combinations of the motors which are being used as generators.

The exact arrangement of the motors and their connections is shown diagrammatically in Fig. 1.

Assume the car or locomotive upon which the motors are

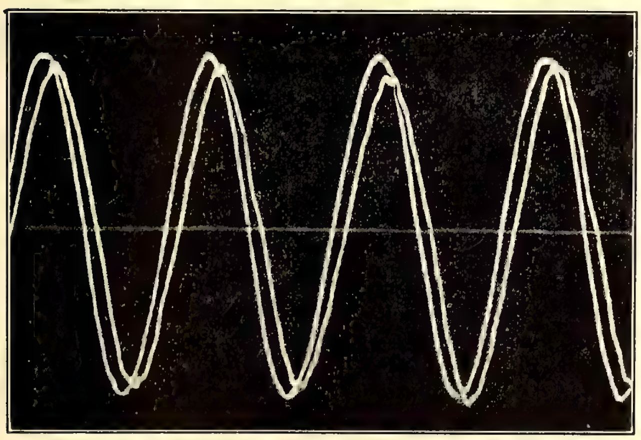


FIG. 4.—OSCILLOGRAM OF CURRENT AND ELECTROMOTIVE FORCE UNDER LIGHT LOAD. THE LOWER CURVE IS THE CURRENT. POWER FACTOR 98 PER CENT LEADING CURRENT

mounted to be in motion, the armatures turning at a corresponding speed. If the field of the first machine be connected to the transformer, an alternating electromotive force will be generated by its armature, the value of which will be directly proportional to the speed. If the field of the other motor be connected to the exciter armature, an alternating current will pass through it, and the second armature will, in turn, generate an alternating electromotive force the value of which varies about as the square of the speed—the excitation of the first machine remaining constant.

The electromotive force generated by the second armature will bear a very close phase-relation with the electromotive force of the transformer, for the reason that the current in the field circuit connected to the transformer lags approximately 90 degs., as does the current in the field circuit of the second machine. This combination throws the generated electromotive force of the second machine approxi-

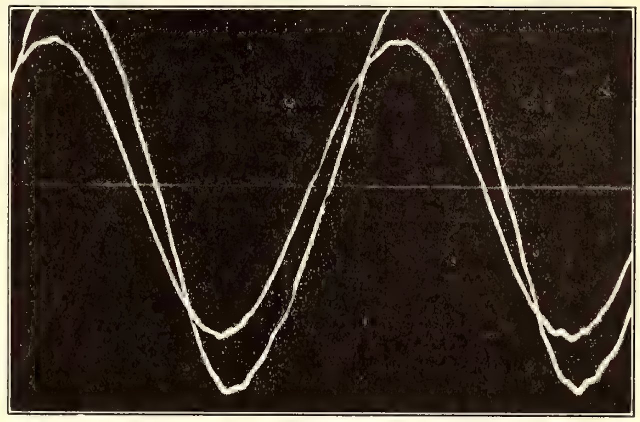


FIG. 5. OSCILLOGRAM OF CURRENT AND ELECTROMOTIVE FORCE UNDER NORMAL LOAD. CONDITIONS AS IN FIG. 4. THE LOWER CURVE IS THE CURRENT. POWER FACTOR 99.5 PER CENT LAGGING CURRENT

mately 180 degs. back of the transformer electromotive force, or by reversing the connections in the same phase-relation.

The phase-relation between the generated and transformer voltages is shown in Fig. 2.

The record shows that the two electromotive forces are in exactly opposite phase. Under these conditions the current flowing after the circuit is closed with the connections reversed will be displaced from the electromotive force,

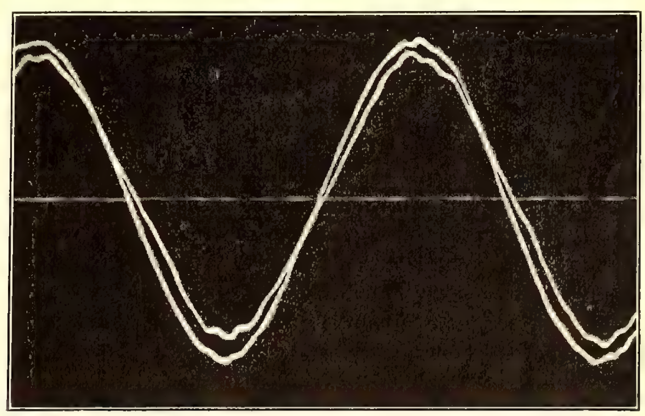


FIG. 6.—OSCILLOGRAM OF CURRENT AND ELECTROMOTIVE FORCE UNDER 100 PER CENT OVERLOAD. CONDITIONS AS IN FIGS. 4 AND 5. POWER FACTOR 97 PER CENT LAGGING CURRENT. THE CURRENT IS THE UPPER CURVE

due to the impedance of the armature circuit. Fig. 3 shows this displacement when the armature is carrying about 100 per cent current overload.

This is at a power factor of 80 per cent. The power factor varies between this and 100 per cent as the load decreases to zero. The obvious method to improve the power factor is to shift the phase-relation of the generated to the line electromotive force. The result of this is shown in Figs. 4, 5 and 6.

Fig. 4 shows approximately the relation of the generated

to the transformer electromotive force as it would be on open circuit, as the current in this case is small.

From these records, it is evident that there is no difficulty in restoring power with a single-phase commutator-type motor at practically 100 per cent power factor, the machine operating as a non-synchronous alternating-current generator.

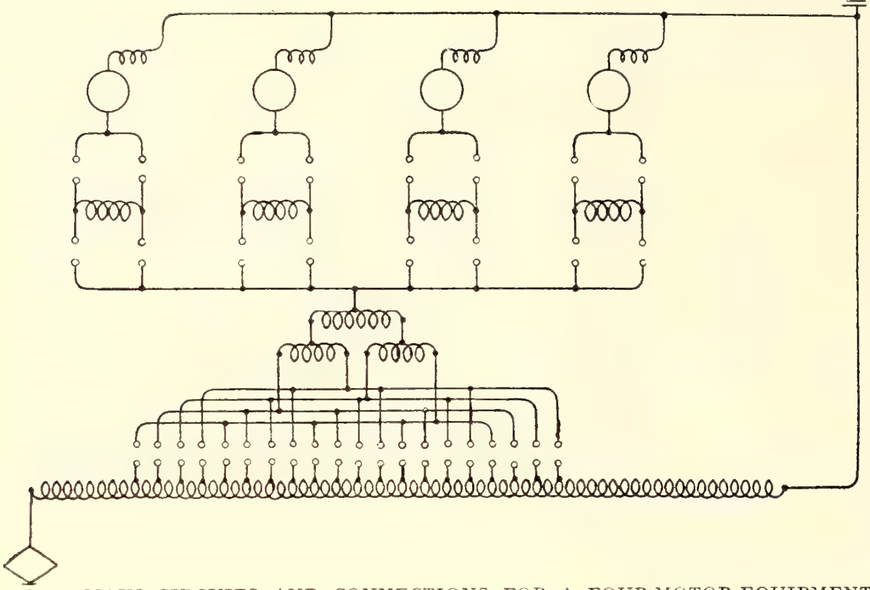


FIG. 7.—MAIN CIRCUITS AND CONNECTIONS FOR A FOUR-MOTOR EQUIPMENT

This condition being established, the next step is to see how it applies to actual operating conditions. From the foregoing it is evident that one of the motors of the equipment must be set aside for use as an exciter for the others, or a separate motor-generator set must be provided. If a separate source of excitation is provided, all the motors can be used to the fullest extent for regeneration of power, in which case the total capacity for regeneration will be increased over the capacity of the machines as motors by the increase in the power factor. If the regenerative function is to be used for braking in making frequent stops, it might be desirable to supply the separate excitation; but if it is to be used in holding the train on grades it is unnecessary, as the remaining motors, if the equipment consists of three or more motors, will have ample capacity to do the work.

Assume a 2 per cent grade of considerable length. The motors, all working, have sufficient capacity to haul the train up the grade. Assume the equipment to consist of four motors. Assume train resistance at 6 lbs. per ton. The total tractive effort will then be 46 lbs. per ton in ascending.

To hold the train at the same speed in descending, a retarding force of 34 lbs. per ton must be supplied. The retarding force necessary is then approximately 75 per cent of the force necessary to haul the train up the grade. It is evident from this that three of the four motors have ample capacity to exert the necessary retarding force, even if the power factor of the machines as generators is no better than when they are operating as motors. It has been shown that the power factor when operating as generators can be made better than when operating as motors; therefore, there is a surplus of capacity in four-motor equipment and in three-motor equipment about an equal capacity.

The characteristics and capacity of the machines being correct for the work, it only remains to provide suitable means for manipulating the circuits to adapt the apparatus to the conditions. This is accomplished by providing switching apparatus to connect the motors in the proper relation and for furnishing and controlling the field current of the machine used as an exciter.

Fig. 7 shows diagrammatically the main circuits and connections for a four-motor equipment. From this it is evident that the switches used must have a current capacity the same as the motors, for there are four in parallel on the transformer and the switches used for reversing carry the current for one motor only. As shown, thirty-six switches are required for the entire control of the motor equipment.

Fig. 8 shows diagrammatically the same motor equipment arranged for regeneration in addition to the regular motor control. As shown, fifty-four switches are required of the motor-current capacity, and sixteen of one-fourth that capacity. Of the added switches of the motor-current capacity, ten have been added to the transformer to enable slow speeds on regeneration to be obtained, and eight are required to change the combinations of the motors. Besides the added switches, three small preventive coils and a few additional transformer taps are required. From this it is seen that the amount of additional apparatus required is insignificant compared with the result accomplished.

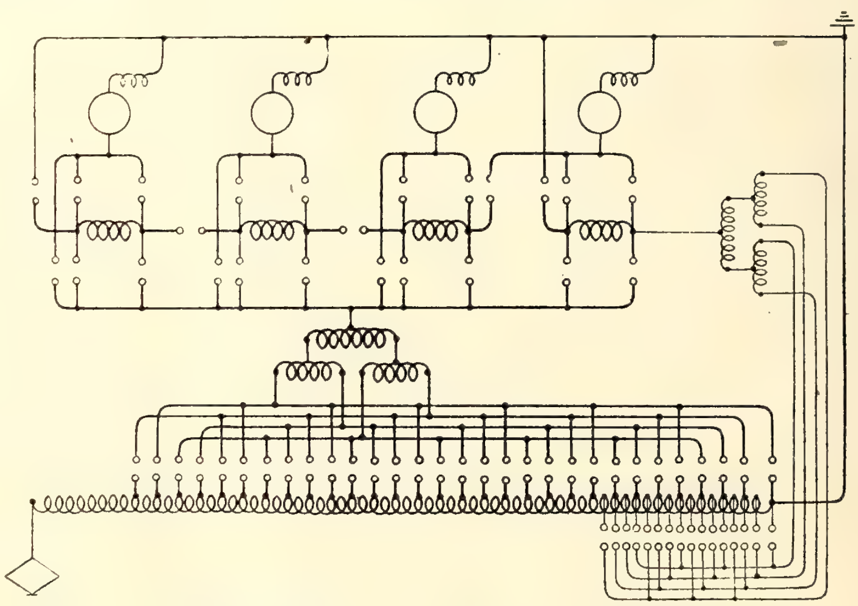


FIG. 8.—FOUR-MOTOR EQUIPMENT ARRANGED FOR REGENERATION IN ADDITION TO THE REGULAR MOTOR CONTROL

The curves shown in Fig. 9 give the relative tractive and retarding effect, both continuous and maximum, of a four-motor equipment.

As shown by the curves in Fig. 9, the three motors of a four-motor equipment acting as generators restoring energy to the line will let a train down a 2 per cent grade at

any speed from 9 miles per hour to 30 miles per hour, that the motors have capacity to haul up the same grade at any speed up to 18.5 miles per hour. This is for continuous duty. At maximum duty for short periods the capacity is increased about 60 per cent. Between 9 miles per hour and 30 miles per hour there are forty operating speeds, the gradations from one to the other being such that at no time will there be any variation exceeding 10 per cent in torque. This necessitates, of course, a rather large number of switches being used, but seems to be a very desirable condition to fulfil in heavy freight traffic.

EFFICIENCY OF THIS SYSTEM OF REGENERATION

The efficiency of the system when the motors are operating as generators and restoring energy to the supply circuit is about the same as the efficiency when operating as motors, there being perhaps a slight advantage in the case of the generator, due to the improved power factor conditions. This, of course, assumes about the same load conditions on the machines in either case. However, the actual saving in power house output can never be a very large percentage. If the entire load consisted of 2 per cent grades and there was no switching to be done, the saving in power consump-

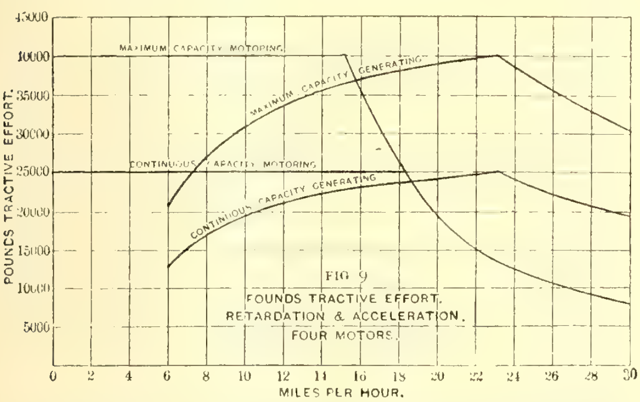


FIG. 9.—RELATIVE TRACTIVE AND RETARDING EFFORT, CONTINUOUS AND MAXIMUM, OF A FOUR-MOTOR EQUIPMENT

tion might be as high as 50 per cent, while under ordinary conditions it could not be made to exceed one-half of this, and under unfavorable conditions or with a level track and long runs, using the regenerative function only for braking, the saving could not be more than a few per cent.

The value of this system of regeneration is not to be found so much in the saving of power as in the saving in wear and tear and the ability to operate over a wide range of speed, as well as the comparative safety of operation. In the case of running heavy trains down long grades, the braking apparatus of all cars in the train can be held in reserve, it being necessary to use it only in emergency or in making the final stop. Under these conditions the number of accidents due to the failure of the brakes would be very much reduced.

This is the only system of regeneration yet developed which can be operated at maximum efficiency over a wide range of speed. In the case illustrated forty speeds between 9 miles per hour and 30 miles per hour are obtained. This number can be increased if desired simply by the addition of a few switches.

The three-phase system is the only other one in which the regenerative function has been developed to any extent, but at most there are only a few widely separated speeds at which it can be operated efficiently. Generally, there is but one.

A system of electric traction in which the trains must go up-grade and down-grade at one fixed speed in order to operate efficiently is certainly at a disadvantage when compared with one in which the trains can be operated at any speed below a certain maximum speed up-grade and at any speed within safe limits down-grade, at all times, whether taking energy from the line or restoring it to the line, the apparatus operating with maximum efficiency.

It will be noted that in this system the impressed voltage is changed to adapt it to the generated, while in the direct-current or the three-phase system there is but one impressed voltage available. This wide range of working voltage, together with the ability to vary the armature current with respect to the field through a wide range, gives to the single-phase series motor the extreme flexibility as a regenerator of power that it has as a motor.

One other point that is worthy of note in connection with the operation of this system is the absolute safety and stability of the combination. While the machines being operated as generators are normally series machines, it will be noted that no one of the armatures is connected in series with its own field, and under no condition can there be any surging or building up of load. In case of momentary interruption of the supply circuit, the circuit again being restored, the system will again operate exactly as before the interruption, there being no surging or violent action of the machines.

The system of regenerating power here described has been used in testing locomotives to give a dead-load condition under a wide range of speed. Numerous stand-tests have also been made, so that the operation of the motors under the conditions is well established and there is no doubt about the scheme doing all that is claimed for it.

ABSTRACTS OF OTHER INSTITUTE PAPERS

INSULATOR FOR HIGH-TENSION TRANSMISSION LINES

A new type of insulator, especially designed for use on high-tension transmission lines, was described in a paper by E. M. Hewlett. Each insulator unit is a flanged or petticoated disk of porcelain with an enlarged central portion having two inter-linked semi-circular holes. It is termed a "linked insulator" because it is used to insulate the interlinked tie wires. The holes in the insulator are so arranged that the tie wires which pass through them exert a compression strain on the porcelain. If the insulator should break, the loops of the tie wires will still be intermeshed, and as several disks are used in series with a factor of safety, the remaining disks will prevent a short circuit being formed until the break can be repaired. Two types of the insulator were illustrated, one for suspension from the cross-arm and one for use as a strain insulator to be inserted in the main circuit, which is looped around the insulator. The mechanical and electrical features of the two forms of insulators are essentially the same. The petticoats and flanges are so arranged that one side of the insulator is always protected from rain.

HIGH-TENSION SWITCHBOARD PRACTICE

A paper by Stephen Q. Hayes touched briefly on the salient points of interest in connection with high-voltage switching practice. Under the heading of the general scheme of connections the switchboard equipment for a plant was summarized as follows: First, the type of plant;

second, the frequency; third, the transformers; fourth, flexibility versus simplicity, and, fifth, main connections. The author also discussed the relative advantages of switchboards of the panel type, of the pedestal type and of the bench-board type; and also the various types of oil circuit-breakers, disconnecting switches and protective apparatus, and he treated of the relative merits of using enclosed wiring and open wiring. The author stated that it is quite possible that in the not far distant future, where the climate is not too severe, the high-tension transformer houses with their breakers, bus-bars, etc., will no longer be used. The transformers, oil circuit-breakers, disconnecting switches, bus-bars, wiring and connections will probably be in the open air. The oil-immersed, water-cooled transformers and electrically operated oil switches are designed to withstand out-of-door conditions. Disconnecting switches have often been used in high-tension transmission lines mounted on the poles and the use of electrolytic lighting arresters with the choke coil combined with the transformer cases would readily permit of this out-of-door operation.

COMMERCIAL TESTS OF LIGHTNING ARRESTERS

A paper by Percy H. Thomas gave an outline of tests of lightning arresters which it was considered should be included in the standardization rules. The tests should be arranged to determine, first, the condition of individual arresters; second, the effectiveness of a particular design, and third, the characteristics of different types. The paper considered in detail the various types of arresters, such as arresters which offer no impedance to the discharge and arresters using series resistance and special forms of arrester. From an analysis of the advantages, disadvantages and limitations of the various possible tests of lightning protecting apparatus, the author concluded that certain tests are of great value in connection with certain types of arresters, but not with all types, and that some of the tests are difficult and awkward to make. He offered the suggestion that tests should be introduced into the standardization rules cautiously and gradually. On the other hand, if rules are adopted there will be a great advantage in many cases of testing lightning arrester apparatus. For example, they will afford a ready means for correctly comparing the numerous low-voltage arresters, especially railway arresters, which appear from time to time. Furthermore, the fact that certain tests have the stamp of approval of the Institute will do much to cause designers to put their apparatus in condition to meet these tests, even if the tests be so inconvenient as rarely or never to be imposed. The following tests were suggested for general consideration as suitable for the approval of the Institute:

1. The insulation strength of all lightning arresters should be able to withstand the abrupt application of the discharge of a condenser of at least 100th microfaric capacity, charged to a potential three times the normal arrester potential and not less than 50,000 volts without sparking between the parts or toward the ground.

2. Breakdown voltages at normal frequencies should be determined in all cases, in accordance with the requirements laid down in the standardization rules for the testing of insulation strength.

3. Where general considerations are not sufficient to determine the amount of impedance offered to a discharge, comparative tests between arresters may be made by noting the needle gap equivalents of two or more arresters by passing across the arresters separately or in series the discharge of a condenser of a few hundredths microfaric capacity charged to a potential of not less than 50,000 volts, nor less than three times the normal voltage of the arrester.

4. Where general considerations are not sufficient to determine the non-arcing feature of an arrester, a test may be made by passing sparks over the arrester when connected to a source of e. m. f. of sufficient power to supply without dropping its potential all the current which the arrester will take.

5. Endurance tests may be made in the same manner as tests of the non-arcing feature.

A PROPOSED LIGHTNING ARRESTER TEST

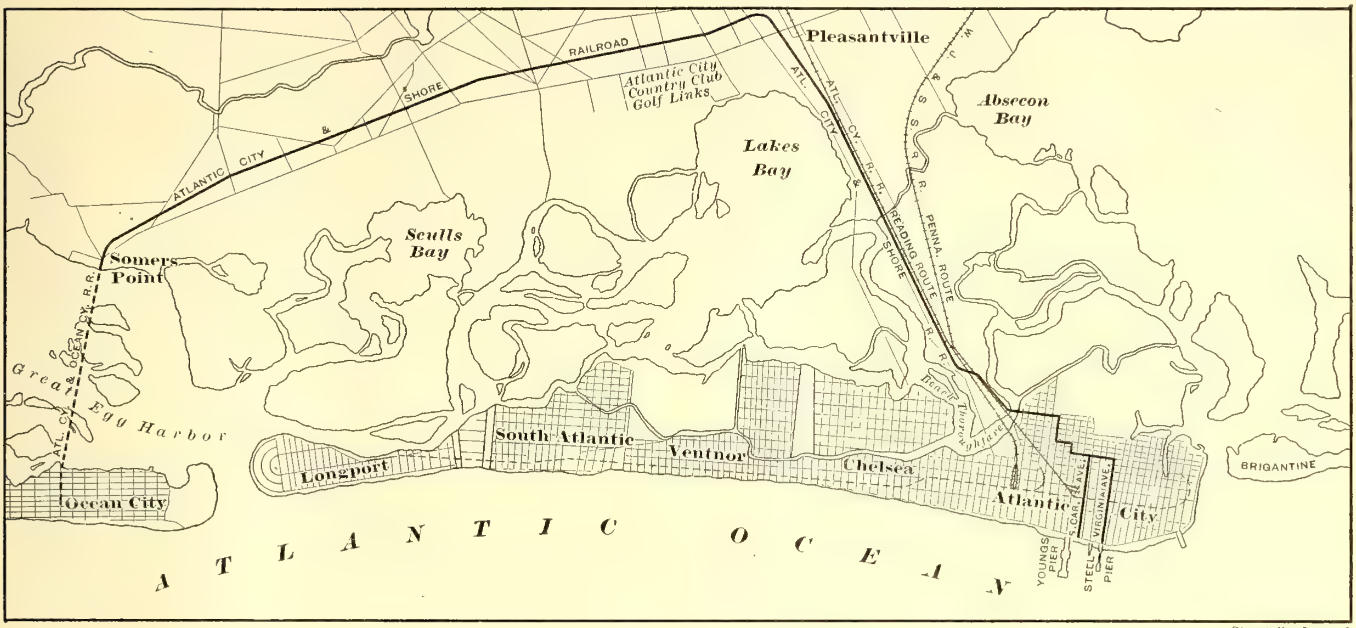
A paper by N. J. Neall outlined a lightning arrester test which he considered to be of value both to the operator of the line and to the manufacturer of lightning arresters. A spark from the induction coil is made to pass over all the gaps of the lightning arresters under test. The apparatus required consists of an induction coil operated from several cells of a storage battery by means of a mechanical vibrator. A small switch in series therewith enables the discharge to be controlled at will. A condenser is placed in series with each terminal of the induction coil, the one being grounded and the other being led through spark gaps to such a point of the series of the lightning arrester gaps that the spark from the coil will divide and pass over them simultaneously in the direction of the line and the ground, respectively. By means of this test, the effect of a disturbance can be estimated positively by the simultaneous use of tell-tale papers at all points where discharges are known to take place to ground. The intrinsic value of the method rests on the importance of knowing as far as possible how great the disturbance may be; how efficient is any given system of protective apparatus to handle them, and of discovering to what degree any given transmission system contains in its elements of length, arrangements and character of apparatus tending to prolong or increase the disturbances once initiated.

TRACK CIRCUIT SIGNALING ON ELECTRIFIED ROADS

A paper by A. L. Frederick Howard gave a brief outline of the various track circuit signaling systems now in use. There are three distinct types of signals according to the method of control, namely, the manual or non-automatic, the controlled manual or semi-automatic, and the purely automatic. Train order signals are of the first type, interlocking signals are of the first and second types, while block signals are of all three types. In the early signal circuits use was made of only one wire, which was set apart exclusively to this service, even in cases where such methods necessitated installing additional return conductors for the propulsion current in order to compensate for the rail given up for the signal system. A more recent method allows the use of both rails simultaneously for the propulsion current and for the signal current. A path for the propulsion current around insulating joints is provided for in the latter system in the form of impedance bonds indicated in the accompanying illustration. The propulsion current divides so that each part passes around the iron core of the bond in opposite directions, its magnetizing action upon the core being zero. On the other hand, the full impedance of the bond is offered to the signal current in preventing the passage from rail to rail of the alternating current used in the signal circuits. The principal difference in the relation between the elements of the track circuit as used on direct-current and alternating-current railway systems relates merely to a higher frequency of the signaling current.

ATLANTIC CITY & OCEAN CITY RAILROAD

A short account was published in the issue of this paper for Nov. 3, 1906, of the Atlantic City & Shore Railroad of New Jersey. This is one of the Stern & Silverman properties, and is probably unique among electric railway enterprises in that for a considerable portion of its route it has running rights over the tracks of a large steam railroad corporation, in this case the Pennsylvania Railroad. The accompanying map illustrates the situation at Atlantic City and gives the route of the company, as well as of an important extension which is being built under the name of the Atlantic City & Ocean City Railway, to connect Ocean City with Somers Point, the present southern terminal of the Atlantic City & Shore Railroad.

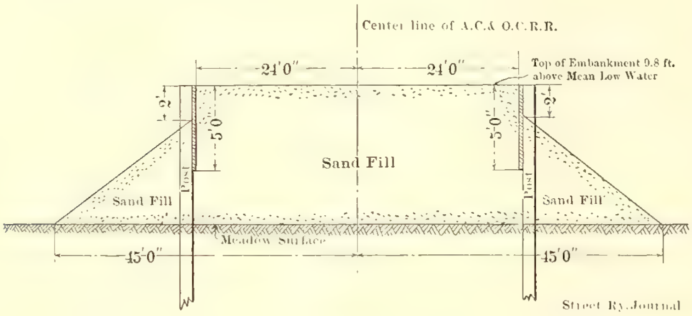


MAP SHOWING THE LINES OF THE ATLANTIC CITY & SHORE RAILROAD AND CONNECTIONS

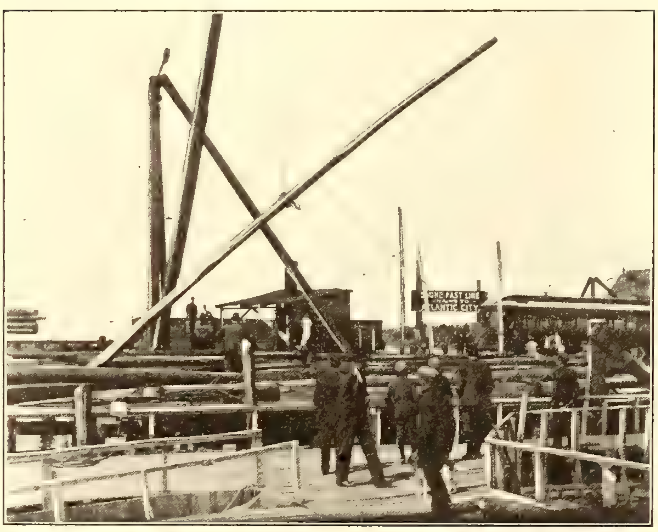
HAULING AUTOMOBILES ON FLAT CARS BETWEEN SOMERS POINT AND OCEAN CITY OVER THE ATLANTIC CITY & SHORE RAILROAD

Some two years ago the Atlantic City & Shore Railroad consisted of a short loop, shown in the map, in Atlantic City, connecting the Board Walk at Virginia Avenue with the Board Walk at South Carolina Avenue. At this time transportation between Atlantic City and Somers Point

was provided by the Pennsylvania Railroad, whose West Jersey & Seashore line extended to Pleasantville, from which point passengers were taken to Somers Point on a single track steam railroad branch. Some two years ago this branch was acquired under a long lease by the management of the Atlantic City & Shore Railroad and was double-tracked and converted to electric power. At the same time, running rights over the West Jersey & Seashore Railroad were secured by the Atlantic City & Shore Railroad from Pleasantville to the western limits of Atlantic City, and from this point a double-track extension with trestles and bridges to span the steam railroads at this point was built to connect with the city terminal of the electric railway company. In this way a high-speed electric railway service is conducted between Virginia Avenue on the Board Walk in Atlantic City and Somers Point. Within the city 550 volts are used on ordinary trolley wire. The Atlantic City & Shore Railroad commences to use the third rail on its own line at the thoroughfare and continues to operate on 650 volts over the trestles and bridges spanning the steam roads. Where it joins the West Jersey & Seashore Railroad that company's third rail is employed between Meadow Tower and Pleasantville. On the main land a catenary construction with 650 volts is used. Power is taken from the West Jersey & Seashore system through its sub-stations in Riga and Atlantic City, and the Atlantic City & Shore Railroad has its own sub-station at Somers Point. The line was put in operation Aug. 25, 1906.



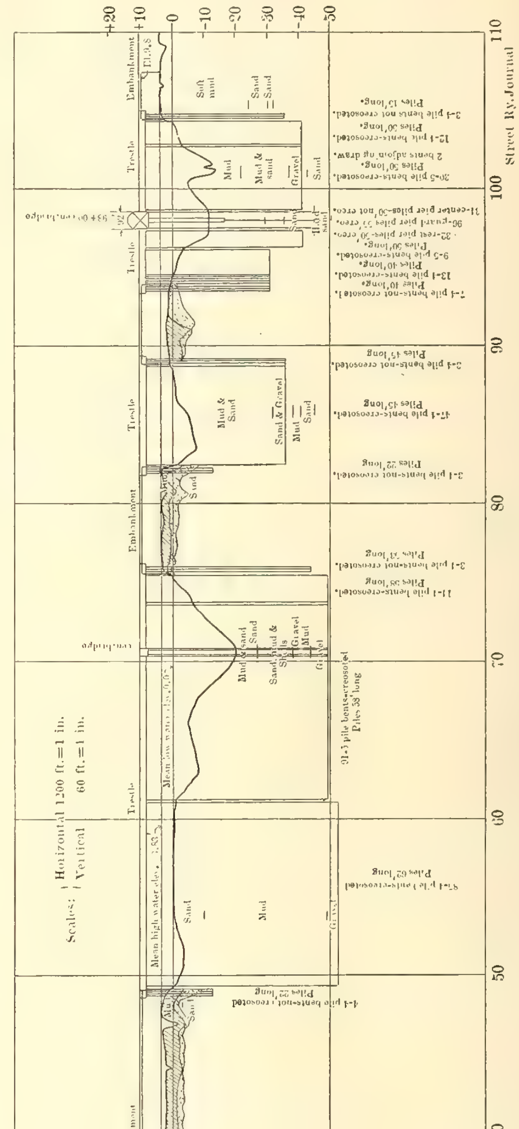
SECTION OF SAND FILL ON THE ATLANTIC CITY & OCEAN CITY RAILROAD



THE SOMERS POINT TERMINUS OF THE ATLANTIC CITY & SHORE RAILROAD

The cars make the run from Atlantic City to Somers Point of 14 miles in 36 minutes, and average about 400 miles per day. At present a 30-minute service is run between 5:30 a. m. and 11:30 p. m.

There is considerable travel between these points, as a great many provisions for the immense hotel population of



PROFILE OF ATLANTIC CITY & OCEAN CITY RAILROAD ACROSS GREAT EGG HARBOR

Atlantic City are raised on the main land, and the golf links at Northfield are well patronized during the season by the summer guests at Atlantic City.

The extension to Ocean City already referred to is being built by the Atlantic City Construction Company, and is one of the most extensive enterprises of its kind ever carried out by an electric corporation. The island on which Ocean City is situated is separated from Atlantic City by a wide inlet and from the main land by Great Egg Harbor Bay. It was necessary to install two drawbridges, and these, with the connecting trestles, have an aggregate length

TRESTLE UNDER CONSTRUCTION ACROSS GREAT EGG HARBOR

of nearly three-quarters of a mile. Near the center the line crosses a low island, where the right of way has been built up by sea sand, which has been pumped up from the bottom of the bay and deposited in a dyke built across the island. At this point it is the intention of the company to build a turnout about 1000 ft. in length, and later to install a pleasure resort with casino, boating, pavilion, etc.

The drawing on page 1152 shows the section of the line between Somers Point and Ocean City, with the bridges, trestles, etc. The latter are built under steam railroad specifications, and the bridges are being erected by the Penn Bridge Company.

In the operation of this line an ingenious scheme will be employed for adding to the income of the company by hauling automobiles from Somers Point to Ocean City. The latter, like all of the South Jersey resorts, is a favorite visiting point for automobiles, which can run there from Philadelphia in two or three hours. The highway bridge, however, is a long distance away, so that it is proposed to run flat cars between Somers Point and Ocean City for hauling automobiles over the trestle. One of the illustrations shows a flat car of this kind carrying two automobiles and hauled by one of the standard motor cars of the company. S. S. Neff, the general manager of the Atlantic City & Shore Railroad, who originated this idea, was formerly connected with the Union Elevated Railway, of Chicago, and also with the Boston Elevated and the Brooklyn Elevated Railway Company, as well as with the Mexico City Tramways Company. The operation of the Atlantic City & Ocean City Railroad will be conducted by the Atlantic City & Shore Railroad. The line to Ocean City will be operated about July 1. The schedule will offer a half-hourly service from each terminal between 6 a. m. and 9 a. m., fifteen-minute headway between 9 a. m. and 9 p. m., and half-hourly headway between 9 p. m. and midnight.

POWER HOUSE IMPROVEMENTS AT NASHVILLE

The boiler capacity of the main power station of the Nashville Railway & Light Company is being increased by the installation of four 600-hp Stirling boilers. The new boilers are provided with Green traveling grates. They are designed for 200 lbs. pressure and 100 degs. superheat. To house them a brick extension has been built on the north end of the station. In the engine room there has recently been installed a 1600-kw railway generator and two 1000-kw rotary converters. The circuit breakers for these are located near the machines and are operated from the main switchboard by solenoids. A new a. c. and d. c. switchboard has also been installed. All of the main a. c. switches, with the exception of the switches on a 3000-kw generator, are of the distant control type.

A new 48-in. cast-iron intake is being extended into the Tennessee River. An ash handling plant for temporary use has been erected north of the generating station. Ash cars pushed from the boiler room basement are dumped into a bucket and a skip furnished by the Link Belt Engineering Company elevates them to an overhead reinforced concrete bunker having a capacity of about four steam road cars. Chutes from the bunker discharge the ashes into cars below.

OVERHEAD CONSTRUCTION AT HOUSTON, TEX.

A large portion of the overhead construction in Houston has been rebuilt in the last two years. In the new construction 30-ft. creosoted pine poles with 8-in. tops are being used. Glass insulators are being used, as trouble has been experienced with certain composite insulators. The span wire insulators are placed over the rails on single track and over the outside rails on double track. In this position they can be gotten at from a tower wagon. All new trolley is No. 00. About 10 miles of 350,000 and 500,000-circ. mil feeders have been put up since the reconstruction work began.

In connection with the opening of the electrified section of the West Shore Railroad between Utica and Syracuse, the Utica papers publish copies of letters written in 1901 to the New York Central officials by J. W. Boyle, then president of the Utica Belt Line Street Railway Company. In these letters Mr. Boyle suggests the electrical equipment of the West Shore tracks between Utica and Syracuse, and in behalf of his company offered so to equip and lease them, indicating that the plan had been under consideration for at least six years.

OCTOBER CONVENTION ANNOUNCEMENTS

Secretary-Treasurer Swenson, of the American Street and Interurban Railway Association, has just issued Convention Bulletin No. 2, giving the hotel rates and general program for the 1907 convention, to be held at Atlantic City, N. J., from October 14 to 18, inclusive.

The place of meeting in Atlantic City will be on the Steel Pier, which has been recently widened, strengthened and reinforced with concrete the entire length. It extends 1600 ft. into the ocean, and will be the general headquarters during the day for the meetings, and upon it will be held the exhibition of electric railway apparatus and appliances given by the Manufacturers' Association. Over 70,000 sq. ft. of net exhibit space on this structure is available, and all indications point to a manufacturers' exhibit which will be even larger and more interesting than the most excellent exhibit given in Columbus upon the occasion of the 1906 convention. In addition to the exhibits shown on the Steel Pier, there will be a fine display of cars within walking distance of the Pier. Along the Board Walk and near the Steel Pier are located the leading hotels of Atlantic City.

It has been decided by the official representatives of the various associations that each association shall have its own headquarters hotel for the Atlantic City convention. It is not the desire of those in charge of the convention that these particular hotels be patronized to the exclusion of others, but rather that they be used as general meeting

RATES BY THE DAY, AMERICAN PLAN, UNLESS OTHERWISE STATED.

	Rooms Without Private Bath.				Rooms With Private Bath.			
	For One Person.		For Two Persons.		For One Person.		For Two Persons.	
	In Single Room.	In Double Room.	In Double Room.	In Extra Large Room.	In Single Room.	In Double Room.	In Double Room.	In Extra Large Room.
Abbey, American	$2.50	$4.00	$5.00	$6.00	$3.50	$7.00	$8.00	$10.00
Abbey, European	1.50	2.50	2.50	3.00	2.00	3.50	6.00	8.00
Acme	2.50	3.00	4.00	5.00	....	....	....	....
Albemarle	2.50	3.00	4.00	5.00	4.00	5.00	6.00	7.00
Algonquin, American	2.00	2.50	3.00	4.00	2.50	3.00	3.50	4.50
Algonquin, European	1.00	1.50	1.50	2.50	1.50	2.00	2.00	2.50
Archdale	2.00	2.50	4.00	4.50	....	....	5.00	....
Berkshire Inn	2 to 2.50	2 to 2.50	4.00	4 to 5	4 to 5	5 to 6	6 to 8	6 to 8
Bingham	2.00	2.50	4.00	5.00	....	....	....	....
Bothwell	3.00	3.50	5.00	6.00	4.00	5.00	7.00	8.00
Brighton	4 to 6	....	8 to 10	10 to 14	6 to 8	....	10 to 12	12 to 16
Carlton	2.00	2.50	....	4.00	3.00	3.50	6.00	8.00
Chalfonte	3.50	4.50	6, 7 to 8	10.00	....	6.00	10.00	12.00
Chatham	2.00	2.50	4 00	5.00	....	4.00	5.00	....
Chelsea	4 00	5.00	8.00	9.00	6.00	7.00	10.00	12 to 14
Colwyn	1.50 to 2	2 to 2.50	2.50 to 4	4 to 6	....	....	....	....
Continental, American	1.50	2.00	3 00	4.00	2.00	2.50	4.00	5.00
Continental, European	1 00	1.25	1.50	2.00	1.00	1.25	1.50	2.00
Craig Hall	2 50	3 00	5 00	5.00	3.50	....	6.00	7.00
Davenport	1.50	2 00	3.00	4.00	....	....	....	....
Dennis	3.50 to 4	4.50	6, 7 to 8	....	5.00	7.00	10.00	12.00
Earl Mar Hall	4.00	5.00	5 00	6.00	6.00	8.00	8.00	10.00
Edison, American	2.00	2.00	4 00	....	....	3.00	6.00	....
Edison, European	1.25	1.25	2.00	....	....	....	....	....
Elberon, American	2.00	2.50	3.00	4.00	2.50	3.00	5.00	6.00
Elberon, European	1.00	1.50	2.00	2 50	1.50	2.00	3.00	4.00
Elwood, American	2.50	3.00	4.00	6.00	3.00	4.00	6.00	8.00
Elwood, European	1.00	1.50	2.00	3.00	2.00	3.00	3.50	4.00
Fredonia, American	2 up	2 up	4 up	4 up	3.00	6.00	6.00	7.00
Fredonia, European	1 up	1 up	2 up	2 up	2.00	4.00	4.00	5.00
Garden, American	3.00	4.00	6.00	7.00	4.50	5.00	8.00	9.00
Garden, European	1.50	2.00	3.00	4.00	2.00	3.00	4.00	5.00
Haddon Hall	3.50	5.00	6.00	8 to 10	6.00	7.00	9 to 16	....
Holland	1.50 to 2	2 50	2.50	4.00	....	....	....	....
Iroquois	2.50	3.00	....	5.00	3.50	3.50	6.00	6.00
Islesworth	3.00	4.00	5.00	6.00	4.00	5.00	7.00	8.00
Jackson	4.00	....	6 00	....	5 00	....	8.00	....
Kentucky, American	1.50 to 2	2 to 2.50	3 to 4	3.50 to 4.50	3 to 3.50	3.50 to 4	4 to 5	5 to 6
Kentucky, European	1 to 1.25	1.25 to 1.50	2.00	2.50	2 to 2.50	2.50 to 3	3 to 4	3.50 to 4
Larsen, American	....	1.50	2.00	2.00	....	....	....	....
Larsen, European	....	1.00	1.00	1.00	....	....	....	....
Loraine, American	2.50	3.00	5.00	6.00	4.00	4.50	7.00	8.00
Loraine, European	1.50	2.00	2.00	3.00	....	....	....	....
Majestic	2.50	3.00	5.00	6.00	....	5.00	7.00	8.00
Marlborough-Blenheim, American	4, 5 to 6	5, 6 to 7	8, 9 to 10	9, 10 to 11	6, 7 to 8	7, 8 to 9	10, 11 to 12	12 to 20
Marlborough-Blenheim, European	2, 3 to 4	3, 4 to 5	4, 5 to 6	5, 6 to 7	4, 5 to 6	5, 6 to 7	6, 7 to 8	8 to 16
Monticello, American	2.00	2.50	4.00	5.00	3.00	3.50	5.00	6.00
Monticello, European	1.00	1.50	2.00	3.00	2.00	2.50	3.00	4.00
Pennhurst	2.50	3.00	5.00	6.00	4.00	5.00	7.00	8.00
Pennlyn	2.00	2.50	3.00	5.00	....	....	....	....
Phillips House	2 to 2.50	2.50 to 3	4.00	4 to 5	....	....	....	....
Ponce De Leon, American	2.50	5.00	5.00	6.00	3.50	6.00	6.00	7.00
Ponce De Leon, European	1.50	2.00	2.00	3.00	2.50	3.50	5.00	6.00
Princess, American	2.50	3.00	4.00	5.00	3.50	4.50	6.00	8.00
Princess, European	1.00	1.50	1.50	2.00	2.00	3.00	4.00	5.00
Raleigh	3.00	....	5.00	6.00	4.00	5.00	7.00	8.00
Roman	2.00	3.50	4.50	5.50	3.00	4.50	5.50	6.00
Royal Palace	3.00	4 to 4.50	7.00	8.00	5.00	5 to 6	9.00	10.00
Rudolf, American	3.50	4.00	7.00	8.00	5.00	6.00	9.00	12.00
Rudolf, European	2.00	3.00	4.00	5.00	3.50	4.50	6.00	8.00
St. Charles	3.00	4.00	6.00	8.00	6.00	7.00	8.00	10.00
St. Clare	2.00	2.50	5.00	6.00	4.00	4.50	8.00	9.00
St. Elmo, American	1.50	2.00	3.00	3.00	....	....	....	....
St. Elmo, European	1.00	1.50	2.00	2.00	....	....	....	....
Seaside	3.50	4.50	7.00	....	5.00	7.00	10.00	12.00
Shelburne, European	1.50	2.00	2.50	3.50	3.50	4.00	5.00	6.00
Sothern	2.50	3.00	5.00	6.00	....	5.00	7.00	8.00
Strath Haven	1.50	2.00	2.50	3.00	....	....	....	....
Tracy, American	2.50	....	4.00	....	....	....	....	....
Tracy, European	1.50	....	2.00	....	....	....	....	....
Traymore	4.00	6.00	8.00	9.00	5.00 to	13.00	10.00 to	16.00
Vermont	1.50	2 to 2.50	3 to 5	6.00	2 to 2.50	2 to 3	4 to 6	6.00
Victoria	1.50	2.00	4.00	5.00	....	....	....	....
Warwick	....	4.00	6 00	7.00	....	5.00	7.00	....
Wenz, American	1.50	2.50	4.00	5.00	....	....	....	....
Wenz, European	1.00	1.50	2.00	2.50	....	....	....	....
Wiltshire, American	2.50	3.00	5.00	6.00	....	....	8.00	10.00
Wiltshire, European	1.50	2.50	2.00	3.00	....	4.00	....	5.00

places for those who are interested in specific lines of work. The Marlborough-Blenheim will, in general, be considered the headquarters hotel of the American Association and also of the Manufacturers' Association; the Chalfonte Hotel for the Accountants' Association, and, in like manner, the Engineers and Claim Agents will have their headquarters at the Dennis and the St. Charles, respectively.

Arrangements for hotel reservations should be made directly with the hotels. It will aid greatly in avoiding mistakes if the members when writing will indicate that their reservations are made in connection with the convention. Each reservation will be carefully checked to avoid any misunderstanding and to insure that the hotels are making the most adequate practicable provision for convenience and comfort. In making reservations, explicit statements should be made concerning the kind of room desired—whether with or without bath—and the dates of arrival and departure from the hotel. The special rates are made with the understanding that the charges of the hotel will be for the full time of reservation. With one or two exceptions, all charges are on the American plan, including a room and private bath, where so stated, and three meals daily. Most of the hotels provide comfortable coaches to and from the station. When arriving, it is advisable to go directly to the coach of the selected hotel. The coach will be found at the side of the station platform. The charge to and from the station is 25 cents each way for each person. The charge for trunks is also 25 cents each way for each trunk.

The bulletin includes the published schedule of rates and accommodations guaranteed by the Atlantic City hotels.

The committees on subjects for the various associations have been actively engaged on the program for several months past, and there is every prospect of a convention at which will be presented a number of interesting papers of great value to the member companies and their officers. Each of the four associations will have a program which in itself will amply repay those in attendance. The complete programs of the various associations will be announced in a bulletin issued early in July.

The morning of Monday, Oct. 14, will be reserved for registration purposes, and the first meetings of the convention will be held on the afternoon of that day. The meetings of the various associations will continue throughout the week, closing on Friday, Oct. 18. Considerable attention has been given to the arrangement of the days upon which the various associations will meet. The following general schedule of meeting days has been decided upon:

MONDAY, OCT. 14

9:30 a. m.—Registration and Badges.
2:00 p. m.—Meeting of Engineering Association.
Meeting of Claim Agents' Association.

TUESDAY, OCT. 15

9:30 a. m.—Meeting of Accountants' Association.
Meeting of Engineering Association
Meeting of Claim Agents' Association.
2:00 p. m.—Meeting of Accountants' Association.
Meeting of Engineering Association.
Meeting of Claim Agents' Association.

WEDNESDAY, OCT. 16

9:30 a. m.—Open Session of American Association and Joint Meeting of Affiliated Associations.
3:00 p. m.—Meeting of Accountants' Association.
Meeting of Engineering Association.
Meeting of Claim Agents' Association.

THURSDAY, OCT. 17

9:30 a. m.—Meeting of American Association.
Meeting of Accountants' Association.

FRIDAY, OCT. 18

9:30 a. m.—Meeting of American Association.

The opening session of the American Association Convention, which is also a joint meeting with the affiliated associations, will be held in Casino Hall, a large audience room seating 800 people, and located at the Board Walk end of the Steel Pier. The Thursday and Friday sessions of the American Association convention will be held in the sun parlor, which accommodates about 250 people, and is located near the outer end of the Steel Pier. The meetings of the Accountants' Association will probably be held in a large audience room in the Chalfonte Hotel, which, as previously stated, is the headquarters hotel for the Accountants' Association. All meetings of the Engineering Association convention will be held in the sun parlor, near the outer end of the Steel Pier. The meetings of the Claim Agents' Association will be held in a suitable audience room in the St. Charles Hotel.

The usual arrangements are being made with the various passenger traffic associations whereby those attending the convention will be enabled to obtain round-trip tickets for one and one-third fare upon the certificate plan, that is, full fare going and one-third fare returning. More detailed announcements relating to transportation and railroad rates will be given in a later bulletin.

EXHIBIT ARRANGEMENTS

As previously announced, the Steel Pier has been secured for the exhibits. There will be available about 83,000 sq. ft. of exhibit space, exclusive of aisles, which is the largest area the association has ever had available for exhibit purposes. Of this total space nearly 60,000 sq. ft. will be provided with the same plant of inside and outside booths which were installed for the Master Mechanics and Master Car Builders' conventions just concluded, and on account of very favorable arrangements with the Atlantic City Bureau of Information and Publicity the Manufacturers' Association announces to its members that this space provided with booths can be had for the low rate of 20 cents per sq. ft., this charge being made entirely for the erection and use of the booths, with no charge for the floor space. In this way the majority of the exhibitors will be relieved of all the cares incident to booth building, and a plant of harmonious booths will be provided thoroughly protected from the weather and ready to receive the exhibits. The part of the space on which no booths are erected will be given free of cost; but, of course, it will be necessary for the exhibitors using this space to erect their own booths. There will also be track space for track exhibits in close proximity to the steel pier. Electric current, both a. c. and d. c., will be available, as well as steam and compressed air. The membership fee has again been fixed by the executive committee at $35 for the current year, and each membership entitles the member, without charge, to four (4) badges, each entitling holder and lady to all the privileges of the convention and to such entertainments as may be provided. While there is an abundance of space, it is desirable to give the exhibitors all the time possible in which to arrange their exhibits. Applications have, therefore, been mailed by Geo. Keegan, secretary of the association, 2304 Park Row Building, New York, it being proposed to start the allotment of space early in July.

PAPERS READ AT THE BLUFF POINT MEETING OF THE STREET RAILWAY ASSOCIATION OF THE STATE OF NEW YORK, JUNE 25--26

SOME NOTES ON ELECTRIC RAILWAY SHOPS AND SHOP PRACTICE IN CENTRAL NEW YORK

BY W. H. COLLINS

The topic for this paper was suggested by the recent inspection of shops by master mechanics of companies in Central New York State. The plan followed was for the several master mechanics to visit each shop in turn, in a body, and submit a report in writing to their general manager.

This inspection demonstrated very forcibly that electric railway practice is rapidly changing. The buildings, tools and methods which have been sufficient in the past are inadequate to-day. It was also evident from the arrangement of these shops that they were not built with a view toward the rapid and economical handling of work. They are rather a series of additions, and the rest of the property has outgrown them.

The machine shops, whether in a separate building or located in a portion of one of the car houses, are so cramped for room that it is impossible to locate the tools to the best advantage. In some cases the tools are good, but in many cases they are inadequate, being nearly worn out. Even where there are good tools they are not, and, in a good many cases cannot be, arranged for the most economical working. As instances of this kind, the following might be cited: a wheel press between the pit and the wall of the building with no room behind it, and so close to the pit that wheels have to be handled across it; a tire-turning lathe at one end of the shop with the wheel press at the other end.

The blacksmith shop, as a rule, is near the machine shop, but instances were found where it is several hundred feet distant. This shop usually has a rather meager outfit, consisting only of tools for light work. Occasionally a power hammer, and in one shop a punch and shears, as well as a spring-tempering furnace, are among the tools.

The paint and carpenter shops are sometimes located in separate buildings at some distance apart. In one place they are on opposite sides of the city. In others they are combined, much to the detriment of the paint shop, as good painting and varnishing cannot be accomplished in a dusty carpenter shop. As an instance of an extremely poor arragement, one road has its paint, carpenter and overhauling shops all combined in one room. A desirable feature which appeared to be lacking in nearly all of the paint shops is a separate fireproof room for paint stock.

In the electrical shops is where the greatest divergence in practice prevails. The practice varies all the way from making repairs to fields and armatures only to producing many of the most used electrical parts. The outfit for this class of work ranges from a banding machine and a baking oven, situated in a corner of the car house called the armature room, to a shop fully equipped with the tools and apparatus for making electrical parts. It is noticeable, however, that some of the shops have discontinued the practice of making their own coils.

The storeroom is usually well stocked, and bears evidence of being well looked after; but it is, as a rule, inconveniently located with reference to the shops. One road has its storeroom ideally located in the center of its shops, with windows all around, thus giving easy access to the different departments.

There is apparently a lack of uniformity in the methods of inspection, but this is largely due to local conditions. At some places it is possible to arrange for doing nearly all of the inspection in the day time, but at other places the conditions are reversed, and it is necessary to inspect cars at night. The tendency, however, is toward a closer and more rigid inspection. The writer believes that inspection pays, and that the closer it is the better it pays.

In the matter of car cleaning there is quite a difference in practice. Some roads continue the old method of washing the exterior of cars with soap and water. Others use no water on the outside of the cars at all, but use instead a prepared oil cleaner, which is applied in liquid form. Both methods are effective so far as cleaning the cars are concerned, but there appears to be considerable difference of opinion as to which is the better method with reference to the cost of cleaning, preservation of varnish, etc. It is also the practice on some roads to give the interiors of cars a general cleaning, such as mopping floors, cleaning windows and wiping the woodwork each day, while on others it is done but once or twice each week. At one place there was a vacuum cleaning device for taking care of plush seats, which did very effective work.

There is no uniform method of keeping service records. Some roads keep few, if any, accurate mileage records. Others keep only the more important records, the mileage of wheels and axles, the oil report, etc., while still others keep the mileage of each part. This can be carried so far that it is cumbersome, besides being an item of considerable expense. It seems to be a good practice to keep records of the more important parts, and occasionally to follow up some particular part, the performance of which is not satisfactory. Anything beyond that appears to be in the nature of a luxury.

To summarize, these repair shops are very inadequate. On account of the lack of suitable tools and sufficient room, they are not in a condition to handle work with the greatest economy.

In the rapid development of these electric railway properties, proper provision does not appear to have been made for the upkeep of the equipment. It now seems that we have reached a point where it is economically practicable to reconstruct our shops. While it is true that electric railway practice is changing, and will continue to change, yet it is sufficiently stable so that plans can be made for providing suitable buildings and tools to handle work with the minimum loss of time.

The harmonious arrangement which prevails in large manufacturing plants, when the process is continuous and where there is so little waste effort, is what we should endeavor to approximate in our repair shops. The buildings should be so arranged that the work can be moved along continuously through the different shops, with the minimum amount of handling.

The organization at these shops seemed to be the redeeming feature. There is a sufficient number of foremen,

and the distribution of forces is the result of careful planning. But while each foreman is capable in his own line, it is seldom that one is found who is versatile enough to take the position of head of the department. This is the element of weakness general to the organizations.

With the advent of the large interurban cars, a new element was projected into electric railway shop practice. These cars are usually equipped with steel or steel-tired wheels, solid gears, etc., and range in weight from 25 tons to 50 tons. This class of equipment cannot be compared with the ordinary electric railway equipment, but would seem to approximate more closely with steam locomotive practice. The writer believes that the methods and shop practices which will most successfully cope with this new problem in the traction field must be worked out along the lines which have proved so advantageous in the operation of steam railroads.

RECENT IMPROVEMENTS IN MOTOR AND CONTROL

BY G. H. HILL

A review of the development of the electric railway during its twenty years of history is particularly impressive on account of its marvelous growth. While recognizing as a prime factor in this growth the universal demand for transportation facilities, a generous measure of the success can well be credited to the sound and sensible engineering that has dominated the art from its inception. From the diverse and various methods proposed a uniform system was early settled upon, which time and experience have proven to be good and adaptable to a development far greater than could have been anticipated. The trolley distribution, the under-running collector, the series-parallel control of motors and the axle hung geared motor which are standard to-day were practically established fifteen or twenty years ago. Improvements, however, have been very marked, for the problem has not been barren of difficulties nor lacking in opportunities. Gratifying as may be the early wisdom, no less so is the consistent advance in reliability, efficiency and capacity of apparatus that has followed.

The progression of application from purely urban service to interurban has marked the most recent era of development, and it is toward this phase of railway work that a review of recent progress is chiefly directed. Interurban service primarily has required increased speed, larger cars, and consequently greater capacity in equipments; attendant on this are a higher voltage, greater mechanical and electrical strain and necessity for increased reliability. The improvements made to meet interurban requirements have naturally influenced the existing apparatus to a considerable extent. A review of each portion of the car equipment will, perhaps, serve best to illustrate what the recent improvements are and to indicate their relative value.

Probably no similar problem has presented more difficulties than railway motor design. Subject to exceptional and sudden electrical strains, extreme ruggedness is essential. Exposed to heat and cold, mud and dust, water and grease, its surroundings could hardly be worse, and unusual protection to its winding is required. Placed in a service where great refinement of attention is impossible, it must nevertheless be reliable and withal efficient.

Although improvements are mostly detailed in character, they are the results of painstaking study and are of much practical value. As an example of modern construction and one of the most popular of recent designs, may be selected the G. E. 80 motor of 40 hp rating, which is of the split frame design found most suitable up to 75 hp size. Above this the box type is usual, and of this form the G. E. 73 may be taken as typical.

The improvements in motor construction which may be considered as recent may be classed as follows: Field coil insulation, lubrication of bearings, shaft and gear strength, gear case design and commutation.

FIELD COIL INSULATION

The modern coil is of the "mummy" type heavily wrapped and made complete without any outside retaining spool. The insulation as now applied, instead of forming only an exterior coat, penetrates to the very heart of the coil. This effect is attained by the vacuum process, which exhausts all moisture and air entrained in the coil and replaces it with an insulating compound. The treatment is not only at a higher temperature than formerly, but for a longer time. A cross section of a modern G. E. coil (see illustration) shows how thoroughly this insulating compound impregnates the winding. In consequence, unless the coils are "roasted" by a too severe load, they are able for many years to resist the action of the water and oil to which they are bound to be exposed. The "mummy" coil is more compact than a spool wound coil, is less affected by a gradual shrinking of the covering, and can be held more effectively against vibration and chafing. Incidentally, the field coil terminal has been improved in strength and insulation and is provided with a shroud or guard to protect the lead from breaking by vibration.

LUBRICATION OF BEARINGS

The change from grease to oil lubrication has proven a most practical advance. The use of oil particularly in the armature bearings has greatly reduced the cost of inspection and maintenance, and has probably doubled the life of the bearings, with a corresponding reduction of damage due to the armatures getting down on the poles. Conservative experience indicates a life of 50,000 car-miles for a bearing with oil lubrication. The amount of oil required will vary somewhat with local conditions, but with systematic attention, one gill of oil for the commutator end bearing and one and one-half gills for the pinion end bearing have been found ample quantity for 1000 car-miles. The axle bearings may be treated the same as the car journals, and three gills for each 10,000 car-miles should ordinarily be sufficient.

SHAFT AND GEAR STRENGTH

Improvement here is largely a matter of quality, which has been steadily raised and now the tensile strength equals from 70,000 to 75,000 lbs. per square inch. The strength of shaft at the pinion end has been further increased by increasing the diameter of the taper to as near that of the shaft as possible.

Pinion material is now readily procurable with a tensile strength of 85,000 to 100,000 lbs. per square inch. The strength of cast gears is, of course, somewhat below this, but for the larger motors a solid gear or a gear composed of a forged rim shrunk on a cast steel center permits the use of a high quality steel in the teeth and has given excellent results. The split gear is almost exclusively used on the smaller equipments on account of its convenience The four-bolt design, which has practically superseded the eight-bolt design, permits a more sturdy structure and a

stronger bolt. Experience indicates that the bolts in the eight-bolt design were frequently weakened by too strenuous efforts in tightening them.

The adoption of a gear case with three points of suspension instead of two produced a most gratifying relief from breakage. Up to the present, malleable iron has been found the most satisfactory material for cases, but on account of the possible saving in weight some experiments have been conducted with the use of sheet steel riveted. The ordinary riveted case, of which there are several on the market, cannot be considered entirely successful, since with a very few exceptions on roads with unusually smooth track the vibration loosens the rivets and the case rattles itself to pieces. Appreciating the advantages and demand for a lighter case than is possible with malleable iron, careful study has been given the problem, and it is expected that a construction now being tried, in which the rivets and seams are welded by a special process, will prove satisfactory.

COMMUTATION

The commutator and brushes have usually required more care and attention than all other parts of the motor. The importance of brush quality as affecting commutator blackening, flashing and wear is frequently overlooked. Unfortunately the quality of American-made brushes has not been as high as it should be, and a better understanding of what is desirable would undoubtedly create the necessary demand for improvements, particularly in the direction of uniformity of product.

The chief ingredients of carbon brushes are hard gas coke and graphitic carbon with a suitable binder of pitch or similar material. The coke supplies an abrasive action which grinds down the mica and keeps the copper surface clean. The soft graphitic carbon is lubricating in nature and of lower electrical resistance than the coke.

The proper proportions of these two elements will vary for different motors, depending upon the proportional amount and quality of mica in the commutator, whether the commutator is grooved or not, the speed of the commutator, the thickness of brush, and, to a certain degree, upon the service conditions. The fineness to which the ingredients are ground, the thoroughness with which they are mixed and the compactness to which they are compressed, that is, the amount of cellular space existing, all have a most practical bearing on the quality and service results. The most frequent cause of chipping and breaking is the stratification of the brush, which is hard to avoid in the extruded or "squirted" type of product. The reduction of expense of motor upkeep would in most cases handsomely repay the attention necessary to procure brushes that conform uniformly to rigid specifications, as to hardness, specific gravity, absence of stratification and fineness of texture.

Recent investigations have aroused an interest in this subject that will, it is believed, make it possible to secure a much more satisfactory product if the railway companies will do their part in sustaining a demand for a superior article.

There is one recent departure in motor construction that merits particular mention. This is the addition to the motor of commutating poles. Motors so constructed are superior in commutation to the ordinary motor, and the limit of motor capacity for any service is no longer a matter of commutation possibilities, but of heating alone. Perfect commutation with extreme overloads, both as to current and voltage, is easily obtained. The commutating poles are small in size and are placed between the exciting fields. They permit a reduction in weight of the exciting fields and a greater freedom of electrical design without sensibly increasing the weight of the motor. Briefly, the function of the commutating poles is to counteract the armature reaction and consequent field distortion and produce a commutating field of constant strength and position with relation to the brushes, unaffected by load or speed of the motor. Many incidental but valuable improvements attend this new departure, which will undoubtedly become a standard construction. Among these are: Absence of flashing and burning of commutator and brush holders, less brush and commutator wear, absence of sparking, lighter and more easily handled field coils.

A complete line of motors of this type has been designed and several hundred have already been sold. A more complete discussion of the theory of this interesting development will shortly appear through appropriate technical channels.

CONTROL

The recent improvements in control and equipment devices may be classed as follows: Cylinder controller details, contactor attachment, rheostat construction, car wiring, train or type M control, circuit-breakers and main switches, fuses and trolleys.

CYLINDER CONTROLLER

As with the motors, the improvements of the cylinder controller have been more a matter of construction details than methods. The higher voltage usual in interurban lines and the general increase in station and feeder capacity, making it possible to sustain very heavy short-circuit arcs, have made it necessary to remodel the controller to provide greater strength of blowout, more complete isolation of arcs and insulation of circuits, and a more rigid fireproof construction.

The K-35 controller may be taken as representative of the most recent construction. The blowout magnet, instead of being a single coil placed at some distance from the arc points, is composed of individual coils, each placed close to the arc which it controls. The magnetic lines cross the arc so as to blow it outward from the contact tip into a chamber formed between the arc deflectors, instead of blowing it sidewise off the edge of the finger and against the arc deflector, as in the older forms of controllers, such as K-6 and K-28. The effectiveness of the new arrangement is many times greater than the old, and as the arc is ruptured much more quickly the burning and blistering of the contacts are much reduced.

The construction and shape of the arc deflectors are such as to separate the fingers and contacts more effectively than in previous designs, and the insulation of the frame and cover is very thoroughly carried out with fireproof and non-hydroscopic material.

The cylinder is made up of cast segments clamped upon an insulated hexagonal shaft by means of flat keys and set screws. This construction is quite a departure from the molded type of insulation for cylinder castings which has been in use for a long time. A distinct advantage is that the cylinder may be more easily repaired in case of damage to one of the contact segments. At the same time, the drive of the segments is more positive and a loosening of

the castings less likely to occur from careless or vicious handling. If they should loosen, they may easily be tightened by the set screws.

The connections of the motors have also undergone some changes of importance. Some of the new type of controllers are arranged with the bridge form of transfer from series to parallel connection, which avoids the opening of the circuit of either motor during the transition and thereby continues the full torque of both motors throughout acceleration. For very small cars this refinement may not be entirely necessary, but for the larger equipments, particularly those geared for high speed and intended for drawing trail cars, the bridge form of control is very desirable in order to avoid the unpleasant jerk when passing from series to parallel. In accomplishing this arrangement several extra control fingers are required and a division of the rheostats into two banks is necessary. The slight complication is more than warranted.

Another change is that of reversing the motors by reversing the field connections instead of the armature connections. In doing this the fields are kept on the ground side of the motor, as is quite necessary. The advantage lies in the fact that the reversing cylinder is not subject to the full voltage, but has across its contacts only the drop of the field, which is not over 20 volts. This eliminates the burning of the reverser contacts, which is apt to occur on hand controls for four motors when the reversing switch is used in an emergency.

The attention of operators has been drawn to the controller difficulties very strongly on account of the burnouts with the attendant flashing and frightening of passengers, which seem to occur more frequently than some years ago. The difficulty has arisen on those controllers which were constructed for a 500-volt circuit and which are now made to operate on a 600 or 650-volt circuit. In order to make these controllers thoroughly safe on the higher voltages, an arrangement has been perfected for operating two contactors, of similar form to those used on train control, in connection with the cylinder, so that the contactors will make and break the motor circuits and thus take all of the arcing. The attachment for doing this is placed at the bottom of the cylinder and consists of a small contact which controls the circuit to the coils of the contactors, the contactors being placed under the car. The arrangement has been installed on several roads and has given such satisfaction that provision has been made so that all of the old cylinder controllers can be fitted with this attachment. The separate, magnetically operated contactor is able to handle high-voltage and heavy-current arcs without difficulty, and, in addition to the duty above described, may also be used as an overload circuit-breaker. In this way no motor current is broken on the platform of the car, a point which will be appreciated by all operators. The overload device consists of a tripping coil on the contactor, which is controlled by a small switch placed in the vestibule convenient to the motorman. This small switch opens only the circuit to the coil of the contactor, which, of course, carries only a small amount of current, but is tripped in case of overload by a coil carrying the motor current. It is closed by the motorman in the same way as the ordinary circuit-breaker.

The use of cast grid rheostats is so universal that no comment upon them is necessary. The advantages of the cast grid type over the wire or ribbon-wound type are: better insulation, better protection from moisture, more rugged construction, ability to withstand more severe overloads of current without damage, and greater ease of repair.

TROLLEYS

For city service the standard US-6 trolley with 4½-in. wheel has given splendid results, the average life being about 10,000 miles. For greater capacity of equipment and higher speeds, however, a trolley base which will swivel more readily is desirable and a different construction of wheel is necessary to secure a reasonable life.

The US-13 roller bearing trolley base has been designed to meet this demand. The base swivels on a roller bearing designed with ample margin for the strain of the pole. The height of the base when the pole is retracted is 5 ins., and its weight is approximately 100 lbs. Four sets of bearings are provided. Operating under tension with a 14-ft. pole, a pressure of 35 lbs. at an angle of 45 degs. can be given the trolley wheel, which, it is expected, will take care of the higher speed service.

The wheel used for high speeds is known as the form 21. It is 5¾ ins. in diameter and has a bearing 3 ins. long with a ½-in. pin. The diameter of the pin is made shorter than on the form 6, to reduce the speed of the rubbing contact, and this, with the increased length of bearing, has made the new wheel very serviceable on equipments as large as 500 hp. When operating at a maximum of 60 miles per hour under these conditions, it has an average life of 5000 miles.

It should be borne in mind in operating these high-speed trolleys that the side spring for conducting the current from the wheel to the pole is absolutely essential to satisfactory life of the wheel, and these springs must be provided with proper tension against the wheel. If this is not done, the current carried through the bearing will soon destroy it. The shape of the fork is such as to prevent its being caught in frogs and switches.

The pantograph form of trolley has many commendable features for catenary overhead construction which will undoubtedly come into general use on interurban roads. The results so far obtained in the use of this form of trolley will not justify us in making a complete recommendation for its adoption until further developed. Under special conditions where an ordinary trolley is extremely inconvenient its use is warranted, but it is believed that substantial improvements can be made in the pantograph type which will make it very satisfactory, and tests and experiments are now being carried on.

In this review no reference has been made to the more radical departures from standard practice which are being given much attention, i. e., the use of single-phase and high-tension direct-current motors. The reasons for using either single-phase or direct-current motors do not arise from consideration of the equipments, but from the desirability of reducing the cost of transmission and distribution of current over long distances. Of the two, the single-phase is the more radical departure, and the problems in the design of the single-phase motor are occupying the earnest attention of able designers. The 1200-volt, direct-current motor is more directly in line with standard practice, and the use of commutating poles has made such a motor thoroughly practicable. In fact, with such a system the problem of greatest importance is the method of distributing and collecting the current. The discussion of these broader subjects, however, would lead beyond the scope of the present review.

RECENT IMPROVEMENTS IN MOTOR AND CONTROL

BY CLARENCE RENSHAW

In dealing with the rather large subject of recent improvements in motors and control, I have not attempted to cover the matter broadly, but have devoted my time to three specific divisions with which I am most familiar, namely: Inter-pole motors, unit switch control and the single-phase system.

INTER-POLE MOTORS

Probably the most promising improvement in direct-current railway motors for many years is the introduction of the inter-pole motor. The commutation of high-voltage current in railway motors has always been a most difficult problem for the designers of such machinery to solve, and the care of commutators and brushes forms no small part of the duties of the mechanical and electrical force of a railway company. The larger the motors used, the higher the voltage, and the more difficult the service conditions, the greater is the importance of this matter. With large motors, flashing over from brush holder to brush holder or from brush holder to ground is sometimes experienced, and on a large system with great power capacity behind them, such flashes often cause considerable damage to motors and control and annoying delays to the service. Most commutator and brush troubles are due either directly or indirectly to sparking, and it is to correct them by correcting their cause that the inter-pole motor has been designed.

Sparking on a commutator bites away a small amount of copper and carbon at each spark, but does not affect the mica between segments. If the sparking is continued, the copper is soon eaten down, thus leaving the mica sticking up. This "high mica" in turn makes the sparking worse and causes a general roughening of the commutator, flattening of the bars, etc., with consequent rapid wear of the brushes, filling the motor with carbon and copper dust, and sometimes causing it to flash, ground, etc. Milling down the mica below the copper prevents some of this trouble, but does not go to the root of the matter.

In service a railway motor does not run continuously with power on, but the time that it is operating under load is varied by a certain amount of coasting and stopping. During this no-load running the roughening which has been caused by the action of the current is partly corrected by the scouring and polishing effect of the brushes without load. In many cases the scouring action predominates so that the commutators remain bright and clean and take on a good polish.

The action of the inter-pole motor in preventing sparking and thus greatly reducing the wear on commutator and brushes can best be understood by the aid of a few simple diagrams. In these a multiple-wound armature has been shown for the sake of simplicity and clearness, although on an actual motor a two-circuit winding would ordinarily be used.

In a motor without inter-poles, as shown in Fig. 1, there are three sets of magnetic fluxes produced; first, the lines "aa" due to the main field coils; second, the lines "bb" due to the current in the armature winding as a whole, and third, the leakage "cc" around each of the slots, due to the current in the conductors in that particular slot. The first set of lines may be regarded as the useful lines, and the second and third as incidental. It is to these last two that sparking is due. The coil "AA," which is just about to have the current reversed in it, lies in such a position that it is not cutting the lines "aa," and hence has no voltage generated in it from that source. It is, however, cutting the lines "bb," so that it has a voltage generated in it by them. When the coil is short-circuited by the brush, this voltage causes a local current to flow across the face of the brush in addition to the line current, which greatly increases the amount of current that the brush must carry. As the coil passes under the brush, also, from position "A" to position "B," the current in the conductors in the slots "A" is stopped preparatory to being reversed, so that the leakage lines "cc" are also stopped preparatory to being reversed. This causes an inductive voltage to be created in the coil in addition to the voltage of rotation generated by the lines "bb," and these two voltages added together produce a spark between commutator bar and brush.

In an inter-pole motor the inter-poles consist of thin poles, each carrying a coil inserted into the frame between

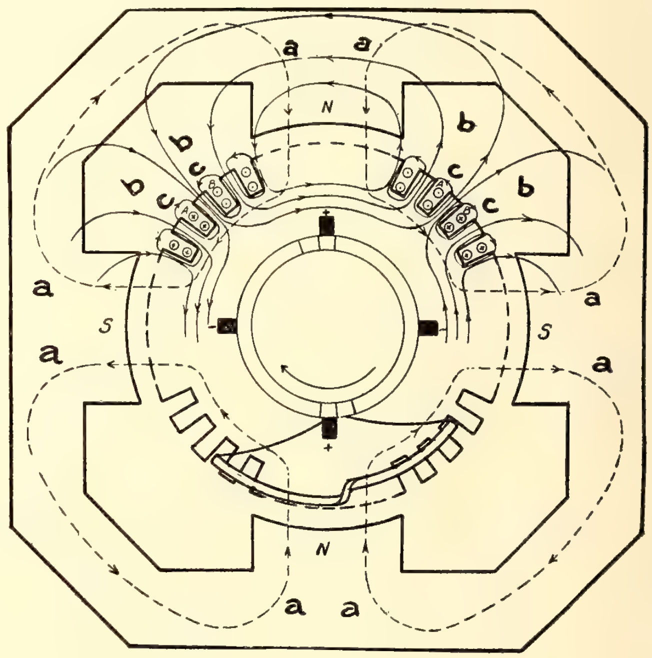


FIG. 1.—MAGNETIC FLUX IN ORDINARY MOTOR

the main field poles and projecting down to the points on the armature at which the sides of the coils short-circuited by the brushes lie. If the inter-poles alone were used without any coil, as shown in Fig. 2, their effect would be to concentrate and increase the lines "bb" due to the armature magnetization, and also the lines "cc," due to the leakage around the slots, owing to the additional iron in the path of those two sets of lines, and thus to raise the voltage in the short-circuited coil, and increase the sparking.

With coils on the inter-poles of sufficient number of turns to just neutralize the armature magnetization, the effect of the lines "bb" will be eliminated, as shown in Fig. 3, so that there will be no voltage generated in the short-circuited coil by its rotation, but the lines "cc," due to leakage around the slots, will still remain, and the increase in these due to the presence of the inter-pole would ordinarily give a sufficiently high inductive voltage to more than offset the advantage gained by the neutralization of the rotation voltage.

If, however, a greater number of turns be wound on the inter-poles, so that their excitation overbalances the armature magnetization instead of merely neutralizing it and sets up a flux in the opposite direction, as shown in Fig. 4, this flux can be made of such a strength that the leakage lines around the coil which is being commutated will also be elim-

inated, so that practically all of the voltage in the short-circuited coil is neutralized and sparkless commutation is obtained. Since the inter-poles neutralize the active voltage in the short-circuited coils, they also eliminate the extra local current in the brushes and thus reduce the total cur-

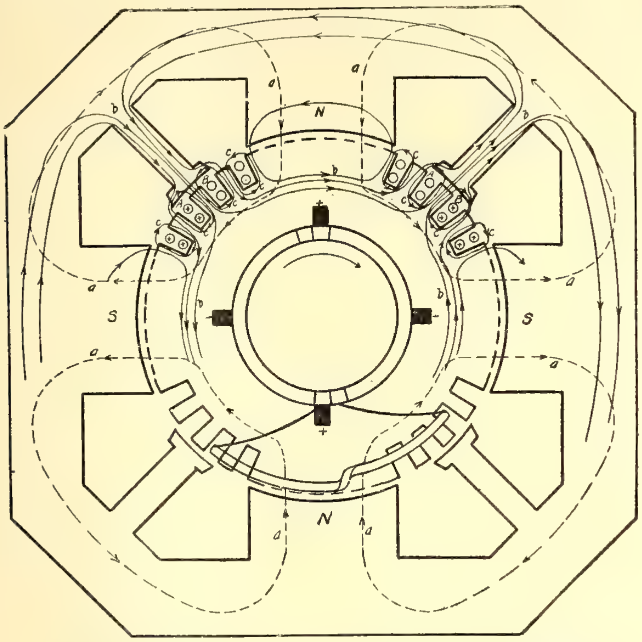


FIG. 2.—EFFECT OF INTERPOLES WITHOUT COILS

rent in the brushes to its minimum value, that is, to the line current. The elimination of sparking and of local currents in the brushes reduces the wear on the commutator and prolongs the life of the brushes to a remarkable extent.

The inter-pole winding is connected permanently in series with the armature winding, as shown in Fig. 5, forming the

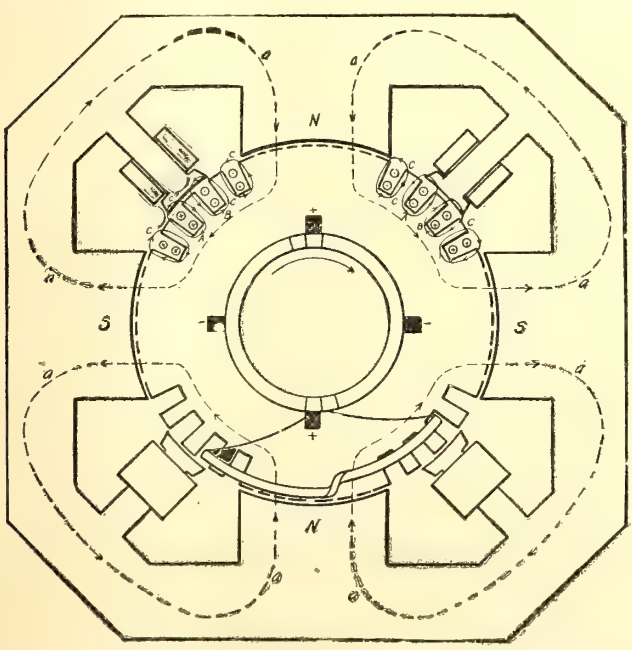


FIG. 3.—INTERPOLE MOTOR WITH ARMATURE MAGNETIZATION JUST NEUTRALIZED

"armature circuit," and in reversing the direction of rotation of the motor the armature windings and inter-pole windings are reversed together as a unit.

Aside from the general reduction in wear of commutator and brushes, the inter-pole motor has many incidental advantages. A properly designed motor of this type should run practically sparklessly from a load so light as to give treble the normal speed up to loads as heavy as double its ordinary one-hour rating. It should permit high voltages to be thrown on it, either at standstill or when running at high speeds, and its stability should be so great that it will

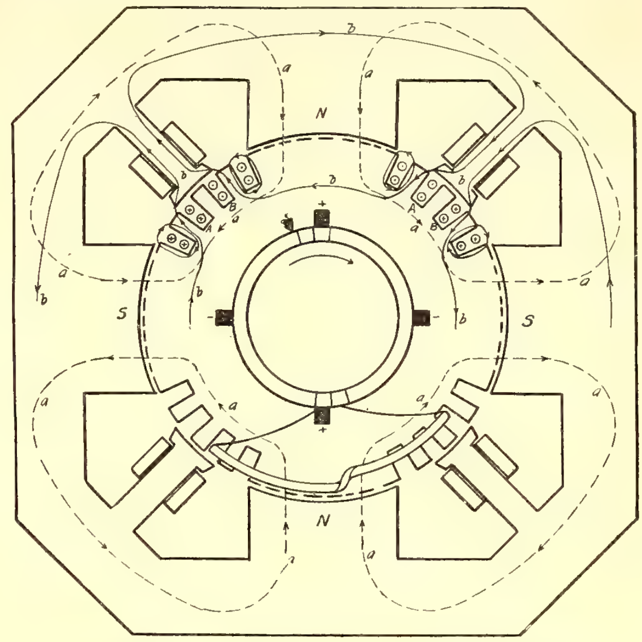


FIG. 4. MAGNETIC FLUX IN INTERPOLE MOTOR

commutate without appreciable sparking rushes of current which in the ordinary motor would invariably cause flashing. This great freedom from sparking and flashing makes the inter-pole motor especially well adapted for high-voltage service.

The use of the inter-pole increases the scope of the de-

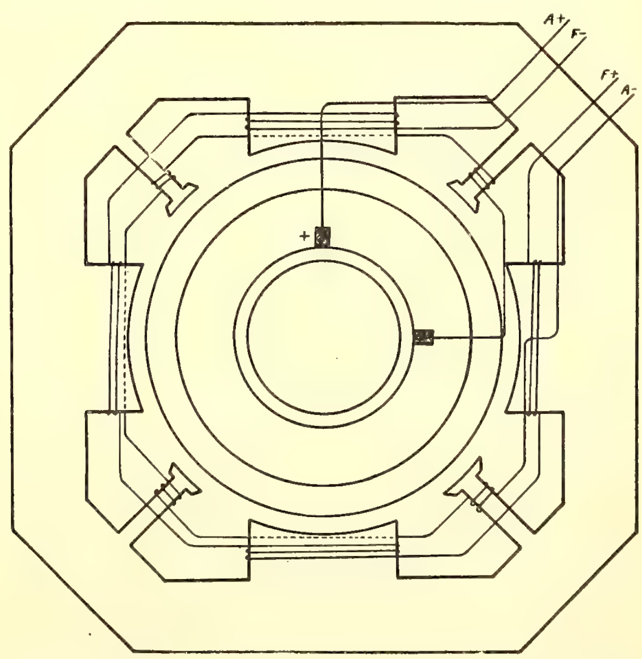


FIG. 5.—METHOD OF CONNECTING INTERPOLE WINDINGS

signer of railway motors in many cases where limitations of speed and weight determine the design, and in general it permits of a somewhat lighter motor. It gives less advantage in small motors than in large ones, as the commutating conditions in such motors are not so serious a problem. However, its general advantages will doubtless ex-

tend its use to sizes as small as 40 hp. Improving as it does those features of the railway motor which are universally acknowledged to be in greatest need of improvement, the introduction of the inter-pole motor is an important step in electric railway development.

UNIT SWITCH CONTROL

A most important development in control apparatus is the perfection and standardization of unit switch-control equipments for all sizes of motors. The ordinary drum type controllers, while in general satisfactory for small equipments, leave much to be desired where it is necessary to handle large cars and powerful motors. Such controllers of large capacity must necessarily be heavy and bulky in order to contain sufficiently liberal contacts and blow-out coils to handle the large currents which pass through them. The weight of such controllers, moreover, must be mounted at the extreme end of an overhanging platform where it is least desirable and a large bunch of heavy cables must be led out to it. On account of the size and pressure of the contact fingers also, the drum requires considerable effort to turn it, especially should the contacts become slightly roughened and quick movements are impossible. Finally, it seems impracticable to design a blow-out which will enable such controllers to break the current with certainty under all circumstances, and in certain parts of the country it is not an unusual sight to see a motorman nursing an interurban car along the streets of a city by means of the overhead circuit breaker and shooting out a stream of fire every time it is necessary to cut off power. The drum-type controller, however, is a rough-and-ready piece of apparatus, and when out of order its faults can be easily located and repaired by a comparatively cheap man if only a sufficient stock of spare parts is kept on hand.

The unit switch control system was originally designed with special reference to the operation of two or more motor cars in a multiple-unit train, and it was at first adapted only for use in connection with the larger sizes of motors. Its other advantages, however, in providing a positive and reliable control, in placing all main circuit contacts and heavy cable out of the way beneath the car and in reducing to a minimum the amount of high-voltage and heavy-current wiring, are now rapidly extending its use to single-car operation and to smaller sizes of equipments.

In the unit switch-control system the main or power drum of the drum type controller is replaced by a group of ten or twelve (according to the size of the equipment) independent or "unit" switches, each provided with a strong magnetic blowout and normally held open by a powerful spring. Each switch is closed when desired by a suitable pneumatic cylinder using compressed air from the brake system. This combination of switches is called a "switch group." The reverse drum of the controller is replaced by a similar drum except that it is more liberal in capacity, built in a separate case and moved to the forward or reverse position by one or the other of two cylinders having a common piston rod. This device is called a "reverser." The overhead circuit-breaker is replaced by a "line switch," which is essentially the same as one of the switches of the switch group, except that it is placed in a case by itself and is provided with an automatic trip, which causes it to open in case of an overload or short-circuit. These three pieces of apparatus effect the various necessary connections between motors, resistance and trolley.

Forming an essential part of the pneumatic cylinder for operating the switch group, line switch and reverser is a magnet valve which governs the admission or escape of air to or from that cylinder. These magnet valves are operated by means of a small 14-volt storage battery, and their opening or closing is regulated by means of a "master controller" to which their circuits are led. The switch group, reverser and line switch may thus be located in any convenient position, and nothing but the master controller need be located on the platform, and only the small low-voltage battery circuits need be carried to it.

For train operation the circuits from the battery and magnets are carried to "train line receptacles" at each end of the car, as well as to the master controllers, and when two cars are coupled together the corresponding receptacles on each car are then connected by a multi-point "jumper," so that the circuits are continued from car to car. When several cars are connected in this way the movement of a single master controller closes simultaneously the corresponding magnet circuits on all of the cars and thus operates also the corresponding main circuit switches.

Connected to the piston rods which move the various switches are a number of small contacts which open or close auxiliary circuits between stationary fingers arranged to press on them. These auxiliary contacts are called "interlocks," and the circuits which operate the magnet valves of each of the various switches are carried through the interlocks of other switches in such a way that the switches cannot be closed except in the proper order.

The unit switch-control system, however, does not consist merely in replacing the ordinary controller with a set of pneumatically operated switches, which may be closed properly or improperly entirely at the discretion of the motorman, but the action of the switches is regulated so as to give a uniform current through the motors while operating on the resistance steps and to thus secure a smooth and even acceleration of the car and protect the equipment from abuse. This is accomplished by means of a "limit switch." The limit switch consists of a coil, placed in series with the motor circuits, which lifts an armature whenever the current exceeds a predetermined amount. To the armature of this coil is attached a disc which closes a secondary circuit between two contacts when the armature is down, and opens this circuit when the armature is raised. The circuits for closing the various switches of the switch group are so arranged that it is not necessary to move the master controller step by step to cause the closing of the different switches, but so that by placing the master controller in a single definite position and holding it there the circuits to the first switches are closed, and the closing of these switches then automatically closes the next ones, etc., by means of the inter-locks. The circuit from the battery which supplies power for this automatic operation is led through the secondary contacts of the limit switch, so that as long as the current through the motors does not exceed the desired value the different switches will close one after the other almost instantaneously. Should the current through the motors at any time exceed the desired amount, however, the armature of the limit switch will instantly raise and thus prevent the closing of any more switches until the current has fallen to the desired value.

The regulation of the current during starting is thus taken entirely out of the hands of the motorman, who simply advances the handle of the master controller to the last notch and holds it there, and the closing of the switches is then governed automatically by the limit switch. In order to provide for the handling of the car under special conditions, however, the apparatus is so arranged that the motorman

may readily notch up more slowly than would be done by the limit switch, or may stop on any notch, and also so that by going to some extra trouble (enough to prevent his doing it unnecessarily) he can short-circuit the limit switch and notch up entirely independent of the current.

As ordinarily built, the master controller for use with the unit switch-control system contains three notches for forward running and three for reverse. If the handle is moved to the first notch a slow-speed resistance point is obtained which is used principally in shifting cars. On this account the first notch is called the "switching" position. If the handle is moved to the second notch, either with or without pausing on the first one, the switches close one after the other until the motors are connected in series. The second notch is therefore called the "series" position, and is, of course, a running point. If the handle is moved to the third notch, either at once or after pausing on one or both of the other two, additional switches will then close in sequence until the motors are connected in full parallel. The third notch is hence called the "parallel" position.

Fig. 6 shows a schematic diagram of the switches and main circuit connections for an equipment of four 90-hp motors, and indicates the sequence in which the various switches close. In addition to stopping the handle on any one of the three notches, as already mentioned, and obtaining the switching, series or parallel connection, the motorman may so manipulate the master controller as to hold the switches in any one of the series and parallel positions indicated on the diagram. In connection with the above diagram, it will be noted that instead of opening the circuit in changing from series to parallel, as is done in the large drum-type controllers, a special resistance connection is used for making the transfer without decreasing the current through the motors. The use of this connection avoids the jerk sometimes obtained with drum-type controllers in passing from series to parallel, and helps in maintaining a smooth and uniform acceleration.

An interesting detail in connection with this system of control is the method of charging the small storage batteries used for operating the magnet valves. Two batteries are carried on each car, and these are connected to the air-pump motor circuit, as shown in Fig. 7. The two double-throw switches are always thrown either both up or both down, so that one battery is connected to the control circuit while the other is being charged. Whenever the pump is running the battery which is being charged is connected by the "battery-charging relay" to the circuit of the pump motor. The resistance in series with the pump motor is so adjusted, in connection with the relative amount of time that the pump is running, and that the control circuits are closed, so that the battery will receive on the one hand sufficient current to charge it properly without, on the other hand, receiving enough current to make it boil or gas. When this adjustment has once been made, the batteries will require little attention other than the reversal of the two switches once each day.

Another detail of the equipment is the air-storage system. A separate "control reservoir" is piped to the air-brake system, as shown in Fig. 8, in connection with a "governor" or check valve and a three-way valve. Ordinarily the three-way valve is turned so that the air is drawn directly from the brake system, but in case of accident to the compressor or main reservoir the three-way valve may be turned 90 degs. and the reserve supply of air in the control reservoir is thus available to return the car to the car house.

Many other details might be mentioned, but the above are sufficient to indicate the completeness with which every feature of the equipment has been worked out.

In providing for the control of the different sizes of motors most commonly used, two sizes of switch groups are employed. The construction of the smaller of these is shown by the cross-sectional view in Fig. 9. A similar view of the larger group is shown in Fig. 10. Fig. 11 shows a reverser with the cover removed.

Unit switch control possesses many advantages, not only over the drum-type controller, but also over any other type of multiple control now on the market. One of the most important of these advantages is the powerful force which is available both for opening and closing the switches, so that their action is most positive. In the smaller switch

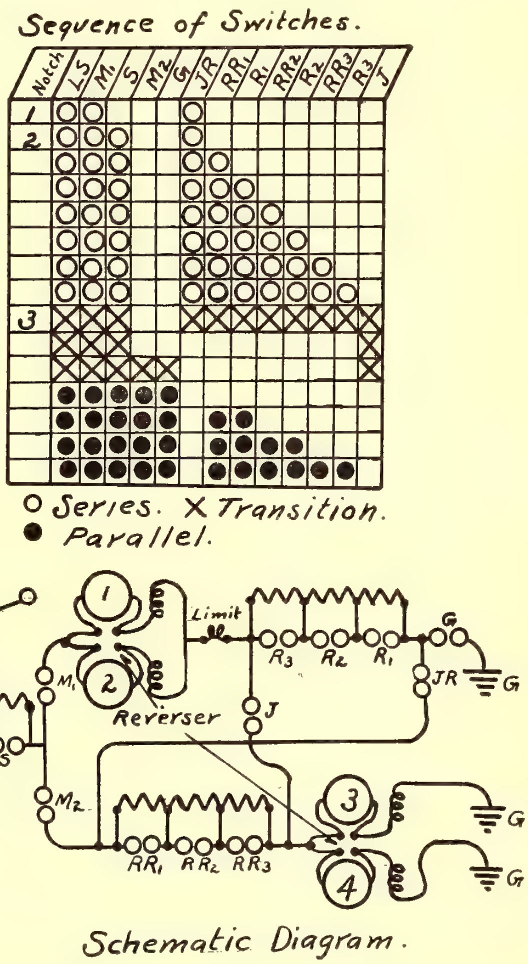


FIG. 6.—SCHEMATIC DIAGRAM OF UNIT SWITCH CONTROL SEQUENCE OF SWITCHES

group, for instance, a force of approximately 75 lbs. is available at the contacts for opening or closing them, and in the larger group this is increased to over 90 lbs., so that the chance of these switches failing either to open quickly, or to make a good contact, is extremely remote. To convince almost anyone on this point, it is usually only necessary to show him the switch group and have him try to prevent a switch from either opening or closing.

This positive action, moreover, is obtained without making the apparatus large or heavy. By using compressed air as a motive force, powerful action is obtained without undue increase in bulk or weight. As a concrete instance of this, it may be mentioned that a complete double-end unit switch outfit for controlling a quadruple equipment of Westinghouse No. 121 motors (90 hp each) weighs only approximately 1650 lbs., including the switch group, reverser, line

switch, master controllers, control reservoir and all details except wiring and resistance.

Another advantage of almost equal importance is the use of a low-voltage battery for operating the control circuits and the fact that the operation of the control is entirely independent of the line voltage. This point is of especial importance on interurban lines where wide fluctuations in voltage are frequently met with.

Although the elimination of bulky controllers and heavy cables from the platforms and the securing of control apparatus which will positively open the circuit under all conditions are in themselves sufficient reasons for the use of unit switch control, the ability to operate two or more cars together with a single motorman, when required, is no mean advantage. There are many instances where trailers are now used, overloading the equipment and slowing down the schedule just at the time when rapid car movement is most needed, where multiple-unit operation would give superior service at less expense. This is becoming widely recognized even in the case of comparatively small equipments for city service, as may be seen from recent orders for twenty equipments of unit-switch control for operating double 60-hp motors in New Haven, Conn., and for eighty equipments for operating quadruple 55-hp motors in Baltimore, Md.

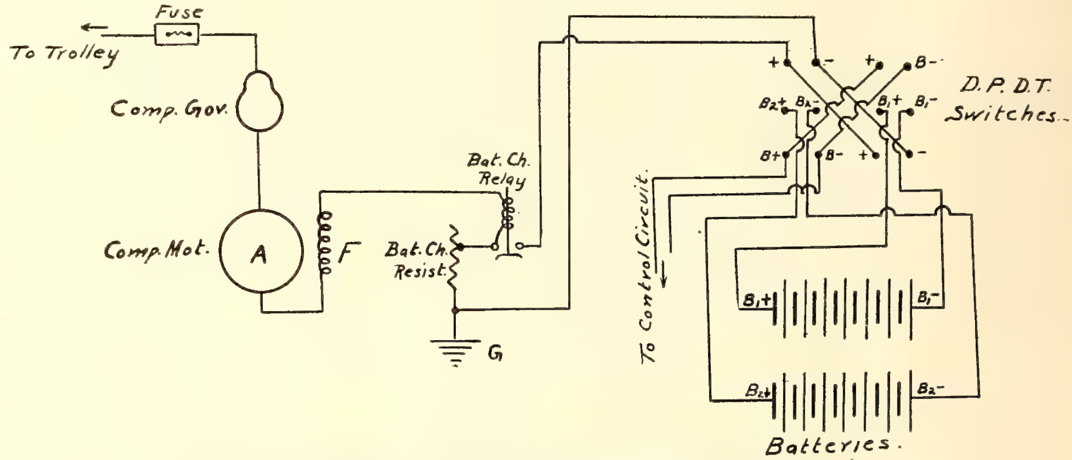


FIG. 7. CONNECTIONS FOR CHARGING STORAGE BATTERIES

THE SINGLE-PHASE SYSTEM

A consideration of recent improvements in railway motors and control would be very incomplete if no mention were made of the single-phase system, although the essential economies of single-phase operation are effected not by the change in motors or control, but in the other parts of the system. In order to obtain these economies, however, car equipments differing from direct-current equipments in certain particulars must be used, and it is proposed to mention briefly the essential features of these.

The single-phase railway system accomplishes the same results in car movement that have heretofore been secured by the use of direct-current equipments, but it does this in many cases with less first cost, less operating expense, increased flexibility and greater simplicity. These advantages are obtained principally by a simplification of the sub-stations and the omission of sub-station attendants and by the elimination of practically all trolley feeders. At the sub-stations, the alternating-current power which is received from the generators is merely reduced in voltage by single-phase transformers and supplied at once to the cars, instead of being changed into direct current by poly-phase transformers and rotary converters. The equipment of such a sub-station is so simple that, except for an occasional inspection, it may be left entirely without attendants.

One of the fundamental characteristics of alternating current is the readiness with which it can be transformed from one voltage to another. Where alternating-current motors are used, therefore, it is not necessary as with direct current to supply power to the cars at the voltage of the motors, but by the use of a transformer on the car the voltage of the trolley and that of the motors may have any desired ratio. As it is entirely feasible to employ a voltage of 11,000 (which permits the distribution of a large amount of power with a very small current) on a properly insulated trolley wire, the single-phase system affords means of operating even the heaviest cars or trains from an ordinary trolley wire of moderate section with no additional feeders.

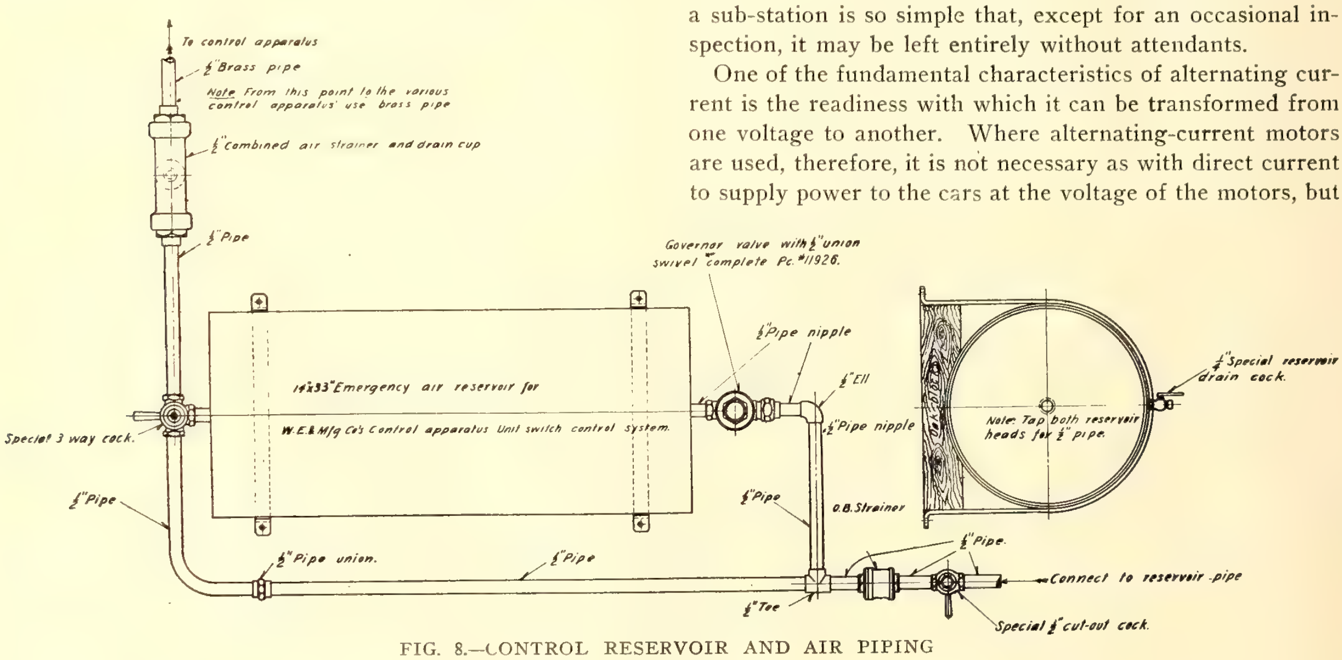


FIG. 8.—CONTROL RESERVOIR AND AIR PIPING

The one element upon which the entire single-phase sys-

tem depends is the single-phase railway motor. This does not involve any particularly new or mysterious principle, but depends for its operation upon an extension of the well-known fact that reversing the current at the terminals of a series direct-current motor does not reverse the direction of rotation or interfere with the operation. This principle holds good no matter whether the current is reversed once every hour or once every minute. Since an alternating current gives merely the same general effect as a very rapid and continuous reversal of a direct current, it would be only natural to expect any ordinary direct-current railway motor to rotate if suitable alternating current were applied to it. Within certain limitations this is the case.

The single-phase railway motor is essentially a series-wound motor very similar to the direct-current motor. On account of the rapidity of the reversal of the alternating current, however, a number of new phenomena are introduced, and in order to secure satisfactory commercial operation from the motor with this current, certain changes in the design of the ordinary railway motor must be made. One of these is to make the entire magnetic circuit laminated instead of merely the pole pieces, to prevent excessive losses, due to the rapid reversals of the magnetic flux. Another essential feature is the "auxiliary" or neutralizing winding which is wound in the slots between the poles in order to neutralize the magnetizing action of the armature and hence its self induction. This winding is connected in series with the armature in the same way as the inter-pole winding of the inter-pole motor. Instead of being located on definite poles, the auxiliary winding is distributed in slots in the faces of the main pole pieces so that the neutralization will be more complete and effective. Unlike the inter-pole winding, however, the auxiliary winding is not used to improve the commutation, but to improve the power factor of the motor.

Owing to limitations of design, the single-phase motor is ordinarily wound for a voltage of from 200 to 250 instead of 500 or 550, as in the case of direct-current motors. The larger currents which must be handled on this account necessitate greater brush capacity than in direct-current motors, so that four brush arms are ordinarily required with a four-pole motor or six with a six-pole motor.

The performance of the single-phase railway motor is very similar to that of a direct-current series motor, the principal difference being that the speed curve is steeper. The general effect of this is to cause a car equipped with such motors to run slower on heavy grades and faster on the level than a car equipped with direct-current motors geared for the same speed at an intermediate load.

The single-phase motor differs from the direct-current motor also in that on account of its self induction it requires the application of a much greater percentage of normal voltage in order to send a given proportion of full-load current through it. On this account, it is not possible to allow as great a variation in the voltage at the car as is sometimes done with direct-current equipments, and to secure satisfactory operation the minimum voltage should never be less than about 80 per cent of the normal. Owing to the small currents used, however, this is a matter that is very easily taken care of. For the same general reason, the voltage on the motor may be varied in larger steps than with direct-current motors, so that fewer controller notches are necessary in order to secure a smooth acceleration, five notches, for instance, being ample for a quadruple 100-hp equipment. For the same reason also, the motors are much less likely to be damaged by too rapid feeding of the controller, and hence automatic acceleration is usually not necessary.

The standard trolley voltage for single-phase operation is 6600, although voltages of 3300 and 11,000 are also employed in some cases. In order to collect current at this voltage from the trolley wire, a pneumatically operated pantagraph

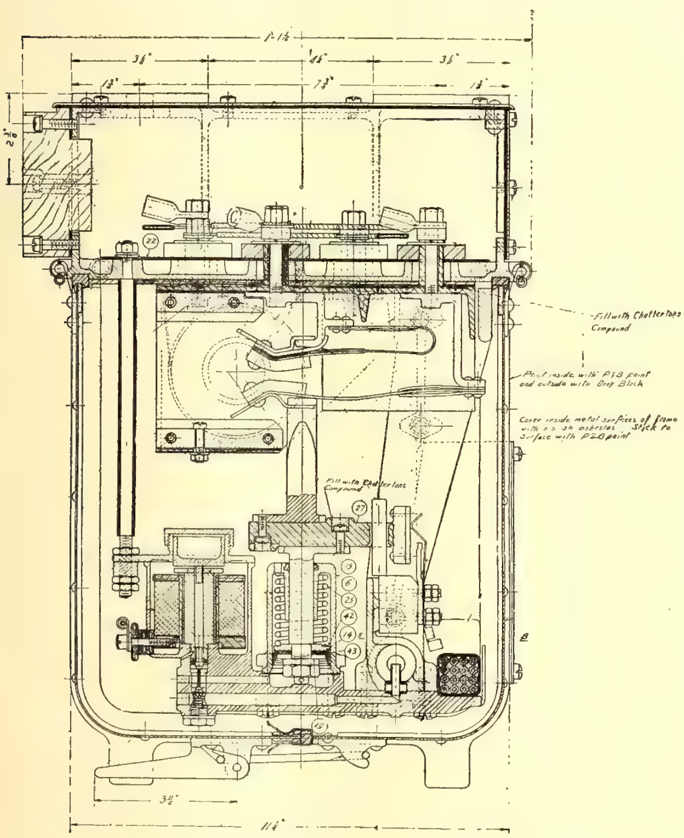


FIG. 9.—CROSS SECTION OF SMALL SWITCH GROUP

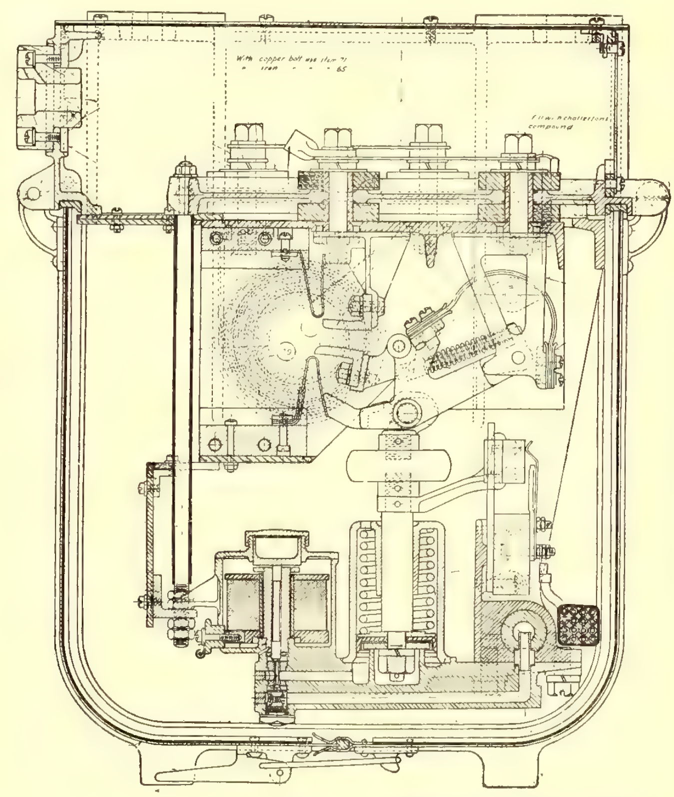


FIG. 10.—CROSS SECTION OF LARGE SWITCH GROUP

trolley has been devised which can be readily raised or lowered by the motorman without leaving his cab. In multiple-unit equipments, moreover, the trolleys on the entire train may be simultaneously controlled from any one point. This trolley is normally held against the wire by means of a spring, but is lowered and automatically locked down by the application of compressed air. Application of the air to another point will then unlock the trolley and allow it to rise.

To reduce the trolley voltage for use at the motors an oil-insulated, self-cooling auto-transformer is used. As this is ordinarily the heaviest single piece of apparatus on the car, it is commonly mounted in the center in order to simplify the matter of balancing.

As with direct-current motors, the speed of the single-phase motor varies with the voltage at its terminals, and the motor is controlled in this way. In order to get a variable voltage for this purpose, however, it is not necessary, as in direct-current practice, to change the grouping of the motors or to introduce resistance into the circuit, but simply to connect the motors to different taps on the auto-transformer.

The various connections between motors and transformer may be made either by drum type controllers or by unit

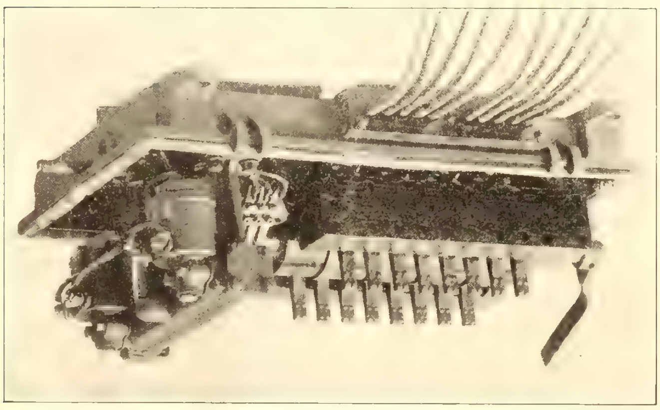


FIG. 11.—REVERSER WITH COVER REMOVED

switches, as with direct-current equipments. On account of the absence of any necessity for making series-parallel connections, both drum type controllers and unit switch groups for single-phase equipments are simpler than those for direct-current operation. For instance, a switch group for handling four 100-hp direct-current motors weighs approximately 760 lbs., while one for handling four single-phase motors of the same capacity weighs only 400 lbs. An entire equipment of single-phase motors, however, is considerably heavier than an equipment of direct-current motors of the same capacity, so that a car equipped with the former and carrying the same passenger load will ordinarily weigh from 10 to 15 per cent more than one equipped with the latter. Switch groups for single-phase operation are controlled by small storage batteries in the same way as those for use with direct-current equipments, but in this case the batteries are taken off of the cars at intervals and charged from a suitable source of direct current at the car house.

The qualities which make the single-phase motor suitable for operation on alternating current make it also an excellent direct-current machine, and such motors will operate beautifully on direct current of the proper voltage. It is often desirable to obtain the benefits of single-phase operation with cars which for a part of their route must run over the same tracks and use the same power as direct current cars, and by connecting two or more single-phase motors in series for such operation they can readily be arranged to run from a 550-volt trolley wire, as well as from a 6600 or other high-voltage one. Single-phase motors run somewhat faster with direct current of a given voltage than with alternating, while where operation on direct current is required of such motors, it is usually over city streets or in other places where only a moderate car speed is desired. On this account, equipments for operation on both alternating and direct current are usually supplied with four motors, which are permanently connected in two pairs of two in series. These pairs are run in parallel on alternating current and in series (so that all four motors are in series) on direct current. This arrangement usually gives a speed on 550 volts direct current about two-thirds or three-quarters as great as that obtained when operating from normal voltage alternating current. When running on alternating current, the motors of such an equipment are controlled in the usual way by connecting them to different taps on the transformer. When running on direct current, they are controlled by means of a resistance in series.

Equipments for operating on both alternating and direct currents are somewhat more complicated and expensive than those for operating on alternating current only, but they are equally satisfactory in operation, and the majority of single-phase equipments now in use are arranged in this way. In such equipments with drum type controllers, the controllers are made with two drums, and in changing from alternating to direct current, for instance, the controller handle is moved from the shaft of the a. c. drum to that of the d. c. drum. In multiple-control equipments, the circuits from the master controller to the various magnets are carried through a changeover switch. This is in the nature of a number of double-throw switches with the wires from the master controller connected to the middle points, so that with the changeover switch in one position a movement of the master controller operates one set of magnet circuits and closes the proper switches for alternating current operation, while with the switch in the other position, the same movement of the master controller operates a different set of circuits and closes the proper switches for direct-current operation. This changeover switch is governed by two relays, one connected to the transformer, and arranged to operate on alternating current only, and the other connected to the direct-current trolley and arranged to operate on direct current only. With such an equipment, therefore, if alternating current is supplied to the car, the changeover switch will automatically set itself in the a. c. position, or if direct current is applied to the car, it will set itself in the d. c. position. The movement of the same master controller in exactly the same way, therefore, closes an entirely different set of switches, according to the kind of current that is being used. Thus, in changing from a. c. to d. c., or vice-versa, it is only necessary to see that the proper trolley is on the wire.

During the past two and one-half years fifteen roads using single-phase apparatus have been put into commercial operation in this country, as well as several in Europe, using American apparatus, and many others are in process of construction. The equipment of the road now in operation ranges from double 50-hp to quadruple 150-hp motors, and the operating conditions cover an equally wide range. In some cases the roads are level, while in others they include grades as high as 10 per cent. In one case a slow-speed town service is given with a maximum speed of about 25 miles per hour and a schedule of about 10 miles per hour, while in another the road operates the fastest electric interurban service in the world and makes a maximum speed of

over 60 miles per hour and a run of 58 miles in an hour and a half.

On a basis of the experience gained from these roads, single-phase equipments have been standardized to a remarkable extent considering the comparatively short time the system has been in use, and the advantages of the system have been so thoroughly demonstrated that at the present time no new railway line is laid out without carefully considering the advisability of using the single-phase system on it.

RELATION BETWEEN MAINTENANCE OF TRACK AND EQUIPMENT OF INTERURBAN LINES

BY W. R. W. GRIFFIN,
Operating Superintendent Rochester & Eastern Rapid Railway Company

It is a very noticeable fact that the majority of papers read before this convention, together with writings in the different journals upon the subject of maintenance of equipment of high-speed interurban lines during the past, very rarely take into account the condition of track as having any bearing upon the same.

FIG. 1

FIG. 2

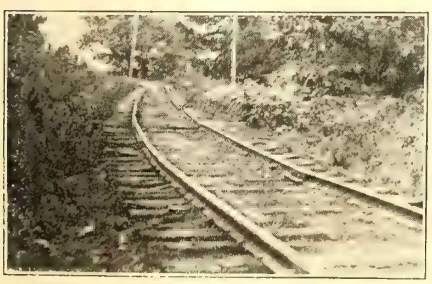


FIG. 3

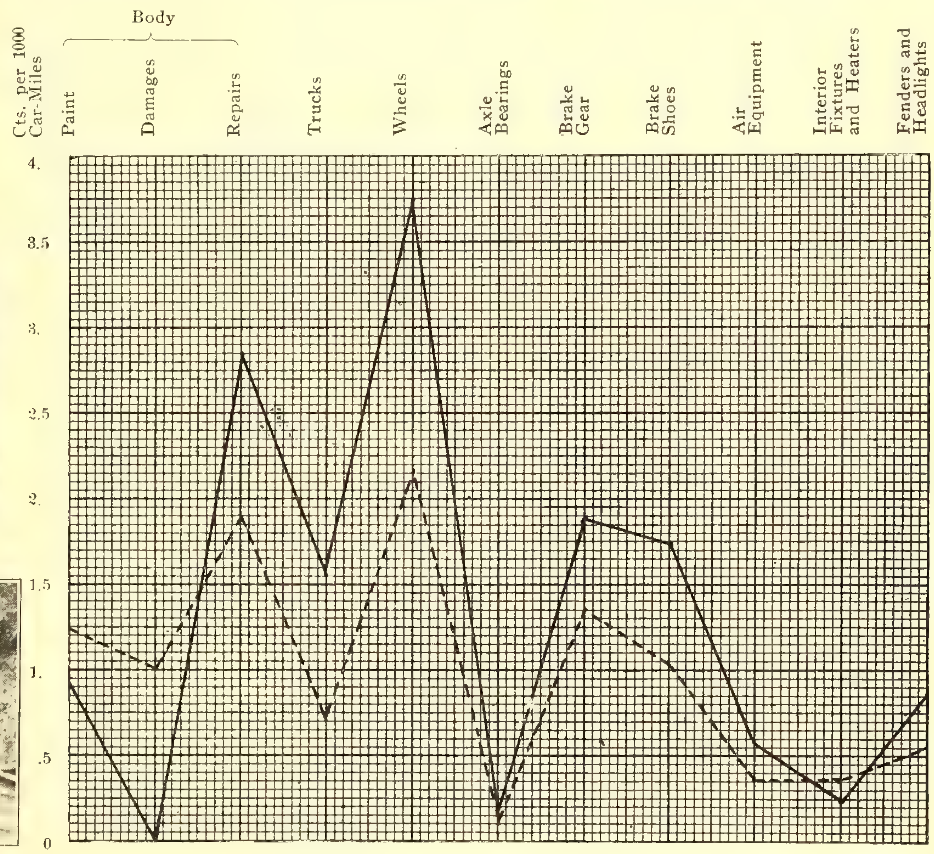


FIG. 4.—MAINTENANCE OF CARS

In traveling over different interurban lines, noting the track conditions and also shop conditions of same, I have come to the conclusion that track conditions enter very largely into the cost of equipment maintenance. Rough track with low joints, bad surface and line certainly racks car bodies, trucks, and is hard as well as dangerous on car wheels. It is also hard on motors, armatures, and is continually tearing off motor cables.

Figs. 1 and 2 show views of pieces of track taken from a limited train making a schedule of 28 miles per hour. This road at the time the photographs were taken required about thirteen cars of heavy equipment to fill schedule. A visit to the shops showed seven busy men in the armature room and other parts of the shop were busy in proportion.

On a visit to another road, the superintendent was seeking advice on maintenance of equipment and ways and means of keeping up repairs sufficient to keep his cars out on the road. A glance at Fig. 3, which is a photograph of a piece of his track, ought to explain the cause of a large percentage of his equipment trouble.

An analysis of two years' maintenance of track and equipment of the Rochester & Eastern Rapid Railway makes a very interesting study. In 1905, the second year of operating the road, there was spent on maintenance of track $175 per mile of road, or $11.20 per 1000 car-miles, and the track was kept in none too good condition. On maintenance of cars (Acct. No. 6) there was spent $14.52 per 1000 car-miles. On maintenance of electric equipment of car, $5.20 per 1000 car-miles.

In 1906, the third year, there was spent on maintenance of track $245 per mile of road, or $15 per 1000 car-miles. Maintenance of cars (Acct. No. 6), $10.77 per 1000 car-miles, and maintenance of electric equipment $5.42 per 1000 car-miles.

An inspection of Fig. 4 shows a large falling off of general repairs to car bodies, trucks, wheels, brake-gear and brake-shoes during the year 1906 over 1905, all of which is directly due to smoother track.

Fig. 5 does not show as decided improvement, except in the item of motor cables. At the same time, considering the fact that the average schedule speed was increased 12 per cent in the year 1906 over 1905, and also that the electrical equipment was a year older, we must admit that the improved track must have had a great deal to do with keeping the electrical repairs as low as they were.

In summing up: Eliminating painting and damaged cars, in body repairs, since these two items have no relation to track, we have

	1905—Per 1000 Car Miles	1906—Per 1000 Car Miles
Acct. 6....	$13.59	$8.53
" 7....	5.20	5.42
Track.....	11.20	15.00
Total....	29.99	28.98

making a total saving of $1.01 per 1000 car miles.

From the foregoing figures, it seems to me that it is good policy still to increase the ratio of total expenditure on track, since the track is the real permanent part of the railroad, and in so doing we not only build up a far better permanent way, but greatly extend the time of renewal of cars and electrical equipment.

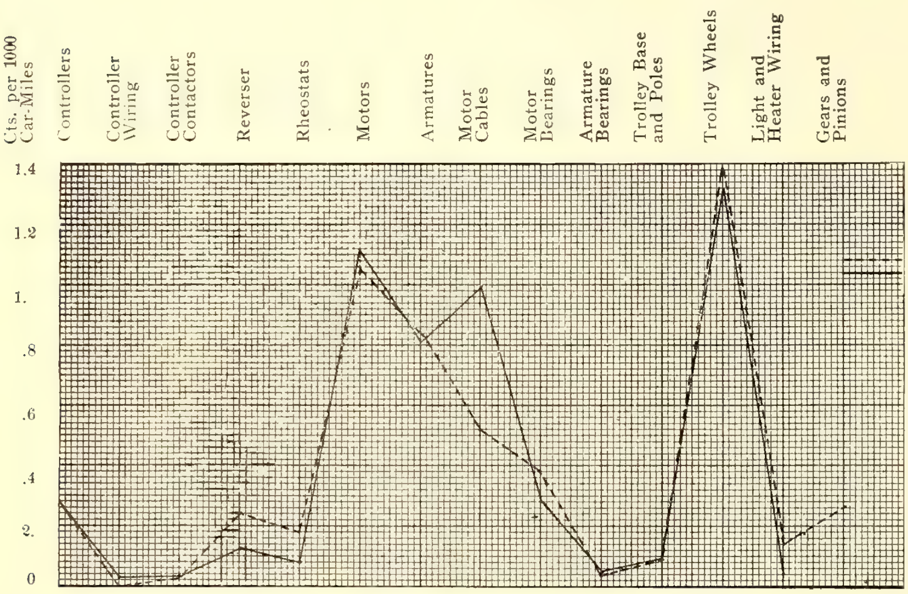


FIG. 5.—MAINTENANCE OF ELECTRICAL EQUIPMENT

COMMENTS ON SALE OF POWER

BY S. B. STORER
Manager of Sales, Niagara, Rockport & Ontario Power Company

In a paper presented before you last year on the "Sale and Measurement of Electric Power," the writer outlined a system of charging that he believed to be based on equity, and which was developed only after a careful study of the factors entering into the cost of power at the switchboard and of those pertaining to its wholesale and retail distribution. Since that time a more extended opportunity has been given for its study and adaptation to varied types of power plants, at the same time affording opportunity for criticism by those interested in the making of power contracts. In general, the criticism has amounted to unqualified condemnation of the contract, as submitted by the Niagara, Lockport & Ontario Power Company in its first reading by a prospective user of power, to be followed a little later by the reluctant admission that perhaps it was not entirely one-sided after all. Almost invariably the final judgment has been a complete approval of the system in so far as its intent and results under it are concerned, but the statement has frequently been made under just such circumstances that there was much room for improvement in the way in which it was expressed in the contract. This point has been well taken, and recently a new contract form has been prepared, in which, it is believed, many changes for the better have been made along those lines without in any way affecting the intent of the contract.

Practically every large power company is to-day embodying in some form in its contracts the agreement that the price at which power is sold shall be dependent on the load factor. In a number of such contracts the question of measurement of the maximum demand is left entirely open, thus avoiding, for the time being, any vexatious disputes about peak loads. All this tends to simplifying the contract very greatly, but it will be found that the disputes will come sooner or later, and, realizing that fact, the writer has taken the ground that all disputes or possible misunderstandings should be thoroughly settled previous to the execution of any power contract.

It is to be regretted that many delays in delivery of apparatus and line material have so far postponed the supply of power by the Niagara, Lockport & Ontario Power Company to its numerous customers that no adequate idea can be given at present as to the general working of the system. To the few customers, however, who are now being supplied it seems to be entirely satisfactory.

As might have been expected, considerable difficulty has been experienced in getting a meter that will successfully measure a 1-minute peak load. But this is only another example of the delays incident to the development of new instruments under existing manufacturing conditions. Such an instrument is entirely feasible and will certainly be on the market very shortly, regardless of delay and difficulties experienced in the past.

The question is often asked as to why so short a time as one minute should have been selected in the determination of maximum demands, but such questions are nearly always prompted by the desire of a prospective buyer to get just as much for as little as he can. One way of answering the question is by asking another one, i. e., why should so long a time have been selected? As a matter of exact justice there is no reason why power sold on a maximum demand basis should not be charged on the true maximum demand whether it lasted one second or an hour, or a day. Where power is sold on a kilowatt-hour basis, the consumer might just as well ask for an agreement whereby the kilowatt-hour should be calculated on the basis of seventy kilowatt-minutes as to ask that a maximum demand should not be deemed to have occurred unless it had lasted for several minutes.

Some power companies avoid disputes over duration of peak loads in determining the maximum demand by incorporating in their contract form an optional use of one-second peaks, one-minute, three-minute or five-minute peaks, with a different rate per horse-power per year for each case. This use is, however, optional only with the power company. This is exactly in accordance with a statement made by the writer in the discussion following the presentation of papers on power matters last year, in answer to a criticism offered at that time; that is, a longer period than one minute could have been selected, but it would have meant a higher rate for the power that a proper revenue might be realized by the power company.

It is also noticed that the highest maximum in the month is used in many places, rather than the average of the daily maximums, as the amount to be charged for. This also tends to simplify matters, but to the writer it does not seem

to give an accurate or an equitable basis for charging. Of course, it may be equalized to a certain extent by the price, but it could not be made to apply alike to all classes of consumers, at a uniform schedule of prices, without working an injustice to some.

The better method seems to be to set aside an amount of power for each consumer, that may be termed "firm" power or "reserved" power, which fairly represents the ordinary daily requirements, and to permit demands in excess of this amount within specified limits, to be charged for only on the days on which they occur. In other words, it is much more equitable to charge for the average of the daily maximum demands for a given month than to make the single extreme maximum in the month the basis of such charge.

In conclusion, it may be said that the movement for a fair and consistent way in which to supply electricity for all kinds of purposes has reached such a proportion as to make it almost a certainty that within a comparatively short time it will be possible for any consumer, no matter what his needs, to obtain whatever he may require on such terms as to put him on an equality with all other consumers. Such an equality can never be obtained by the use of a straight kilowatt-hour charge, but only by the combined use of a kilowatt-hour charge and a maximum demand, or service charge.

SOME PHASES OF ELECTRIC RAILWAY ACCOUNTING

BY J. C. COLLINS

According to the program, I am to discuss "Some Phases of Electric Railway Accounting," but in considering what I should talk about it seemed to me that you would be better pleased if I confine myself to one of the many topics that interest the operating man, and if I could bring you certain facts relative to the experience of the Rochester Railway Company it would be not only more interesting for you, but more valuable. I shall, therefore, speak to you this morning concerning the job order system, which is, in my opinion, the best method to arrive at the detail of costs.

The standard system of accounting makes no provision for a sub-division of the thirty-nine operating accounts that go to make up the operating expenses; consequently, it is left to each road to devise some method that will give to the officials the details of cost in their respective departments, and at the same time give to the general manager or general superintendent the necessary detail to keep him in touch with what is going on. This is especially true of the track, line and mechanical departments.

In operating subsidiary accounts the tendency, in my opinion, is to go into so much detail that the system becomes cumbersome, in which event it becomes necessary to analyze the detail. It is not unnecessary complication that each road is looking for, but the shortest and simplest method that will place the facts in the possession of the department heads. It seems to me that the job order system of cost accounting affords the solution of the problem.

This system permits the separation of the details of cost of the various operations to any degree of fineness which may be thought necessary and is a great aid in preparing costs. The idea of preparing unit costs is daily becoming more popular with our department heads, as it is of immense service in the making of new estimates. It is also of great benefit in making comparisons, for with this information the man in charge can quickly tell which of his foremen is the most competent.

For instance, in a case of track construction at two or more locations it is very interesting to compare the cost per foot for track laying, cost per cubic yard for placing concrete, and so on. By this comparison the head of the department can base on facts his opinion as to the capabilities of his foremen, the facts being actual unit costs for work done under exactly similar conditions.

The day has passed when department heads are content to wait until the end of the month to know in their respective departments what it is costing to operate. For that reason the job order system must be such that this information can be given daily. It is obtainable by the system used by the Rochester Railway Company, and, as we

ROCHESTER RAILWAY COMPANY.

Job. No.......... Account..........

Department.......... Rochester,.......... 190....

Estimate for..........

Total Estimate

Approved

Gen'l Manager. Head of Dep't.

Form 102.

FRONT OF ESTIMATE CARD, SIZE OF CARD 5 INS. X 8 INS.

have received a number of inquiries as to how we arrive at our detail of costs, I thought a description of our system might be of interest to the representatives of the different companies assembled here.

An estimate card, on which is noted the cost in detail of the proposed work and the account to be charged, is made out by the head of the department in which the estimate is prepared. When the head of any department makes an es-

Cost of Work Estimated on Other Side.

Items.	Labor.	Material.	
Totals			
Actual cost..........			
Estimated cost..........			
Increase or decrease..........			

BACK OF ESTIMATE CARD, SIZE OF CARD 5 INS. X 8 INS.

timate of the cost of some particular work he desires to do, the knowledge that the actual cost will be compared with the estimated cost, and with work in other departments, serves to make him careful to reduce the cost to the lowest possible figure consistent with good work.

After the estimate card has been prepared it is transmitted by the department head to the general manager, whose signature carries with it the authority to proceed with the work and the approval of the amount to be charged. The general manager, through his approval of the estimate cards, is constantly in touch with the work being done and the actual cost to date.

From the general manager the estimate card is forwarded to the auditor, who examines and verifies the charge, and then forwards the card to the job order clerk. The cards are numbered consecutively, beginning with No. 1, the first issued in the calendar year.

As soon as the job order clerk receives the card he numbers the job and places the card on file. The number is then

ROCHESTER RAILWAY COMPANY
Job Orders.

Job.		
280	Equip car No. 490 with air brakes, estimate $280	Charge Acct. K.
281	Equip car No. 491 with air brakes, estimate $280	Charge Acct. K.
282	Install two Eureka signals on Sea Breeze Line, estimate $1,200	Charge Acct. Sub. 2.
283	Paint car No. 334, estimate $45	Charge Acct. 6.
284	Paint car No. 437, estimate $50	Charge Acct. 6.
285	Paint car No. 443, estimate $50	Charge Acct. 6.
286	University Ave. feeder, 1-600,000 C. M. U. G., estimate $4,000	Charge Acct. E.
287	Track work—acct. Saratoga Ave. Imp., estimate $4,000	Charge Acct. P.
288	Track work—acct. Jones St. Imp., estimate $1,350	Charge Acct. P.
289	Changing motors in 12 Sea Breeze open cars to 4-G.E. 90, estimate $16,000	Chg. Acct. Sub. L 4,000 Chg. Acct. Roc. 7-12,000
290	Paint car No. 42, estimate $35	Charge Acct. 6.
291	Installing auxiliary police call—cashier's office, State St. Bldg., estimate $600	Charge Acct. 3.

June 21, 1907. R. E. DANFORTH, Gen. Mgr.

SPECIMEN TYPEWRITTEN REPORT OF JOBS AUTHORIZED

telephoned to the department making the estimate, as well as to the storekeeper, and is confirmed as soon as possible by sending typewritten copies on which are noted the number of the job, the account charged and a description of the work to the heads of all departments. The foremen

the job order clerk. The latter, in figuring out the costs of the various jobs, also makes a complete distribution of the payroll on a distribution sheet, the footings of which are posted on the back of the estimate card.

The job number is given on the requisition under which the material is drawn from the storeroom. These requisitions, when filled, are assembled daily by the storekeeper, and totals by accounts are posted on his distribution sheet. From this sheet at the end of the month the auditor gets

Form 152.
Storekeeper. ROCHESTER RAILWAY COMPANY.

Deliver to.................................articles below. ....190....

Car No.......................... Charge Account No.......................... For Job No..........

Quantity.	ARTICLES.	Price.	Amount.	Bin.

O. K.......................... ....Approved ....

Order material for each account on separate requisition. Foreman.

REQUISITION ON STOREKEEPER. SIZE OF SHEET 9 INS. X 4¼ INS.

his posting figure for materials charged to the different accounts. These requisitions are sent daily to the job order clerk, who sorts them according to job numbers, figures the cost of each job to date, and posts the cost to date on the back of the estimate card. When the job is completed the actual cost in detail is compared with the estimated cost,

Form 89 ROCHESTER RAILWAY COMPANY.

Time Sheet. ....Department. Pay Roll Ending..................................190....

Car Number.	DATE DESCRIPTION OF WORK.	Job Number.	Hrs.	Hrs.	Hrs.	Hrs.	Hrs.	Hrs.	Hrs.	Hrs.	Total Hours.	Amount.
	Rate per hour.................. Total											

....Workman

....Foreman

Approved

TIME SHEET. SIZE OF SHEET 10¾ INS. X 9½ INS.

Form 88 ROCHESTER RAILWAY COMPANY

Daily Time Report.

Date....................................190.... ....Department. ....Foreman.

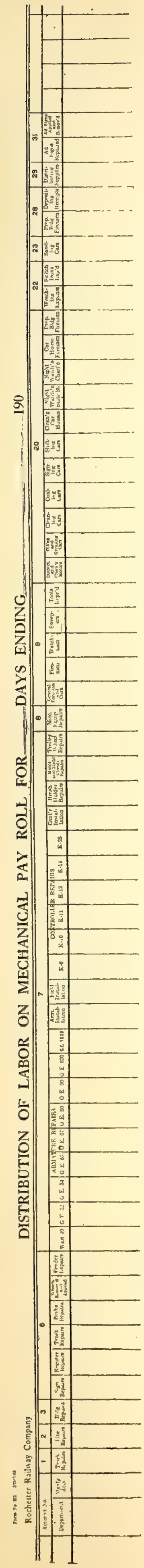
No.	NAME.	Total Hours.	Rate.	HOURS.								Job No.	Description and Location of Work.

DAILY TIME REPORT. SIZE OF SHEET 9¼ INS. X 8½ INS.

of the different departments, when necessary, are advised of the number, and instruct their men to use it on their time sheets, except in the track department. In that department, where we employ a number of Italian laborers, each track foreman makes one sheet covering the work of the men in his gang. These time sheets are then sent to the timekeeper, who posts the time and forwards the sheets to

and the head of the department that prepared the estimate is given a copy of the record for his information.

The working out of these estimate cards requires attention to figuring the cost of the work, and at the same time the fact that an estimate has been made out, and that the estimate will be compared with the actual cost, is an incentive to the different heads to keep more closely in touch



UPPER PART OF SHEET SHOWING DISTRIBUTION OF LABOR ON MECHANICAL PAY ROLL. SIZE OF SHEET, 31½ INS. X 18 INS.

UPPER PART OF SHEET SHOWING DISTRIBUTION OF MATERIAL AND SUPPLIES ISSUED FROM STOREROOM. SIZE OF SHEET, 46 INS. X 11½ INS.

with the progress and cost of work. This record is constantly referred to, and has proved by practice to be a feature of great value.

The job order system also acts as a check on the timekeeper and storekeeper, as has been demonstrated several times within our experience. We have a system which we thought would not permit mistakes to be made by the timekeeper, but since adopting the job order system we have discovered where the timekeeper has credited too much time to a man or wrong rate, and the mistake has passed unnoticed until the distribution of detail costs has been made up. The same is true of the storekeeper, so while our real object is to make a complete analysis of each account, we are also making a very careful audit of both the timekeeper and the storekeeper.

Another highly important advantage is that the miscellaneous charge is brought down to a minimum. This charge, under other methods that we have used, is often of such dimensions as to cause remark, but apparently it could not be lessened; but under the present system, with the various items admirably separated, the charge is always so small as to be passed over by the most exacting official without comment. The system also provides order in procedure. Before it was put into effect, work was done and charged to its proper account before the exact amount involved was known. The bad effects of this plan are evident, and are avoided by the thorough method that is an essential part of the job order system.

A summary of the advantages of the system may be of interest. It provides for a fine sub-division of the operating accounts, and enables the general manager to keep constantly in touch with everything that is going on. It aids in preparing unit costs and permits comparisons to determine the relative efficiency of foremen. It gives the detail of the cost of operation from day to day, and enables the general manager to see at a glance the variation from year to year in such cost. It tends to increase carefulness in the preparation of estimates, and, through comparison of the estimate with the actual cost, assists the official making the estimate to avoid errors that lead to estimates that are too low or too high. It affords an incentive to heads of departments to keep very closely in touch with the progress of work, and requires order in procedure, with the additional advantages of reduction of miscellaneous chargings and a thorough check upon the timekeeper and storekeeper.

GOVERNOR HUGHES NAMES UTILITIES BOARD

Gov. Hughes, at noon, Friday, June 28, caused to be announced at the Executive Chamber the names of the members of the New York City and State Utilities Commissions. Postmaster William R. Willcox is the chairman of the New York City Commission, and Frank W. Stevens, of Jamestown, Chautauqua County, is the chairman of the State Commission. The members of the two commissions are: First District (New York City)—William R. Willcox, chairman, of Manhattan; William McCarroll, of Brooklyn; Edward M. Bassett, of Brooklyn; Milo Roy Maltbie, of Manhattan; John E. Eustis, of the Bronx. Second District (up-State)—Frank W. Stevens, Jamestown, chairman; Thomas Mott Osborne, of Auburn; Charles Hallam Keep, of Buffalo; James E. Sague, of New Hamburg; Martin S. Decker, of New Paltz.

When Gov. Hughes formally makes the above appointments on Monday he will announce the terms for which each of his first appointees is to serve, the longest term being five years. The idea is to have one member of each commission to go out each year. The salary of each commissioner is fixed by the bill at $15,000 a year.

Briefly, the Public Utilities bill puts under direct State control every public service corporation in the State of New York, with the exception of the telephone and the telegraph. Under the new law, four of the most important State commissions will pass out of existence. In their place are the two boards of five members each, all of whom have just been appointed by the Governor. These boards will have complete control of the regulations governing the transportation and lighting facilities of the State. As previously stated, one of the commissions will have jurisdiction in the four counties composing New York City, and the other will have under its direction all the other counties of the State. These two bodies will have complete and free-handed control, and will be held to enforce the regulations provided for in the measure.

PROCEEDINGS OF THE NEW YORK STATE CONVENTION

The twenty-fifth annual convention of the Street Railway Association of the State of New York took place at Hotel Champlain, Lake Champlain, N. Y., Tuesday and Wednesday, June 25 and 26, 1907. There was a large attendance.

TUESDAY'S PROCEEDINGS

President J. N. Shannahan, of the Fonda, Johnstown & Gloversville Railroad Company, called the convention to order at 10:30 on Tuesday morning. After the roll-call and the reports of the secretary and treasurer, President Shannahan delivered his annual address.

Wm. L. Pattisson, secretary and counsel of the Plattsburgh Traction Company, then extended to those in attendance the privilege of transportation on that line during the convention.

The secretary then announced that the association had twenty-six member companies, a gain of three during the last year. There are nine associate members and sixty-eight allied members. He then announced that letters of regret had been received from the president and secretary of the Central Electric Railway Association of Ohio and Indiana; Hon. T. C. Platt; Hon. Chauncey M. Depew; the general passenger agents of the Lehigh Valley Railroad and the New York Central Railroad; the president of the National Accountants' Association; the chief engineer of the New York Central & Hudson River Railroad Company; the general passenger agent of the Erie Railroad Company; Major-General Bancroft, president of the Boston Elevated; August Belmont, of the Interborough Rapid Transit Company, of New York; Charles R. Huntley, of Buffalo; C. L. S. Tingley, president of the Accountants' Association; C. S. Sergeant, vice-president of the Boston Elevated Railway; the general freight agent of the Delaware, Lackawanna & Western; the secretary of the Interstate Commerce Commission; President Loree, of the Delaware & Hudson; Governor Hughes, and various others.

President Shannahan then asked whether the committee on brakes and braking had any report to offer. The committee was composed of Messrs. Stanley, Fassett, Hanf, Millen and Harvie. In the absence of Chairman Stanley, Mr. Fassett announced that the committee had found local conditions so diverse that a standard system of brakes was impossible. The report was accepted.

Mr. Fassett was then asked for the report of the committee on rules.

Mr. Fassett replied that the rules for city service formulated by the association were now in general use throughout the State, and the committee saw no reason for changing them. He suggested, however, the appointment of another committee to draw up rules for interurban work. After a discussion of this subject, it was decided to discharge, with thanks, the present committee and to appoint two new committees, a city committee and an interurban committee of three members each. The committee on interurban rules was requested to report at the next quarterly meeting. In this connection Mr. Allen agreed to send to each member operating an interurban road a copy of the rules employed by his road. This will allow the member to write the chairman of the committee on rules any suggestions which might seem desirable.

The paper by J. C. Collins on "Some Phases of Electric Railway Accounting" was then read. This will be found elsewhere in this issue.

DISCUSSION ON ACCOUNTING

T. W. Wilson said that the Buffalo Company uses a sheet instead of a card for preparing estimates. On this sheet is a place for the job number and for the approval of the manager and president. About 4 ins. is left at the bottom where the auditor can record the amount of supplies and cost of labor. These items are posted from time to time. When the job is completed, the sheet shows a very accurate tabulation of the total cost, both of labor and material. Where the work authorized is track construction the total cost is reduced to the price per foot of single track.

E. S. Fassett said that the United Traction Company, of Albany, prepared an authorization in detail, stating the amount, which was sub-divided into labor and material, etc. This authorization is approved by the various officers of the organization under whose jurisdiction the work would be done, and is then authorized by the general manager of the Delaware & Hudson Railroad.

C. Loomis Allen, of Utica and Syracuse, asked Mr. Collins how far he carried the job order system in their maintenance work. For instance, in shop practice, when a car is pulled in for general overhauling, whether that would be a part of the job order system.

Mr. Collins replied that the job order system was not used for certain work that has to be done regularly, like cleaning cars, trucks, and so on, but for practically everything else.

H. M. Beardsley, of the Elmira Water, Light & Railroad Company, said that that company uses a system similar to that described by Mr. Collins, but does not apply it in exactly the same way. It had not been found cumbersome, because it was just as easy for the storekeeper, if he gets a requisition for some material, to charge that material to a job order, or a working order, as it is called in Elmira, say, "No. 201," as to charge it to "Account 6." The total, when the working order is completed, is simply transferred from Working Order 201 to Account 6, or from Working Order 203 to Account 7, and so on. He thought the system very convenient in checking up supplies.

E. F. Peck said that the Schenectady Railway Company had also practically adopted the Rochester system. On its jobs, or construction work, or extraordinary maintenance charges, the head of the department from which the order originates makes, first, a detailed estimate, which is submitted to the general manager. If the job is approved, instructions are given to apply for a working order, which the department head does, giving his estimate on this working order. That is sent to the auditing department and the working order is issued and again returned to the general manager for his signature. That gives authority to go ahead with the work. On all maintenance charges the Schenectady Company uses the regular job system similar to the Rochester system, and it works out very well indeed.

J. H. Pardee said that J. G. White & Company have a system of authorizations and cost analysis that is a little different from any others that he had seen, although the principle is the same. It would not be applicable to small jobs or jobs lasting only a very short time—less than a month, but in reconstruction or new construction that would last for a period of several months or through a season it is very convenient. The first of each year each of the White operating companies makes up a detailed statement of the construction or reconstruction required during the year. It is divided, if there are subsidiary companies, under the head of the different companies, or any other convenient division of the work is used, and the au-

thorization is passed by the board of directors, or approved by the proper officers. Afterward, on the first of each month, a cost analysis sheet is prepared which shows the different authorizations, Nos. 1, 2, 3, 4, as the case may be. The first column contains the amount authorized to be spent; the next column, the money actually expended from the start of the job up to the first day of the month; the next column, amount of obligations covered by contracts; the next column shows the balance available; the next column shows the estimated cost to complete the job; the next column, either the gain or the loss. If it is a gain, it is entered in black ink, and if it is a loss—an estimated loss, of course—it is entered in red ink, so that the proper officers can see at a glance whether there is going to be an overrun or whether they are going to save money on the job. The last column shows the per cent of the work completed. The plans work out very well, and gives almost graphically a complete report on the whole job and on each individual job.

Vice-President Wilson here took the chair and announced as the next order of business the paper on "Some Notes on Electric Railway Shops and Shop Practice in Central New York," by W. H. Collins, of the Fonda, Johnstown & Gloversville Railway.

DISCUSSION ON SHOP PRACTICE

W. H. Evans, of Buffalo, said he was very much interested in Mr. Collins' suggestion about the master mechanics visiting different shops, but thought that when they visit a shop they should criticise. It is a great advantage to have some one come in and tell what is wrong. He had found that the best suggestions frequently came from master mechanics whose roads are poorly equipped and so who had found it necessary to devise some scheme to meet requirements which others did not find necessary. While the maintenance of records can be carried to an extreme, it is of vital importance that the actual record of the work as it progresses should be recorded and filed and in shape for ready reference and comparison. For this use he favored a tabulated record rather than a number of different sheets, as it frequently occurs that the latter become misplaced. He also thought it desirable to arrange the different equipments at different car stations or divisional points according to the character of the equipment and the style of the cars. This plan very much simplifies the matter of repairs. He did not quite agree with those who say that conditions vary in different localities. We are rapidly approaching a condition which very urgently requires the standardization of equipment, and outside of localities where there are excessively steep grades, or something of that kind which requires emergency brakes, and so on, the conditions to be met in different localities are very similar. With that in view, he believed it desirable for nearly all the roads to prepare for heavier equipment.

Wm. W. Cole, of Elmira, believed that in repair shops there is generally too much handling of material. In the manufacturing shops of the new design the article keeps going from shop to shop with absolutely no rehandling until it reaches the assembling room. The same conditions can be brought about in the design of a car house or a repair shop. The cars come in over the working pits where the general repairs are done. The machine shop should be located alongside, and the material should go direct from the repair pit to the machine shop. Then should come the blacksmith shop, and back of that should be the carpenter shop, so that the body of the car as it is taken from the truck goes through the machine and the blacksmith shop and is pushed right backward into the carpenter shop. On the other side of that is the paint shop. In that way the car would undergo absolutely no re-handling.

GROUP OF DELEGATES AT THE LAKE CHAMPLAIN CONVENTION

W. J. Harvie, of the Utica & Mohawk Valley Railway Company, believed that the conditions in New York State described by Mr. Collins was due largely to the fact that most of the men in charge of equipment have to deal with the immediate present. They are so busy with the conditions before them that they do not have time to consider the conditions that may exist perhaps six months or a year hence. These conditions are being gradually overcome, and one reason for it in his opinion is the meetings which have been had at the different shops throughout the State.

F. P. Maize, of Rochester, and F. M. DuBois, of Syracuse, concurred in the favorable opinion expressed by Mr. Harvie of the master mechanics' meetings.

Mr. Allen asked if it would not be possible to devise

standard layouts for repair shops of different sizes but capable of extension.

Mr. Evans thought this hardly feasible just at the present time, when the companies are changing from the older to the heavier equipments, and it is rather difficult to tell what the requirements will be. He did think, however, that it might be possible to standardize the trucks, particularly on double-truck cars, to a greater extent, so that the body can be run in and changed over to another pair of trucks kept ready. The defective trucks could then be repaired and made ready for the next body. In that way considerable time would be saved in which the car is out of service.

President Shannahan also thought it might be difficult at present to standardize shop buildings, local conditions are so varied. After further discussion on this point, in which Messrs. Harvie, Collins, Evans, Benedict, Allen and Peck participated, it was decided to appoint a committee of three master mechanics to report as to the design of a model repair shop and report at the next meeting. The convention then adjourned.

WEDNESDAY'S SESSION

On Wednesday papers were presented by Messrs. Hill, Renshaw and Griffin. They are published elsewhere in this issue. There was no discussion. The following officers were then elected for the ensuing year:

President—Thomas W. Wilson, International Railway Company.

First Vice-President—E. S. Fassett, United Traction Company.

Second Vice-President—E. F. Peck, Schenectady Railway Company.

Treasurer—H. M. Beardsley, Elmira Water, Light & Railroad Company.

Secretary—J. H. Pardee, of J. G. White & Company.

Executive Committee—C. Loomis Allen, Utica & Mohawk Valley Railway Company; C. Gordon Reel, Kingston Consolidated Railroad; W. S. Darbee, Albany & Hudson Railroad Company; J. C. Calisch, Buffalo & Lake Erie Traction Company.

EXHIBITS AT THE CONVENTION

There was no attempt to have an elaborate exhibit at the Lake Champlain convention. At the same time, two or three manufacturers who have recently brought out new types of apparatus took occasion to show them in one of the rooms on the ground floor of the hotel.

The largest and most elaborate exhibit at the convention was made by the Westinghouse Air Brake Company, which showed a new combination automatic car coupler and air-pipe connector for electric cars. It is understood that this ingenious device is the latest invention of Mr. Westinghouse himself, and its design has received a very large amount of his personal attention during the last year or so. The coupler is intended especially for electric traction service where the difference in heights of cars, sharp changes in grades and short-radius curves make the application of an automatic coupler, especially one involving air connections, extremely difficult. The plan has been worked out very carefully, however, and the exhibit attracted a great deal of attention. For convenience in demonstration the coupler was mounted in a frame and the two draw-bars were brought together and separated by air power supplied from a motor compressor. One of the couplers was also arranged to be raised and lowered, to illustrate the perfect action of the coupler when the drawbars are at different heights. A section of the coupler was also shown. Briefly, the drawheads are pivoted to the drawbar to compensate for vertical movement, while the drawbars themselves are pivoted to the car body or truck in the ordinary way. When the drawbars are coupled together they are held rigidly in position by two cams. To release these cams, they can be thrown or kicked out by the trainmen. Of the two lines of air pipes, one is carried on the inside of the coupler and the other on top. Rubber gaskets thoroughly protected by collars make a rigid and permanent air line connection. Electrical jumpers can be hung below when required. The coupler has been in use for a considerable time on an electric surface train on Commonwealth Avenue, in Boston, in New Bedford and on the Westinghouse train on the Twenty-Third Street crosstown line in New York. An order has also been received for twenty couplers of this kind from the Consolidated Railway Company, of New Haven, for cars now being built for that company at the Wason plant at Springfield.

The Ohio Brass Company exhibited a model of its Lintern car signal system. Two good-sized models of the ends of cars were shown, one the rear end with the signal lights, the other the front end carrying the marker lights. Upon these models were mounted lamp sockets to correspond with the interior illumination of the car, and a painted diagram of the connections made the working of the system clear. The size of the models made it possible to show the system in actual operation. The company also had for distribution pamphlets on its crossing signal, Tomlinson couplers and other specialties.

The Taylor Electric Truck Company, of Troy, exhibited a steel-tired wheel with a malleable iron center, similar to that which attracted considerable attention at the Columbus convention, and which was described in these columns at that time.

In addition to the above, a few models were exhibited, among them one of a very ingenious screw jack shown by Giles S. Allison, and which will be described later in these columns.

THE BANQUET AND OTHER ENTERTAINMENTS

The annual banquet of the association was held on the evening of Tuesday, June 25, in the large dining room of the hotel, and was attended by about 160 persons, including a large number of ladies. The speakers' table occupied one side of the room, and the others in attendance were seated at smaller tables in parties of eight persons. The banquet was an excellent one and the speeches were in a particularly happy vein. It was expected that Hon. W. Caryl Ely would be able to come as toastmaster, but in his unavoidable absence the position was very ably filled by W. W. Cole, of Elmira, who was extremely happy in introducing the various speakers. After a short speech by President Shannahan, the addresses of the evening were given by Hon. Howard McSherry, of the Public Service Corporation; Hon. Miles T. Frisbie, of the New York Assembly; C. Loomis Allen, of Utica, and J. M. Wakeman, of the STREET RAILWAY JOURNAL.

The other entertainments for which arrangements had been made were a trip to Au Sable Chasm on the afternoon of Tuesday, and a ball game between the railway men and the supply men on Wednesday. The trip to the Chasm was made by special train from the Point Bluff station to the junction with the electric road of the Keesville, Au Sa-

ble Chasm & Lake Champlain Railroad Company, where a third-rail electric locomotive hauled the two special cars to the entrance of the Chasm. The threatening weather at starting discouraged a number from attempting the trip, but those who participated were amply repaid by the beauty of this wonderful rift through the rocks. The afternoon was pleasant and the party reached the hotel on their return a little after seven o'clock.

Owing to the inclement weather on Wednesday afternoon the ball game was postponed. It is understood that Capt. H. N. Ransom, of the supply men, and Capt. Chas. H. Clark, of the railway men, had surprises in store, but what these were and the ability of their respective nines will not be disclosed for another year. At that time it is hoped that the base ball championship will be definitely settled.

DATA SHEETS ON MAINTENANCE & INSPECTION OF ELECTRICAL EQUIPMENT

The committee on maintenance and inspection of electrical equipment of the American Street and Interurban Railway Engineering Association has issued three data sheets for information to be used in the report of the committee at the Columbus convention. The committee consists of John Lindall, chairman; W. D. Wright, E. T. Munger, L. L. Smith, and replies should be sent to John Lindall, superintendent of motive power and machinery, Boston Elevated Railway Company, 439 Albany Street, Boston, Mass. The data sheets follow:

DATA SHEET NO. 1

Name of company, city, State.

(1) Number of cars; motor, trailer. (2) Weight of cars, (3) length of cars, (4) size and number of motors per car, (5) type of control.

(6) Frequency of inspection of control: (a) K type, (b) multiple-unit type. (7) Is inspection made by day or night? (8) State what determines frequency of inspection, whether brakes, control, commutator work or oiling.

(9) State what is done to maintain car wiring in safe condition. (10) How do you test car wiring, including light, heat, motor wiring? (11) How is light, heat and motor wiring installed—in canvas hose, conduit, cleats, molding or in transite?

(12) How often do you inspect trolley apparatus? (a) wheel, (b) bow, (c) shoe, (d) base. (13) What does inspection consist of? (14) How often do you replace bushings in trolley wheels? (15) State what is done by way of overhauling to maintain control equipment in a safe and reliable condition, and at what period of time or mileage.

(16) State what electrical safety devices are used for the protection of apparatus. (17) Type of fuse and location, (18) type of circuit breaker and location, (19) type of lightning arrester and location, (20) state methods of inspecting and testing same.

DATA SHEET NO. 2

Name of company, city, State.

(1) Do you manufacture armature coils? (2) Have you used asbestos-covered wire for same? (3) If so, are you satisfied that results obtained justify use of same at extra cost of the wire?

(4) Describe materials used in covering and insulating coils wound with cotton-covered wire, and methods of applying same; (5) describe materials used in covering and insulating coils wound with asbestos-covered wire, and methods of applying same.

(6) What test do you give coils for short circuits? (7) What insulation test do you give armature coils? (8) Have you any preference for rolled or drawn copper commutator segments over drop forged segments, or vice versa?

(9) How many sizes of shaft journals do you use on any one type of armature? (10) Do you allow 1-16 in. or 1-32 in. difference in diameter between sizes? (11) Do you sleeve worn shaft journals with steel tubing? (12) If so, do you apply same hot or cold? (13) What difference do you allow between inside diameter of sleeve and diameter of shaft journal? (14) Do you bore your babbitted armature bearing shells or babbitt to size?

(15) What grade steel wire do you use for banding armatures; also state specifications for same if you have any? (16) Describe any special piece of apparatus or tool that you are using that is especially interesting, useful and valuable for repair work on motors, or other electrical apparatus used in car equipment.

(17) Do you have evidence of old cores materially increasing armature temperature? (18) Do you rebuild and reinsulate armature cores? (19) What determines period at which core should be rebuilt and reinsulated?

(20) Do you manufacture field coils? (21) Do you use asbestos-covered wire for same? (22) If so, are you satisfied that results obtained justify the use of asbestos-covered wire at extra cost? (23) Describe materials.

(24) What test do you give field coils in shop? (25) What test do you give field coils in use in motors? (26) What experience have you had with field coils wound with cotton-covered wire impregnated by vacuum process with solid compounds? (27) What experience have you had in impregnating armature coils with solid compound by vacuum process?

(28) At what speed do you run field coil winding machine? (29) What is your opinion of the relative value of field coils wound with double cotton covered wire, covered with cotton materials, and vacuum impregnated with solid compound, and coils wound with asbestos-covered wire, covered with asbestos materials, and treated with liquid compounds and paste of any description? (30) How often do you test and recalibrate circuit breakers? (31) How often do you give air compressors shop overhauling?

DATA SHEET NO. 3

Name of company, city, State. (1) Describe, without mentioning the manufacturer's name, the characteristics of motor carbon brushes giving the best service. (2) Aside from requiring a brush to give satisfactory service, what specifications would you lay down to manufacturer to govern him in making up brushes to best meet your needs?

(3) What simple test or inspection do you have to determine, before using, whether brushes are of satisfactory quality? (4) Do you approve of boiling brushes in paraffine? (5) Is any other treatment of brushes beneficial?

(6) What do you regard as the principal cause of flat spots on commutators? (7) What is the most effective means of avoiding same? (8) Do you consider grooving mica below surface of commutator effective in improving commutation? (9) If so, on what motors and under what conditions is grooving commutators necessary or desirable?

(10) What proportion of your commutator and brush holder troubles do you attribute to: (A) Fast feeding of controller? (B) Quality of brushes? (C) Quality of commutator bars? (D) Quality of commutator mica? (E) Design or characteristics of brush holders? (F) Other causes. (11) Remarks concerning these various troubles and their remedies.

(12) Do you experience trouble with burnt or broken brush-holder springs? (13) If so, what means do you take to overcome the troubles? (14) What method do you use to avoid the grounding of brush holders?

(15) What period of days, or if on a mileage basis, how many miles run, between times of lubrication on: (A) Armature bearings? (B) Motor axle bearings? (C) Truck journal bearings? (D) Air compressors? (E) Motor gears?

(16) Do you inspect electrical equipment on the mileage or on the time basis? (17) What period of days, or miles, elapses between inspections on: (A) Brushes, brush holders and commutators? (B) Armature clearance from pole pieces? (18) What is the period or mileage from one thorough overhauling of motors to the next, where armatures are taken out, commutators turned, bearings renewed, fields revarnished and everything put in first-class condition?

(19) Give briefly the rules governing car-house men in the inspection work, both for light inspection and for heavy inspection and repairs, also enclose such forms or blanks as are used on inspection and remarks concerning their use. (20) How do you obtain car mileage, and in what form is this kept for use of the mechanical department?

A. S. & I. R. ENGINEERING ASSOCIATION ANNOUNCEMENT

The American Street and Interurban Railway Engineering Association announces that the meeting of the association will convene at 2 o'clock p. m. on Monday, October 14, the meeting to continue during Tuesday morning and afternoon. On Wednesday morning, October 16, the joint meeting of all the associations will be held at 10 o'clock and the closing session of the Engineering Association will be held at 2 o'clock on that afternoon. The headquarters for the Engineering Association will be at the Hotel Denis. A splendid program is well under way and every endeavor is being made to have all material printed and distributed to the members several weeks in advance of the meetings. The Question Box is provided as a means of bringing miscellaneous matters before the convention. Papers have been assigned on several subjects, and it is asked of each member that he assist in making the Question Box a success by indicating at least one question in which he is especially interested. The list of questions received will be printed and forwarded to the members the first part of July for answers, the questions and answers to be printed and sent out with the advance papers.

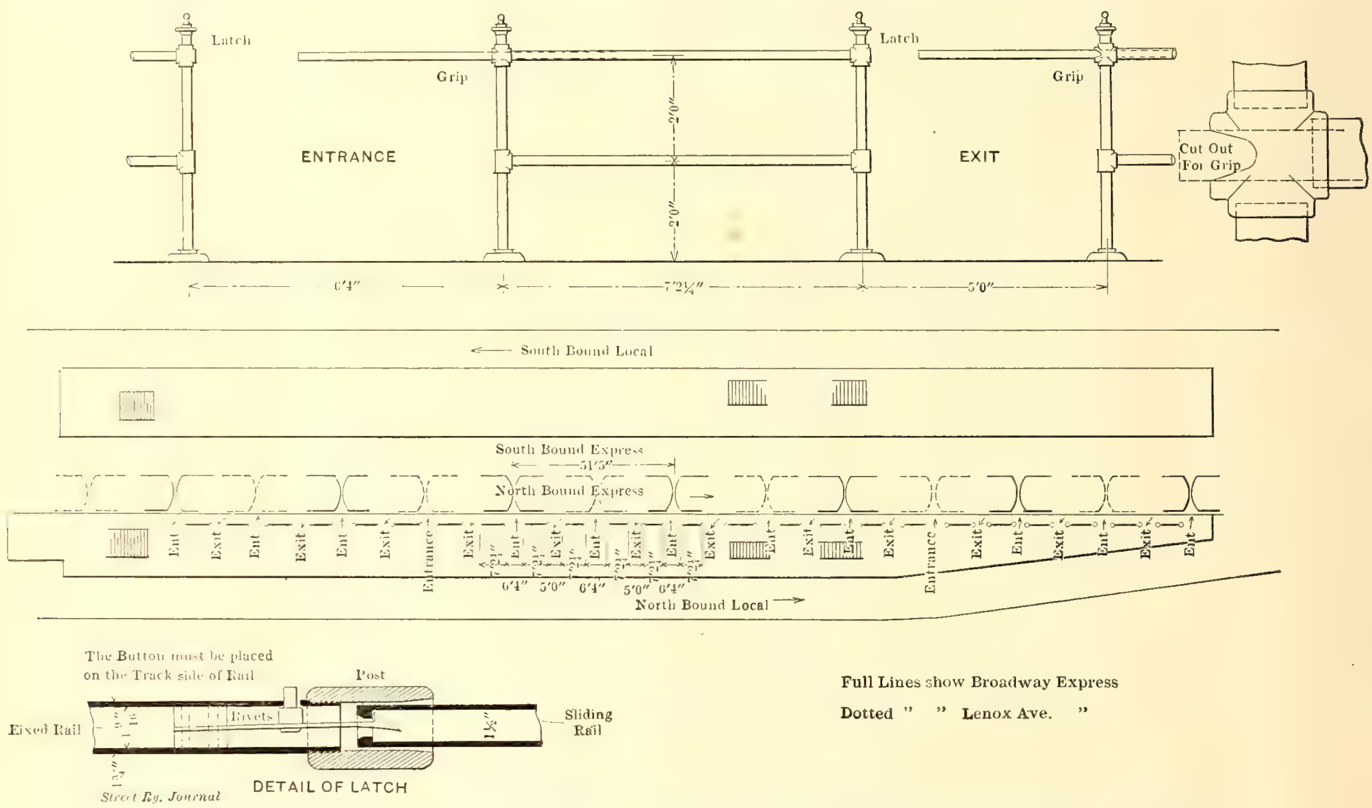
PLATFORM ARRANGEMENTS AT GRAND CENTRAL

The management of the Interborough Rapid Transit Company has been planning for a long time to introduce some arrangement of platforms at the Grand Central Station which would obviate the congestion of passengers at that point. At this station more passengers leave and board the cars, counting those who transfer from local to express strains and vice-versa, than at any other station on the system. During the rush hours it is often impossible for all passengers desiring to board a train to do so unless a stop should be made so long that it would delay the traffic on the rest of the system. For this reason it has been the practice to make a stop of a pre-determined duration sufficient to allow all passengers who wish to leave the train and to take in as many entering passengers as possible before the dispatcher sounds the gong to start the train.

The management has believed for some time, however, that if it were possible to divert the lines of entering and leaving passengers it would be possible to make a quicker stop. With this end in view it has been the practice of the company for some time to stop its Broadway expresses at one point on the platform and the Lenox Avenue expresses half a car length away from the point at which the Broadway expresses stop. These points are marked by signs so that passengers waiting for the Broadway expresses will congregate at one point and those for the Lenox Avenue expresses at another, and so will not interfere with each other. This plan, however, has not entirely settled the problem, and the company last week installed railings still further to separate the incoming and outgoing passengers.

This railing is 4 ft. high and is erected 4 ft. from the edge of the northbound express platform. It is in sections 7 ft. 2¼ ins. long, with entrances 6 ft. 4 ins. wide. The entrances and exits can be closed by a sliding bar with a latch. As shown by the diagram, a northbound Broadway express is stopping at the station. A platform guard stands at each entrance to keep back the passengers who wish to board the train, while those leaving the train have a clear exit, one to each side of each entrance. As soon as the last passenger leaves the platform the platform guard throws back the bar and admits the line of boarding passengers.

The dotted lines in the diagram show the position of the Lenox Avenue expresses. Here the former exits are used as entrances, and vice-versa. The plan is being tried during the summer months when the travel is not so great, so as to determine its efficiency before the winter rush commences.



PLATFORM AND RAILING LAY-OUT AT THE GRAND CENTRAL STATION OF THE INTERBOROUGH RAPID TRANSIT COMPANY

BROOKLYN SUBWAY APPROVED

The Rapid Transit Commission of New York adjourned sine die Thursday, June 27, after a little more than thirteen years' service. Before ending its final session it passed resolutions practically insuring the construction by the city of the Fourth Avenue (Brooklyn) subway and authorizing the construction by the Interborough of additional tracks at Ninety-Sixth Street in the present subway. Legal forms of contract for six of the fourteen sections of the new Brooklyn subway were ready for the board's approval. The plans and specifications for the whole route were ready, but only the contract forms were acted upon. When these sections are completed Brooklyn will have a subway running from near the approach to the new Manhattan Bridge to the outskirts of the thickly populated part of the borough. The whole line, when built, will extend to Fort Hamilton and Coney Island. The estimated cost of the road is set at $23,000,000.

The most the board could do was to approve the contract forms and authorize the holding of a hearing. This was done, and July 13 was set as the date for the hearing.

EXPRESS CARS FOR THE PHILADELPHIA & WESTERN RAILROAD

Announcement has already been made in this publication of the formal opening of the Philadelphia & Western Railroad. This brief description of the express cars used built recently by the St. Louis Car Company may be of interest.

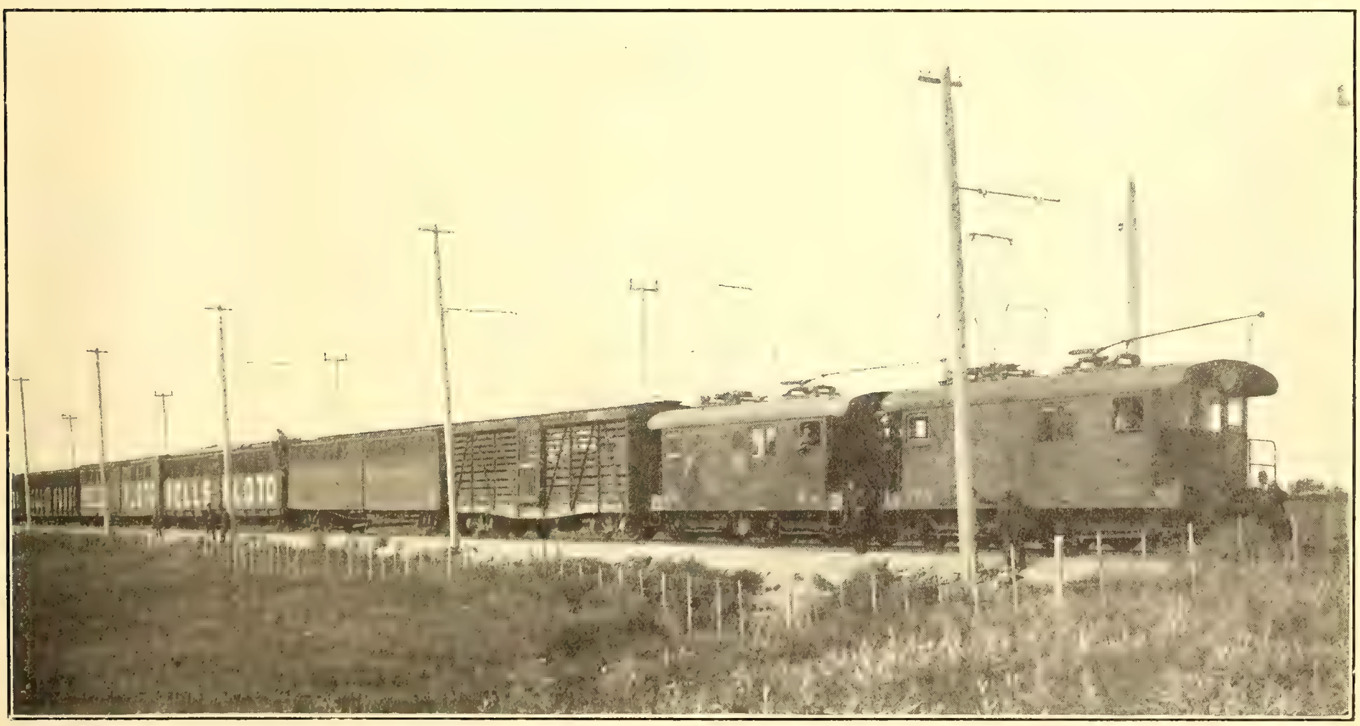
The cars are 50 ft. long over all, 9 ft. wide, and have the steam coach type of hood. The side sills are made of 5-in. x 8-in. long-leaf yellow pine timbers and reinforced with steel channels. The center sills are of 6-in., 12½-lb. I-beams with wood fillers. The interior is one large compartment, no partition being made for the cabs. The side of the car contains two large sliding doors, and the interior is fitted with twenty electric heaters to guard against damage to perishable freight.

BAGGAGE AND EXPRESS CAR FOR THE PHILADELPHIA & WESTERN RAILROAD

The car is built for operation in either direction. Both pilots, which are of the locomotive type, are fitted with snow plows. As the road is operated by a third rail, the trucks are provided with third-rail contacts. Trolley connections are also provided. All of the wiring of the car is in conduit.

HAULING A TWENTY-THREE CAR CIRCUS TRAIN

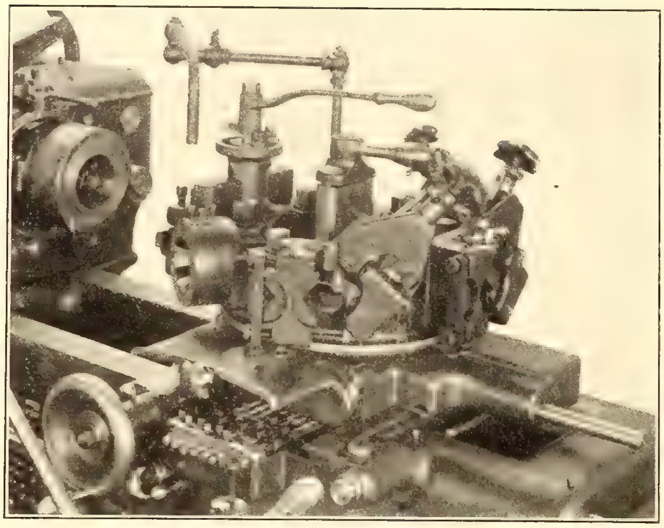
The Sells-Floto Circus train was taken over the Spokane & Inland division of the Inland Empire System, of Spokane, Wash., on Sunday, June 8, the circus being hauled from Palouse, Whitman County, to Spokane, a distance of 76 miles. This is the first instance of a circus being transported by electric power in the Northwest. The circus consisted of five 60-ft. Pullman coaches, seven standard stock cars and eleven 60-ft. flats, aggregating 2300 tons. The Spokane & Inland division is equipped with the single-phase system, 50-ton, 600-hp Westinghouse locomotives being used for heavy hauling.



A TWENTY-THREE-CAR CIRCUS TRAIN IN THE NORTHWEST BEING HAULED BY TWO SINGLE-PHASE LOCOMOTIVES

A NEW OPEN TURRET LATHE

A new Pratt & Whitney open turret lathe suitable for doing a variety of work, in which are combined a number of new features, including a cross sliding turret, is announced by the Niles-Bement-Pond Company, of New York. The machine has a stiff head, with constant speed arranged for



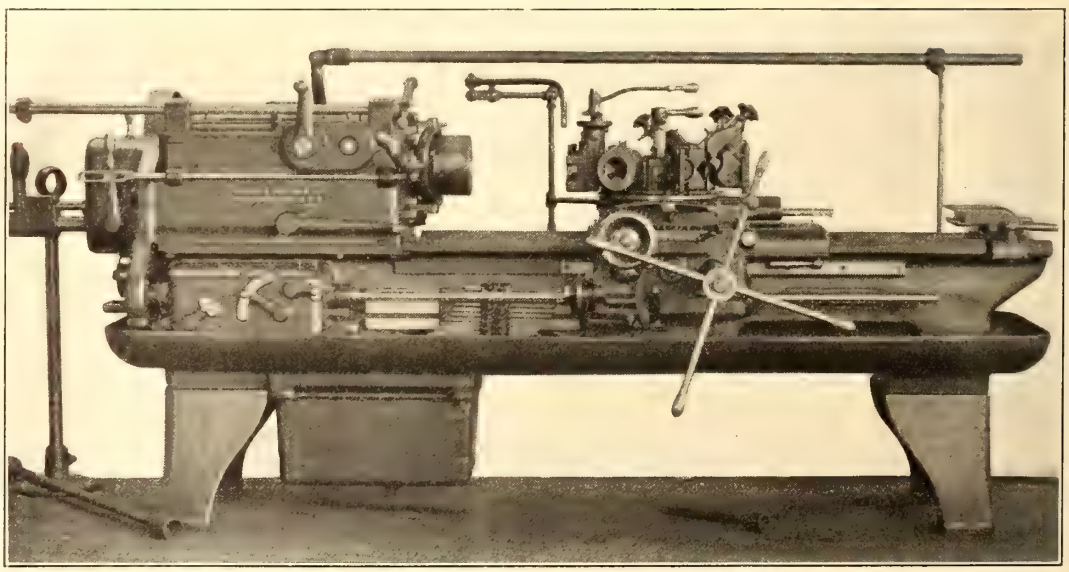
LATHE, SHOWING CROSS SLIDING TURRET

either direct-connected motor or countershaft drive by means of a single pulley, and is said to possess practically all the flexibility of the engine lathe. The turret is mounted on a slide, having both positive power and hand longitudinal and transverse direction, and the machine is recommended for bar work up to 2½ ins. diameter by 26 ins. long, for castings up to 14 ins. diameter, and for cylindrical operations on work within these dimensions. The gears are of extra heavy pitch and of ample width safely to withstand the hardest usage. The head, which is stationary, is of box construction, the gears running continually in oil.

Eight variations of speed are provided, and by using the two-speed countershaft these may be doubled. All of the controlling levers and connections are within easy reach of the operator, and the spindle can be instantly stopped by the movement of any lever on the head stock. The rod chuck may be operated while the machine is running. The collect jaws are supported up to their outer end. The complete chuck can be readily removed from the spindle when combination lathe chucks or special face plates for castings are to be substituted. A positive screw feeding device automatically feeds the rod forward to its stop and the bar may be round, square or any irregular cross section, and need not necessarily be free from scale, as there are no delicate parts or complicated gearing to become clogged. A follower bar is furnished which enables short pieces of stock to be as conveniently handled as long bars, and at the same time serves to keep such piece concentric with the spindle. An efficient stock stop for gauging the length of stock is provided, which, when not in use, can be moved forward and swung upward, so as not to interfere with the turret tools.

One of the most important features in the new lathe is the compound turret with power and hand feeds and adjustable stops, which are conveniently located. The longitudinal turret slide travels on large raised "V's," is provided with gibs its full length, and a binder which permits the slide to be firmly clamped to the bed at any point within its travel. The power longitudinal feed is positive in both directions, and has six changes, any one of which can be instantly set. The six automatic longitudinal stops and the six supplementary stops give two positions to each turret tool, and make it possible to use all twelve stops for one or all tools in the turret. The stops are held in a heavy steel bracket, which may be moved along the front of the bed and clamped where desired. In case it is desired to run through a few special pieces of work, the automatic stops may be dispensed with and the supplementary stops used in their place without the necessity of disturbing adjustments.

The distance from the axis of the spindle to the turret tool is altered by traversing the turret slide. This arrangement permits ample support for long bars, and if the machine is belt-driven gives an unvarying belt tension. The cross slide has both hand and power feed, and there are six variations of the power feed in either direction. Eight distinct adjustable cross stops are provided, which may be used in any combination desired. The bed and pan are made in one single casting and have "U"-shaped cross webbing, insuring rigidity. A variety of turret tools is designed to meet practically all the various requirements of the machine.

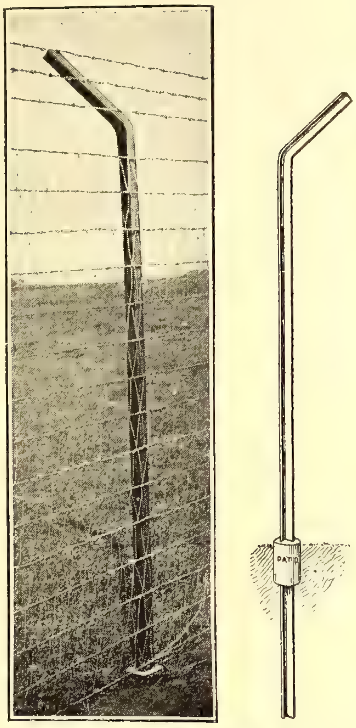


OPEN TURRET LATHE

Theodore P. Shonts, president of the Interborough Rapid Transit Company, says that the type of car to be adopted in replacing the rolling stock on the company's surface lines has not been decided upon. Among the cars under consideration are the pay-as-you-enter car used in Montreal and cars equipped with the Minneapolis gate. Both types have been described in detail in the STREET RAILWAY JOURNAL.

A NON-CLIMBABLE FENCE POST

A non-climbable fence post has been designed by J. H. Downs, of New York, that should prove especially advantageous for use at trolley terminals, street railway parks and such other grounds or tracts as companies desire to fence and make positively inaccessible except by the regular entrance. This post is all in one piece, and, as shown in the accompanying illustration, is made to carry woven wire with barbed wire on the top which is bent at an angle of 45 degs. Corner and end posts are, of course, bent to the peculiar requirements of each installation. In the same way posts are punched to order, so as to suit any kind of fence. The posts themselves are made from high carbon steel angle, and are painted with waterproof paint. They can be driven, thus saving the labor and expense of digging post holes. An adjustable collar of vitrified clay, burned hard, is provided, which can be slid down the posts after they are driven, leaving about 1 in. of the collar above ground. By tamping them well the posts will remain rigid.



FENCE POSTS WIRED AND SHOWING COLLAR

PORTABLE SUB-STATION

An interesting feature of the equipment being installed by the Los Angeles Pacific Company is a portable sub-station designed by C. M. Warnecke, chief electrician of the company, which resembles a freight car. It is 30 ft. long and 8 ft. wide, and weighs, including apparatus, 100,000 lbs. As it is built in sections, any piece of apparatus can be removed without disturbing the remainder of the structure. For controlling the high-tension line a Hartman type C, 100-amp., 22,000-volt, automatic oil switch was installed. This switch, which is shown in Fig. 1, is of the wall mounting type and is controlled by means of a 1/4-in. steel tiller rope running over pulleys to the operating handle shown on the right-hand side of Fig. 2. The switch is entirely self-contained, the series transformers for operating the overload coil being mounted on the supporting frame with the switch cells. This makes a very compact layout and one which is easy to install. In addition to the apparatus just described, the sub-station contains one MP 6/400-kw, 550/600-volt, 415 r. p. m. induction motor-generator and three 150-kw, 15,000/2400-volt, single-phase transformers. This equipment enables the Los Angeles Pacific Company to deliver 1200 amps. at 550 volts as a booster at any point along the line. Hartman oil switches, furnished by B. F. Kierulff, Jr., & Company, of Los Angeles, the Pacific Coast agents of the Hartman Circuit Breaker Company, are being used throughout the system of the Los Angeles Pacific Company.

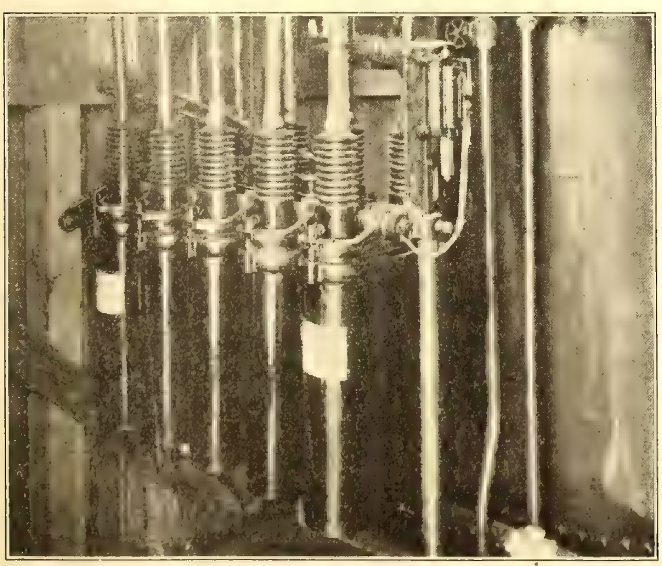


FIG. 1.—OIL SWITCH FOR 22,000 VOLTS

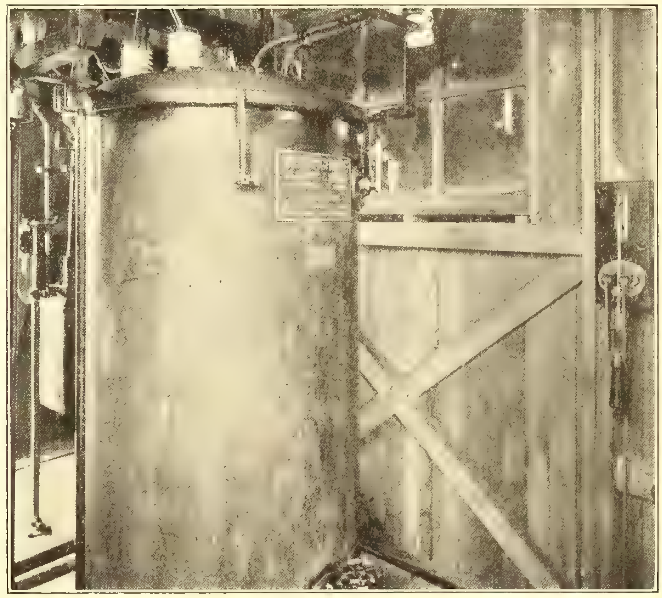


FIG. 2.—OPERATING HANDLE OF OIL SWITCH, SHOWN TO RIGHT OF TRANSFORMER

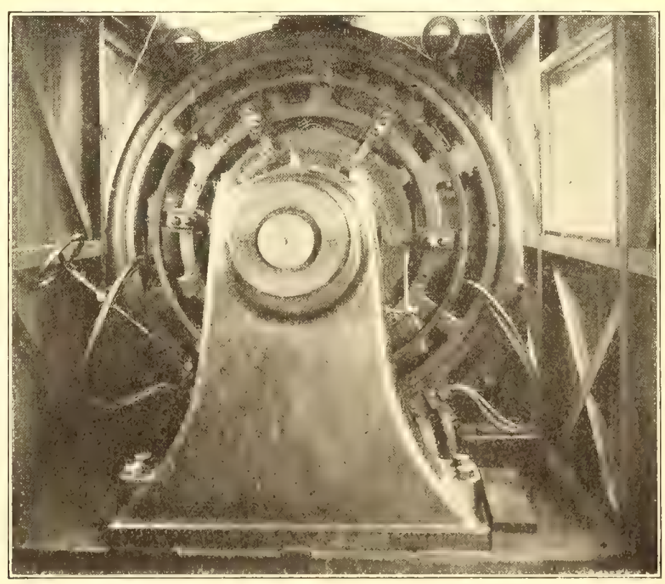


FIG. 3.—MOTOR-GENERATOR SET IN PORTABLE SUB-STATION

NEW EQUIPMENT FOR EASTON TRANSIT COMPANY

The Easton Transit Company has added eight ten-bench open cars built by the J. G. Brill Company, and seven 20-ft. closed cars built by the John Stephenson Company, to its rolling stock. These cars will be operated over the local tracks in Easton. A still more important addition to the equipment of the company is a lot of six 30-ft. 8-in. Brill grooveless post, semi-convertible cars, which will do service on the new Easton & South Bethlehem road, which is one of the six operated by the Easton Transit Company. This

EXTERIOR OF EASTON TRANSIT CAR

is a through line between Easton and South Bethlehem, 12½ miles in length, 7 miles of which are built over private right of way 15 ft. to 50 ft. in width. It is proposed to operate the section over this private right of way on a fast schedule, and the cars will make 7 miles in eleven minutes. The line will go through the villages of Wagnersville, Middletown and Shirmersville and the boroughs of Freemansburg and Northampton Heights. The fact that the lines also skirt for a distance of about 2 miles the plant of the

INTERIOR OF EASTON TRANSIT CAR

Bethlehem Steel Works, now under construction and partly in operation, will have a most important bearing on the traffic returns. The track is laid with 70-lb. T-rail on 6-in. x 6-in. x 8-ft. ties, stone ballasted. The overhead work is of bracket and span construction.

The new semi-convertible cars measure 30 ft. 8 ins. over the end panels and 40 ft. 1 in. over the vestibules. The width over sills, including sheathing, is 8 ft. ½ in.; over posts at the belt, 8 ft. 4 ins.; side sills, 4 in. x 7¾ in.; end sills, 5¼ ins. x 6⅞ ins.; sill plates, 12 ins. x ⅜ in. The bodies are mounted on the 27-E1 truck with 6-ft. wheel-base. Four motors of 40-hp capacity are installed on each car. The interior of the cars are of cherry and the ceilings of birch. High roll-back seats are provided. Other specialties that go to make up the equipment are "Dedenda" gongs, "Retriever" singal bells, etc.

THE SECOND DELAWARE & HUDSON GASOLINE MOTOR CAR

The General Electric Company has just made available some data on the second gasoline-electric car which it has built for the Delaware & Hudson Railroad. The car body is 50 ft. long and constructed of steel, but a small amount of wood is used as interior trim. The roof is of the Mann type, equipped with globe suction ventilators. The ends of the car are rounded to decrease the wind resistance. The car body is divided into an engine compartment, a small baggage compartment, smoking, main, toilet, and operating cab at the rear end. The seating capacity is forty, and if baggage compartment were included, approximately forty-eight. The trucks were constructed by the American Locomotive Company, and are of the standard swing bolster type, special attention being paid to obtain the minimum amount of weight. Thirty-six-inch wheels are used, with a 6-ft. 4-in. wheel-base. The passengers enter at the end of the car through a vestibule entrance on either side.

The main generating set is installed in the motor compartment and consists of a gasoline motor of 150 hp to 175 hp, of eight cylinders of the V construction. The gasoline motor is directly connected to an eight-pole commutating pole, 90-kw generator mounted upon the same shaft, and an exciter of 3½-kw capacity for exciting the fields of the main generator and affecting the variable potential control. From the generator leads are conducted to two motors situated one upon each truck at either end of the car. These motors are of 65-hp capacity, and are always connected in parallel. The required torque or speed at any moment is obtained by varying the field current of the generator through a controller, embodying essentially the required resistance arranged in fifteen steps.

To return to the gasoline motor. This motor is of the four-cycle type, equipped with two separate systems of ignition, high tension by plug, and induction coil connected to a four-volt storage battery. The make and break is connected to a direct driven Simms-Bosch low-tension magneto. The carburettor is of the single-nozzle, hand compensated type, gasoline being supplied to it by means of a diaphragm pump. The cooling is effected by fin type radiators situated upon the roof directly over the engine compartment. The circulation is by thermo-siphon. The gasoline motor is controlled by one lever superimposed over the controller handle. The normal speed is 550 r. p. m. For acceleration a higher rate of speed is attained, and for slowing down and stopping at stations the engine speed is dropped.

The car is lighted electrically from a small floating storage battery across the exciter. One light is provided for each seat. The car is heated by by-passing as much as required of the exhaust gases through pipes suitably installed, approximately in the same position as steam pipes are installed in a standard railway coach.

The rate of acceleration of a mile per hour per second will be obtained to approximately 25 to 28 miles per hour. From this point on acceleration will fall off gradually until full speed is attained at approximately 50 to 55 miles per hour. The total weight of the equipment is 30 tons.

FINANCIAL INTELLIGENCE

WALL STREET, June 26, 1907.

The Money Market

Apart from a slight advance in the rates for short-time accommodations the local money market failed to reflect to any appreciable extent the continued drain upon the resources of the New York City banks. Gold to the amount of $7,400,000 was exported to Europe, during the week, of which $2,750,000 went to London and $4,650,000 went to Paris, bringing the total shipments on the present movement up to $24,800,000. In some quarters it is believed that further shipments of the metal will be made later in the week, but there are strong indications that the outward movement is nearing an end. For the first time since the beginning of the export movement the rates for foreign exchange show a declining tendency, and at the close the exchange situation both here and at Paris was decidedly better. It now looks as though the demand for the precious metal at Paris has been about satisfied. The last statement of the Bank of France made a very strong exhibit while the gold holdings of the Bank of England were considerably larger than in recent weeks, that institution absorbing practically all of the gold arrivals from South Africa during the past fortnight. The heavy withdrawals of gold, however, have reduced the reserve of the local banks to a rather low level, and it is expected that the cash holdings will be further reduced as a result of this week's gold shipments. In addition, corporations have again entered the market for money, but so far the borrowings from this source have been comparatively light. The United Railways of St. Louis has sold $1,200,000 two-year 5½ per cent notes, the proceeds of which will be used to refund $1,500,000 Citizen Railway first mortgage 6 per cent bonds, falling due on July 1. The balance of $300,000 will be made up in cash now held in the company's treasury. The Chesapeake & Ohio, it is understood, will be in the market for the sale of an issue of $25,000,000 or $30,000,000 bonds, while the St. Louis & San Francisco will also need considerable cash under its new financial plan.

The demand for money from stock exchange houses has been extremely light, borrowers generally being disposed to draw their immediate requirements from the call loan department rather than to enter into contracts for fixed periods. There was, however, an improved demand at the close of the week for the short maturities and rates for thirty to sixty days advanced about ¼ per cent to 4½ per cent. Otherwise the rates for time money remained absolutely unchanged. Four months' money was obtainable at 5 per cent, five and six months at 5½ per cent, and 6 per cent for seven and eight months. The banks, however, were not disposed to offer with any degree of freedom and the bulk of the week's supply of time money came from outside sources. During the current week preparations will have to be made for the July 1 interest and dividend disbursements, which are now estimated at close to $185,000,000, but it is expected that the bulk of these disbursements will soon find their way back to the banks and may result in a somewhat easier market. Another factor that is receiving more or less consideration is this season's supply of Klondike gold. The first shipment of $1,000,000 was made early last week, and it is expected that the total receipts from this source will be fully as large as in former years. Rates of exchange on New York at the interior points indicate that the movement of money in this direction is rather free, but relief from this source will be only temporary, and within another month or six weeks it is expected that New York will, as in former years, begin to send money in volume to the West and South for crop-moving purposes.

The bank statement published on last Saturday was unexpectedly favorable. Loans decreased nearly $5,500,000, indicating that the higher rates for call money have induced trust companies and other institutions to enter the market. Deposits were $7,290,300 smaller than in the preceding week. The decrease in cash of $710,600 was considerably less than expected in view of the heavy shipments of gold to Europe. The reserve required was $1,822,375 less than in the preceding week, thus increasing the surplus reserve by $1,111,975. The surplus now stands at $5,626,600, compared with $10,912,925 in the corresponding week of last year, $15,094,675 in 1905, $38,452,675 in 1904, $12,923,850 in 1903, and $12,978,350 in 1902, $6,611,250 in 1901, and $15,526,850 in 1900.

The Stock Market

There was a decided improvement in the securities market during the week. Trading at times was intensely dull, and although operations were confined almost entirely to the professional element the feeling in financial circles was more optimistic than for many weeks past. During the first half of the week trading sank to extremely small proportions, but the price movement showed no decided tendency in either direction, fluctuations generally being confined to the small fractions. The market disregarded the unfavorable developments. The continued outflow of gold to Europe resulting in slightly higher rates for money here, the failure of the Reading directors to increase the dividend rate on its stock, the internal disturbances in France, and the depression in British government securities, which under ordinary conditions would have resulted in a rather sharp decline in values failed to exert the slightest influence. Operators for the fall were not disposed to take advantage of these unfavorable factors to force prices to a lower level. The belief was generally entertained that the market being heavily oversold, they would probably be unable to repurchase stocks without bringing about a sharp advance in prices. During the last half of the week the market developed greater activity and strength. The failure of the money market to reflect in appreciably higher rates the heavy outflow of gold, the belief that money will work easier after the mid-year settlements are completed, and that a considerable portion of the moneys disbursed on July 1 for interest and dividends will be reinvested in securities were doubtless responsible for the pronounced strength prevailing in the market at the close of the week. Other important factors included the weakness in the foreign exchanges both here and abroad. For the first time since the beginning of the gold export movement the foreign exchange market reflected the outflow of the precious metal by an abrupt fall in the rates for sterling here and a corresponding advance in sterling at Paris, indicating that the demand for gold at that center has been practically satisfied. The crop news coming to hand was very encouraging. Warm weather has prevailed in all of the grain States during the past week, and conditions of both wheat and corn have been materially improved. Railroad earnings continue to show substantial gains over those for the corresponding periods of former years, and according to the traffic managers of the large transportation companies there is every reason to expect a continued heavy movement of freight for some time to come. The upward movement was undoubtedly helped by the improvement in the foreign situation. The declaration of the regular quarterly dividend on Anaconda, and the improvement in the London copper metal market were reflected in sharp advances in the copper shares. Other stocks to respond to the better condition were Reading, Union Pacific, Southern Pacific, the Hill shares and the United States Steel stocks, the buying of all these shares being characterized as better than has been witnessed for some time past.

The local traction stocks followed the course of the general market, Brooklyn Rapid Transit and the Interborough-Metropolitan issues scoring sharp advances in prices over those prevailing at the close of a week ago.

Philadelphia

There was a decided improvement in the market for local traction issues during the past week. Dealings were confined to a comparatively small number of stocks, but the individual totals were considerably larger and prices in most instances ruled fractionally higher. Philadelphia Rapid Transit was the leading feature in point of activity, more than 15,000 shares changing

hands. At the beginning of the week the stock advanced to 24⅜, but later there was more or less selling to realize profits on the announcement that the Select and Common Councils had approved the rapid transit ordinance, giving the company a franchise in perpetuity to operate surface lines. This selling carried the price off about a point, but subsequently there was a recovery to 23¾. Philadelphia Traction and Union Traction were strong in sympathy, the first named rising to 93½, while the latter advanced to 58¼. Other sales included American Railways at 48½ and 48⅝, United Companies of New Jersey at 241⅛, Philadelphia Company common at 39¾ and 40 and the preferred at 44.

Chicago

There were no important developments in the local traction situation during the week. The Western representatives who were in New York conferring with Eastern interests have returned to Chicago, and it is understood that a further modified plan will be presented to the minority holders of the Chicago West Division and the North Chicago City Railway Companies. If this plan is accepted, and it is believed it will be, it will be possible to go ahead with the reorganizing of the Chicago Union Traction Company.

Trading in the local tractions was fairly active, but prices displayed some irregularity. City Railway opened at 160 and dropped 5 points to 155, and North Chicago, after selling at 40, advanced to 42. West Chicago sold at 33½. Union Traction common ran off from 3¾ to 3⅛, and the preferred sold at 17½. Early in the week Metropolitan Elevator preferred sold at 62½, ex. the dividend, but later it rose to 63¾ and then reacted ½. Metropolitan common sold at 23½ and 24. South Side Elevated sold at 80½ and 80⅛, ex. the dividend of 1 per cent.

Other Traction Securities

Very little activity developed in the Boston market, and apart from Boston & Worcester common, which advanced nearly a point to 24, on the purchase of about 500 shares, prices showed very little change. Boston & Worcester preferred sold at 71½. Massachusetts Electric common brought 16, and the preferred 56. Boston Elevated was steady at 134. West End common fluctuated between 85 and 84, and the preferred changed hands at 101. Trading in the Baltimore market was extremely dull. United Railway issues were practically at a standstill, but prices were not materially changed. The stock sold at 11. The 4 per cent bonds sold at 85, and the incomes at 50⅛ and 50¼. The funding 5s declined a small fraction to 78¾. Knoxville Traction 5s brought 104½, City & Suburban 5s sold at 106⅞, and Baltimore City Passenger 5s at 101½.

Comparatively few sales of any kind were made on the Cleveland exchange. Eighty shares of Aurora, Elgin & Chicago preferred changed hands at 75, and later a six-share lot went at the same figure. Two ten-share lots of Northern Ohio Traction & Light sold at 24½, which is ⅜ lower than former sales, and Tuesday two blocks of twenty and thirty shares, respectively, went at 25¼. Cleveland & Southwestern preferred was offered aa a small reduction this week. No transactions were noted in Cleveland Electric, the last sale being at 48.

Security Quotations

The following table shows the present bid quotations for the leading traction stocks, and the active bonds, as compared with last week:

	June 19	June 26
American Railways	48	48
Boston Elevated	a134	133
Brooklyn Rapid Transit	52¾	55¼
Chicago City	155	150
Chicago Union Traction (common)	3	3½
Chicago Union Traction (preferred)	14	16½
Cleveland Electric	47	45½
Consolidated Traction of New Jersey	71	72
Detroit United	63¼	—
Interborough-Metropolitan	16	16¾
Interborough-Metropolitan (preferred)	44½	47
International Traction (common)	—	45
International Traction (preferred), 4s	—	69
Manhattan Railway	129¼	130
Massachusetts Elec. Cos. (common)	15	16¼
Massachusetts Elec. Cos. (preferred)	56	57
Metropolitan Elevated, Chicago (common)	22	23
Metropolitan Elevated, Chicago (preferred)	63	63½
Metropolitan Street	81	—
North American	66	67⅞
North Jersey Street Railway	40	40
Philadelphia Company (common)	39½	41
Philadelphia Rapid Transit	24⅛	23⅞
Philadelphia Traction	92	93
Public Service Corporation certificates	64	—
Public Service Corporation 5 per cent notes	92	—
South Side Elevated (Chicago)	83	*80
Third Avenue	105	105
Twin City, Minneapolis (common)	92	92
Union Traction (Philadelphia)	58	58

* Ex-dividend. a Asked.

Metals

The "Iron Age" says that again evidence is cropping up that smelters have not covered their requirements of pig iron as fully as was claimed, and they appear in the market for early deliveries. So far as the finished iron and steel trade are involved, the outlook for a peaceful continuance of work is good. The sheet and tin plate scales for the coming year are settled, and the puddling and bar mill scales are under negotiations.

Copper metal remains unchanged, the large selling agencies still quoting 25½c. for Lake, and 24¼c. for electrolytic.

C. S. MELLEN AND THE NEW HAVEN RAILROAD SYSTEM

Under the title of C. S. Mellen and his railroad system the "Wall Street Journal," of Thursday, June 20, devoted almost an entire page to a review of recent operations in the New England railroad field, including the acquisition of the electric railway lines by the New York, New Haven & Hartford Railroad. A very valuable feature of the article was a map of the transportation lines Mr. Mellen has brought under the control of the New Haven company. Of the trolley purchases made by the company the "Journal" had this to say:

Mr. Mellen next went to examine his outposts. He found he had none! Word came that the New Haven road had purchased a trolley line. People said, "What does Mellen want of that?" Before they could get any answer the news came that he had bought three more. Hardly a week went by in which the New Haven road did not buy a few miles of trolley line, first in Connecticut, then in New York, then in Rhode Island, and then in Massachusetts. Not only would it buy, but it would build and connect up lines previously purchased. To-day the New Haven road has upward of 1400 miles of trolley lines in New England.

"This man will ruin the New Haven road," said the pessimists. "What does Mellen want with hundreds of miles of trolley lines?" The reason for the enormous trolley acquisitions of the New Haven road can best be explained by the following hitherto unpublished extract of a letter by C. S. Mellen to a friend:

"The thought of our company when it first acquired an interest in Massachusetts trolleys was not the suppression of competition, for we do not believe there is any serious competition between the two systems of traction, electric or steam. Rather, it is our thought that all systems will ultimately develop into the electric, and the street railways, so called, become adjuncts to or supplementary to the present trunk lines, which are now operated by steam, but which we believe are later going to be transformed into electric lines.

"When the question of rapid transit between congested communities is ultimately solved, and as the public will in its exasperation demand that it shall be solved, the solution to my mind is going to be the use of what are now the trunk or steam lines between the cities, and circuits for collection and distribution by street railway tracks within the cities. In that way more than any other is the rapid transit the public desires to be provided, although I confess the public seems slow to appreciate it."

AN IMPORTANT RIGHT-OF-WAY DECISION IN INDIANA

The Indiana Supreme Court has rendered an important decision relative to the right of an interurban railway company to condemn a right of way across farms for a transmission line from its power house to another or leased interurban line. The question was raised by the condemnation of a way from the power house in Rushville of the Indianapolis & Cincinnati Traction Company across the country and farms to the road from Greensburg to Indianapolis, which the company operates under lease. L. H. Mull objected to having the high-voltage wires cross his field and appealed to the Circuit Court, where a decision was recorded against him. He then appealed to the Supreme Court, where it was held:

(1) The power conferred on interurban railroads by acts of 1903, page 92, to condemn lands for uses appurtenant to all roads "acquired" by them includes power to condemn a right of way for a transmission line of poles and wires appurtenant to a leased line.

(2) Said acts of 1903 is constitutional.

(3) Said right of condemnation is not affected by the fact that the transmission line extends across country from a power house on the road leading east through Rushville to the road leading southeast to Greensburg.

(4) The rule that a lawful business or structure is never a nuisance per se applies to a high-voltage electric line built across a farm by authority of law.

ACCOUNTING BLANKS WANTED BY ACCOUNTANTS' ASSOCIATION

The demand on the American Street and Interurban Railway Accountants' Association for blanks from companies that operate both railway and electric lighting properties is so frequent that the secretary, E. M. White, of Birmingham, Ala., has asked all companies that operate these various properties to send him with as little delay as possible a duplicate collection of all blanks used by them. The present collection of the association is not up to date and is not arranged so as to give the best results to the members. These collections Mr. White will arrange by companies in suitable binding, one set to be used at the convention and the other to loan to members. This appeal is made especially to the small company, whether it has worked out a satisfactory set of blanks for itself or not. As the subject of electric light classification will receive considerable attention this year, it has seemed a very suitable time to take up this matter of forms as used by the public service corporations, and Mr. White therefore asks all companies that are interested to give this request for blanks early and careful attention.

The data sheet asking for information in reference to the operation of street railway, electric lighting and other public utilities by the same organization contains the following questions:

Does your company operate both street railway and electric light?

Does your company indirectly, through lease or stock ownership, control and operate both street railway and electric light?

Does your company through a common ownership and operation, control and operate both street railway and electric light?

Does your company operate, either directly or indirectly, any other public utilities than street railway and electric light?

If so, what?

At the convention of the National Electric Light Association the question of a standard classification of accounts for electric lighting companies was discussed, and the matter re-referred to the committee for further consideration.

President Tingley, of the American Street and Interurban Accountants' Association, is of the opinion that it would be unfortunate for the lighting companies to adopt a standard classification which would differ in its fundamental principles from that adopted by the American Association; particularly, as many companies, members of the American Association, are also members of the National Electric Light Association, and a classification divergent in principle would be apt to create confusion, particularly among the smaller companies where the same officers would be obliged to deal with both classifications. In order that he may have the data necessary intelligently to consider this matter, and bring it to the attention of the association at the next convention, Mr. Tingley asks that the data sheet be promptly filled out and returned to him at Philadelphia.

AFFAIRS IN CHICAGO

N. W. Harris & Company, of New York, together with the Harris Trust & Savings Bank and the First National Bank, of Chicago, have purchased $6,000,000 first mortgage 5 per cent twenty-year bonds of the Chicago City Railway Company. The bonds will be offered to investors at a price slightly under par.

The purchase of the $6,000,000 bonds above referred to will enable the company to undertake the first extensive work to be started under the direction of the new Chicago Board of Supervising Engineers provided for in the traction ordinance approved by the voters of Chicago at the recent municipal election.

Differences between the Union Traction Company and the North Chicago and West Chicago Street Railroad Companies on the one side, and the Chicago West Division Railway and the North Chicago City Railway Companies on the other, over the terms on which stocks shall be deposited for acceptance of the traction settlement ordinance to the Chicago Railways Company, apparently disappeared on Saturday. The protective committees of stockholders in the underlying companies issued a circular letter strongly advising and asking the right to deposit stocks of these companies in escrow. The escrow proposition is set forth as follows in the letter:

> We now expect to conclude an arrangement whereby the underlying stocks will be deposited in escrow with the Chicago Title & Trust Company, the deposit to become absolute, provided a certificate signed by Judge Grosscup and Mr. Gray shall be thereafter filed with that company, in the following form:
>
> "We hereby certify that a plan of reorganization formulated by the authority of the Chicago Railways Company has been filed with us and that in our judgment said plan makes full provision, all things considered, for the execution of whatever finding may be hereafter made by the arbitrators in the matter of the issuance and distribution of the securities of the Chicago Railways Company."
>
> In case the certificate is filed, whereby the deposit of the underlying stocks becomes absolute, then Judge Grosscup and Mr. Gray, the arbitrators named in the deposit agreement, are to set a time for the full hearing of all the parties in interest—the plan to be given to all the parties in time to enable them to get ready for such hearing.

Accompanying the letter is a form of authorization, directed to the Merchants' Loan & Trust Company, for the deposit in escrow and for absolute deposit in case of fulfilment of the condition. The letter is signed by Cyrus H. McCormick, Thos. Templeton, Charles W. Ware and John F. Bass for the West Side Company, and by Leon Mandel, Charles A. Mair, James F. Porter, John A. Chapman and John F. Bass for the North Side Company.

This plan of deposit in escrow is said to have been proposed by Judge Grosscup, and to be acceptable to Union Traction and its allied interests. The committees expect to have prompt response from stockholders so that within the next four or five days it will be possible to make the escrow deposit.

It is expected also by both sides that the required certificate by Judge Grosscup and Prof. Gray will be given soon after the deposit in escrow. In that event the unconditional deposit can be made many days before the date of expiration of the time limit for acceptance of the ordinance July 26.

In the current number of the "Journal of Finance," Dickinson MacAllister, former president of the West Side Metropolitan Elevated Railway Company, is quoted as saying that, although he has no business interests as an officer or stockholder in any Chicago traction line, he intends to live in Chicago for the sole purpose of watching the improvements in the city's local transportation lines.

More than 100,000 shares of preferred and 200,000 shares of common stock in the Chicago Union Traction Company were brought to Chicago from New York by Receiver Marshall E. Sampsell, and General Counsel W. W. Gurley, of that company, and deposited with the Chicago Title & Trust Company, early this week, to insure acceptance of the traction settlement ordinance as soon as the deposit of the stocks of Chicago West Division Street Railway and North Chicago City Railway Companies is assured. The conferences in New York in the last week are said to have been over differences between the Union Traction Company and the North Chicago Street Railroad and West Chicago Street Railroad companies, as well as the deposit of underlying stocks. These differences, it is said, will be settled without imperiling the ordinance. The deposit of stocks, it is taken for granted by traction men generally, will be made by all the companies named in the ordinance to the Chicago Railways Company.

STONE & WEBSTER PLANS IN WASHINGTON

The Puget Sound International Railway & Power Company, having for its purpose the carrying out of plans for the interurban electric railway between Seattle and Bellingham, Wash., proposed by Stone & Webster, has been organized and incorporated. The foregoing announcement was made by C. D. Wyman, of Stone & Webster, who is vice-president of the Seattle Electric Company, vice-president of the Puget Sound Electric Railway Company and president of the Whatcom County Railway & Light Company. Mr. Wyman is quoted as follows:

"Our interests are negotiating an affiliation with the Everett street railway properties, which will give us control of them. The new company will immediately begin carrying out its plans for the building of interurban roads from Bellingham to Seattle. It has always been our plan to afford the Puget Sound cities an interurban service eventually from the international boundary to Olympia and Chehalis, and perhaps finally to Portland and the Grays Harbor country.

"Our first step was the Puget Sound Electric Railway, between Seattle and Tacoma. That has developed the valley through which it runs. Another region to the north, with Bellingham as the center, we shall develop with similar lines as rapidly as conditions permit, as the money is raised, the franchises and rights of way acquired and other plans perfected.

"The interurban project necessarily involved Everett's necessities and led to the negotiations which will give us the control of that system. The statement that we have bought the road there is not true, but the arrangement under way will give us the control. We shall build such extensions and connections as the conditions in that city seem to justify, giving it the advantage of a more elaborate interurban system. We shall put surveyors in the field with the idea of locating accurate and positive routes for lines through to Seattle. Our engineers have already made surveys 30 or 40 miles south of Bellingham, and these will be continued in this direction.

"The Nooksack power plant will be used to operate the northern portion of the system, and will probably soon be increased in capacity. It is our policy to develop the interurban system from each center, until we shall have completed a through line from the boundary south. Thus we commenced from Seattle. We have already extended from Tacoma south to American Lake, and will continue to Olympia. Our next step is the system from Bellingham, and we shall make plans for reaching out from Everett.

"We also expect to push the extension of our Puget Sound Electric Railway Company's system from Brookville to Puyallup, thence to Sumner, and finally to Orting and up that valley."

THE CLEVELAND SITUATION

The Cleveland Electric Railway Company has refused to negotiate with the Low Fare Railway Company regarding the compensation for the use of its tracks in so-called free territory. The reasons assigned for the action is that the basic ordinance granted the Low Fare Railway Company is invalid, and that the City Council has no power to fix such compensation. This makes it necessary for the City Council to fix the compensation. The Low Fare Railway Company proposed to pay a gross sum for the use of the tracks and a fixed sum for repairs, taxes and maintenance. The Cleveland Electric claims that the amount paid should be in proportion to the use of the tracks. While the small company would have but few cars to operate over them now, later on the business might increase and the use become greater and more burdensome to the owners. For this reason, the Cleveland Electric says that, even if it is wrong in supposing that the franchise is invalid, the manner of compensation is not satisfactory. So far no compensation has been fixed for the use of the streets on which the franchises of the old company have expired. Secretary H. J. Davies, of the Cleveland Electric, and A. B. DuPont, of the Low Fare Railway Company, were to fix the amount. They held a meeting or two and failed to agree. Since that time little has been done. The City Council appointed a time for them to report, and in case they did not do so, said that a third man would be named to go over the work with them. They did not report and the third man has not been appointed. Both Mr. Davies and Mr. DuPont have been busy with other things and have not had the time to take the matter up.

At the Council meeting Monday evening, H. P. Bradbury, who has been in charge of the work of securing consents on Quincy Street and Central Avenue for City Clerk Peter Witt, reported that he had consents for 7,524.81 ft. on Quincy Street and 7,978.59 ft. on Central Avenue, which he filed. In order to have a majority of consents on Quincy Street a little less than 10 000 ft. must be secured on Quincy, and a trifle less than 13,000 ft. on Central Avenue. Mr. Bradbury claimed to have a lot of other consents which he was not ready to file, as he had not been able to verify the ownership of the property. It is claimed that these include those that have been revoked and all others about which there is doubt. On Tuesday, Cleveland Electric representatives were refused access to these consents by City Clerk Witt.

At a special meeting of the City Council, Tuesday afternoon, to discuss the failure of the Cleveland Electric Railway Company and the Low Fare Railway Company to agree upon terms by which the cars of the latter may be operated over the tracks of the former in so-called free territory, a note from the Cleveland Electric was read, which stated that its stand in the matter was contained in a communication to the Low Fare Railway Company. Although invited to be present the officials of the Cleveland Electric did not attend the meeting.

It has been announced that the Circuit Court, made up of judges chosen from outside districts, will render its decision in the Isom injunction suit on July 15. The case has been reviewed by the court and arguments presented covering the points that were taken up in Common Pleas Court.

PLANS FOR THE PROPOSED MEMPHIS INTERURBAN

The Clarksdale, Covington & Collierville Interurban Company recently incorporated by R. F. Tate, W. A. Gage, G. W. Agee, James S. Robinson, Dudley S. Weaver, H. E. Craft, W. E. Craft, W. E. Willett, A. Walsh, W. A. Percy, Ed. Manigan, M. J. Roach, Walter Goodman, I. D. Block, Louis Sambucetti, R. B. Nebhut, H. D. Minor, C. F. Farnsworth and W. C. Knight, proposes to build a system of interurban electric railways to extend out of Memphis.

The charter authorizes the construction of a street railway in the city of Memphis, and lays out a number of north and south routes, and a number of east and west routes and two crosstown routes. Among the routes asked are north and south on Front and Third Streets, east on Washington Street and Pontotoc Avenue, and across town on McLean Avenue. The south routes work out to Riverside Park and South Memphis, crossing Nonconnah east of the Illinois Central. The north routes proposed are out the Randolph Road to Wolf River, and also out Looney Street and Vollentine Avenue to the property of the Union Land & Improvement Company to Wolf River, where it is crossed by the New Raleigh road. The east routes go out Harbert Avenue, and other lines on the north side of the Southern Railway, and another line out Walker, Trigg and Carnes Avenues on the south side of the Southern Railway. The capital of the company is fixed at $50,000, with the privilege of increasing same.

R. F. Tate, the president of the Lake View Traction Company, an affiliated company, has this to say in regard to the companies:

"The capital of the Lake View Traction Company has been increased to $1,000,000 of preferred and $1,500,000 of common stock, and the company has been steadily at work acquiring rights of way, real estate, franchises and doing engineering and location work. We hope to begin the work of construction to Lake View by September. Our charter is taken out under the laws of Maine, whose corporation laws are very favorable, but we have been advised that it is desirable to incorporate also locally, because of the facility in condemning rights of way where they cannot otherwise be obtained. A street railway of another State cannot condemn in Tennessee, though it may in Mississippi. But under the legislation passed at the last session in favor of the interurbans, the power to condemn for rights of way, power houses and parks is given to any street railway company in Tennessee. This is the prime reason why the stockholders of the Lake View Traction Company have applied for a charter for the Clarksdale, Covington & Collierville Interurban Company.

"In order that these lines may enter the city of Memphis over their own rails we will ask the grant of a franchise from the city of Memphis which will admit of our getting routes out south, east and north."

STANDARD CLASSIFICATION OF THE ACCOUNTANTS' ASSOCIATION

It will be remembered that at the last convention of the American Street and Interurban Railway Accountants' Association the secretary of the association was authorized to reprint the standard classification of accounts from the report of the association, and to sell the book to non-members for $1 per copy. Acting under these instructions the secretary, Elmer M. White, of Birmingham, Ala., has issued the pamphlet, which in addition to the classification and form of report includes the reports of the committee on classification for the last three years. These reports contain answers to questions asked by the members, and in this way amplify the instructions on classification.

COMMITTEE ON ACCOUNTS OF ACCOUNTANTS' ASSOCIATION MEETS IN CLEVELAND

The committee on standard classification of accounts of the American Street and Interurban Railway Accountants' Association held a meeting in parlor O of the Hollenden Hotel, Tuesday, with Chairman W. F. Ham, of Boston, presiding. The committee had under consideration a report of a sub-committee on interurban railway accounts, of which W. H. Forse, of the Indiana Union Traction Company, is chairman. This involves a possible change in the classification of accounts as now used by the companies, and the members spent the day in discussing the matter. As nothing final was expected at this meeting, however, Chairman Ham said that no detail of the work done could be made public and that possibly nothing would be given out until the annual meeting of the association. Those attending the meeting are as follows: W. F. Ham, chairman, of Boston; C. N. Duffy, of Milwaukee; F. R. Henry, of St. Louis; W. G. McDole, of Cleveland; C. L. S. Tingley, president of the association, of Philadelphia; W. H. Forse, of Indianapolis; A. B. Bierck, of Long Island; A. C. Henry, of Lake Shore Electric, of Cleveland, and Henry J. Davies, secretary of the Cleveland Electric, of Cleveland.

CLEVELAND, ALLIANCE & MAHONING VALLEY PERFECTING PLANS FOR BUILDING

The Cleveland, Alliance & Mahoning Valley Railway Company will within a short time finally close up the lease for the old track of the Baltimore & Ohio Railroad between Ravenna and Newton Falls. The bonds of this company have been sold and everything is now in readiness to take care of the arrangements that have been made for building. Nothing has yet been done toward electrifying the old steam road, although the track and roadbed have been straightened up in some places. As soon as the papers are signed the work will begin in earnest. In the first place, the steam road will be put into first-class condition and electrically equipped. It will be straightened at Newton Falls, so that the line will touch the edge of the town and connect with the private right of way from that point to Warren. This short section will be new road altogether. After this section is put into operation the branch from Ravenna to Alliance will probably be built. These lines are both direct and pass through thickly populated territory. At Alliance the line will connect with the Stark Electric for Canton and at Ravenna connection will be made with the Northern Ohio Traction & Light Company for Akron and by that route for Cleveland until its own line is built.

INDIANA RAILROAD COMMISSION SEEKS INFORMATION

Interlocking devices, block signals and highway and street crossings—under the authority granted to the Indiana Railroad Commission by the amended law of 1907—are the points covered in blanks the Commission has prepared and is sending out. It is supposed that the information gathered on these blanks will be used as data in any proceedings with reference to the placing of the different safety devices. Most important, perhaps, is the information concerning Indiana highway crossings. The blank asks for the number of grade street crossings on each line; number of grade highway crossings; number of overhead street and highway crossings, number of undergrade street and high crossings, and the number of all the crossings named above protected by watchmen, gates, bell or otherwise, or not protected at all. The interlocking blank asks for the number of such devices in which each road is concerned; the year constructed or rebuilt; whether it is mechanical or electrical; name of the company operating it; average daily train movement; the number of laborers employed, and the total number of their hours of labor, also the number of levers operated. The block signal blank is divided into three sections: one concerns the lines now equipped; the second the lines to be equipped, and the third lines not to be equipped. With reference to the first two, information asked for concerns the date of the construction of the system, actual or contemplated; the number of miles of automatic block; number of miles of manual telegraph block; miles of controlled manual block, and the total number of miles of all kinds in the State, actual or contemplated. In addition there is space for the railroad to outline the expenses of construction, maintenance and operation; the questions asking for the average cost a mile for the construction of each kind; average cost a mile for the maintenance of each kind, and the average cost a mile for the operation of each kind.

THE PLAN FOR ISSUING THE BOSTON ELEVATED BONDS

The $5,800,000 4 per cent Boston Elevated bonds approved by the Railroad Commissioners on June 15, will probably be sold by the road in instalments of varying amounts from time to time as the progress of the construction work or the condition of the company's treasury requires. The Boston Elevated Company is in no pressing need of funds and is in shape to take care of all its capital requirements out of its present cash balances for a long time to come. The management for several years has closely adhered to the policy of keeping the company financed ahead of actual requirements and provided with a working capital sufficient to meet all reasonable demands upon it. The $5,800,000 bonds will be used mainly for three purposes: Payment of new rolling stock, estimated at about $2,000,000; cost of power house enlargements, say, $1,500,000; Forest Hills extension and purchase of real estate, about $4,000,000. This makes a total of $7,500,000. The difference between this figure and the $5,800,000 bonds will be borne by the West End Street Railway, which will pay by issues of its own securities for the major part of the new rolling stock and a large part of the power house additions. The road has already sold a block of these bonds to R. L. Day & Company and Estabrook & Company. These bonds are a direct obligation of the Boston Elevated Company, mature May 1, 1935, and are being offered at 97 and interest, at which price they show an income return of about 4.18 per cent.

MERCHANTS' PLAN ACCEPTED BY THE PHILADELPHIA COUNCIL.

The Councils of Philadelphia have passed the Retail Merchants' Plan, which is designed to put the entire street railway system, as far as possible, on a firm foundation, with definite limitations and under a measure of municipal control. The basis or starting point of the "Merchants' Plan" was in the provision for a sinking fund to be set aside by the company out of its gross earnings, for the purpose of retiring its entire capital, so that at the end of the term its property and holdings should pass unencumbered to the city. This has been amended as follows:

"The city reserves the right at any time after the said sum may have reached the sum of $5,000,000 to require by ordinance of Councils that the same shall be paid over to the City Treasury and become the absolute property of the city, at the same time requiring that further payment toward said fund as provided for hereunder shall be made directly into the City Treasury."

STREET RAILWAY PATENTS

[This department is conducted by Rosenbaum & Stockbridge, patent attorneys, 140 Nassau Street, New York.]

UNITED STATES PATENTS ISSUED JUNE 11, 1907.

856,253. Safety Guard or Fender for Tramway Cars and the Like; Gustav Hauff, Kimberly, Cape Colony. App. filed Oct. 15, 1906. The front of the fender is adapted to fold up when an obstruction is encountered, thereby tending to pick up the obstruction.

856,266. Brake Construction; Van Buren Lamb, New Haven, Conn. App. filed Oct. 28, 1905. A brake-shoe having upon its rear surface a projecting part of decreasing thickness toward its ends and provided with undercut lateral surfaces converging toward the ends of the shoe. A supporting member is adapted to fit said projecting part and be connected thereby to the shoe, and dissimilar connecting means adapted to secure the member to the head.

856,273. Railway Switching System; William Macomber, Buffalo, N. Y. App. filed Feb. 20, 1905. Provides for moving and locking a rail switch and producing an indication of the movement thereof and the fact of its locked condition.

856,290. Signaling Mechanism; Walter A. Pearce, London, England. App. filed Nov. 28, 1906. Provides an improved form of electrically controlled coupling between the operating rod and the rod which is connected to the signal.

856,293. Trolley Pole Controller; Andrew L. Prentiss, Buffalo, N. Y. App. filed Sept. 24, 1906. A crank or arm extending downward from the pole has a link connection with a pneumatic retrieving cylinder horizontally mounted at the base of the pole. Provides tripping means for admitting air to the retrieving cylinder.

856,324. Railway Switch Operating and Signaling System; Asbury G. Wilson, Wilkinsburg, Pa. App. filed Sept. 6, 1905. Details of the operating mechanism for switches of the interlocking type.

856,285. Insulating Covering or Sheathing for Contact-Rail Conductors; William H. Baker, Lockport, N. Y. App. filed March 21, 1906. An insulating covering for third rails formed of overlapping sections which make provision for the enlargements' due to the fish-plates.

856,435. Pressed Steel Car; William G. Wagenhals, St. Louis, Mo. App. filed April 16, 1906. Details of construction.

856,437. Switch Lock; William Anderson, Memphis, Tenn. App. filed Sept. 24, 1906. Provides a switch lock with a compound lever comprising two members, one of which is always locked against movement when the other is unlocked and vice versa.

856,440. Block Signal System; Elmer F. Bliss, Schenectady, N. Y. App. filed Dec. 5, 1906. Provides, among other features, an arrangement for closing the circuits of the transformers ahead of the train whereby a plurality of the transformers may be controlled through a single conductor or pair of conductors.

856,448. Control System for Electric Vehicles; William Cooper, Wilkinsburg, Pa. App. filed Oct. 3, 1906. Means dependent upon a material difference in the speeds of the several motors for automatically interrupting the supply of energy to the motors of an electric vehicle.

856,461. Railway Brake; Cornelius Furman, Decatur, Ill. App filed March 18, 1907. Relates to the construction of the hanger bracket and the incorporation of anti-rattler springs at the ends of the links by which the shoe head is supported.

856,465. Block Signal System; Laurence A. Hawkins, Schenectady, N. Y. App. filed Dec. 3, 1906. A signal system having brake rails energized by transformers connected in a special way across the leads of a three-wire system.

856,466. Block Signal System; Laurence A. Hawkins, Schenectady, N. Y. App. filed Jan. 11, 1907. Relates to modifications of the above.

856,467. Block Signal System; Laurence A. Hawkins, Schenectady, N. Y. App. filed Jan. 10, 1907. The system is so arranged that current is supplied to a block only when it is necessary to clear a signal, or to maintain it at clear position in front of an approaching train.

856,535. Trolley Pole for Conducting Electric Current to Vehicles; Robert Lindsay and John Lindsay, Dunedin, N. Z. App. filed June 26, 1905. The trolley pole is formed of longitudinally telescoping sections, spring pressed outward, whereby the pole may be reversed without removing the trolley wheel from the wire.

856,583. Block Signal System; Laurence A. Hawkins, Schenectady, N. Y. App. filed Nov. 8, 1906. The rails of this system are conductively continuous for all currents. Transformers and signal-controling relays are connected to the rails and normally open switch contacts in circuit with the transformers and arranged to be closed by an approaching train.

856,598. Steel-Tired Wheel; Isaac E. McCracken, Wilkinsburg, Pa. App. filed Feb. 25, 1907. Comprises an inner frame and a tire, interlocking parts thereon preventing relative rotation thereof, and means not piercing the frame and tire at said interlocking parts for fastening the tire to the inner frame.

856,670. Block Signal System; Charles C. Anthony, Philadelphia, Pa. App. filed Nov. 28, 1906. Provides a system in which only one of two main signals employed in each block, one at each station, may be moved out of the danger position at one time to permit a train to pass by it into the block and then only when the block contains no trains moving toward the signal operated.

856,715. Tramway Switch; Malcolm C. Matthews, Chicago, Ill. App. filed Nov. 10, 1906. A partially rotatable switch carrying diverging track sections.

856,737. Electric Controller; Richard Van R. Sill, Newark, N. J. App. filed March 6, 1907. Details of construction of a controller for street cars, etc., including roller contacts spring pressed together and which embrace sector blades on the controller shaft.

856,765. Track Sanding Device; Arthur A. Churchill, Portland, Ore. App. filed Feb. 23, 1907. A vertical pipe arranged adjacent the sand-box and a horizontal pipe leading from the sand-box into the vertical pipe. The horizontal pipe has a V-shaped opening in its top for the admission of sand and an air delivery nozzle behind the sand admission opening.

856,782. Third Rail Cover for Electric Railways; William F. Kemper, Chicago, Ill. App. filed Jan. 21, 1907. An insulating cover for third rails and means for shifting the cover during the passage of a train.

856,882. Rail-Joint; Jefferson D. Jones, Temple, Tex. App. filed Feb. 1, 1907. Comprises a pair of rails, a supporting member located under the abutting ends of the rails, and main and auxiliary retaining means on the supporting member arranged to engage over the bases of the rails.

856,899. Valve; Alfred D. McWhorter, Atlanta, Ga. App. filed Feb. 6, 1907. A valve casing provided with inlet, atmosphere, brake cylinder and auxiliary reservoir ports and valve mechanism therefor, operating to bring said ports into communication in the following sequence: auxiliary reservoir and brake cylinder, inlet and brake cylinder; and on release brake cylinder and auxiliary reservoir and brake cylinder and atmosphere.

856,983. Track Sander; George Nugent, Toronto, Can. App. filed May 20, 1907. Relates to the construction of the discharge pipes.

PERSONAL MENTION

MR. G. E. PECK, formerly with the Waterloo, Cedar Falls & Northern Interurban Railway at Waterloo, has accepted the position of auditor and cashier of the Mason City & Clear Lake Interurban Railway and the People's Gas & Electric Company, of Mason City, Ia.

MR. B. B. WINCHESTER, who has been superintendent of the New York & Long Island Traction Company, with headquarters at Hempstead, L. I., has been transferred to the central office of the company at Long Island City. He is succeeded as superintendent by Mr. J. P. Kineon.

MR. ROBERT LONG, of the National Brake & Electric Company, has just returned from South America, where he has spent a year in the interests of his company. While in Montevideo he equipped with air brakes eighty-five cars of the electric railway described in the issue of this paper for May 4, 1907.

MR. CHARLES R. McKAY, for some time connected with the General Electric Company at Cincinnati, has been appointed superintendent of the lighting department of the Toledo Railways & Light Company, to succeed Mr. E. J. Bechtel, who has become consulting engineer for Hodenpyle, Walbridge & Co.

MR. CHARLES E. WARWICK, superintendent of transportation of the Galveston Electric Company, has resigned, and Mr. F. C. Randall is acting superintendent. Mr. Warwick came

to Galveston two years ago, succeeding Mr. Lawson as superintendent. Mr. Lawson is now manager for the Oklahoma City Electric Company.

MR. J. M. McELROY, general manager of the Manchester Corporation Tramways, is planning to reach New York next week for a trip of inspection of the electric railways of this country. Mr. McElroy has been very prominent in the electric railway developments in the United Kingdom, and is president of the Municipal Tramway Association of Great Britain.

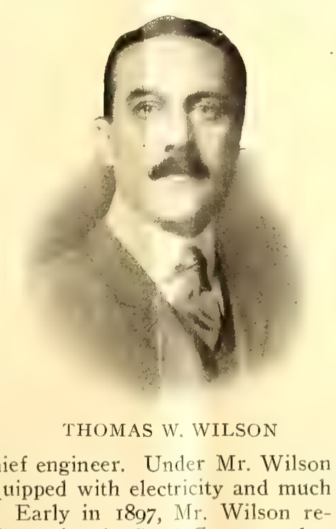
MR. C. H. MATHEWS has been appointed claim agent of the Georgia Railway & Electric Company, vice Mr. W. H. Williams, resigned. Mr. Williams has been connected with the street railway systems of Atlanta continuously for the past twenty years. Mr. Mathews has been connected with the Georgia Railway & Electric Company for the past six years as claim agent.

MR. WILLIAM FINDLAY SHUNK, for a time chief engineer of the old Metropolitan Elevated Railroad, of New York, under whose supervision work was begun on the elevated railroad, died at his home near Harrisburg, June 22. Mr. Shunk was born in Harrisburg in 1830, and was graduated from the United States Military Academy. He became an engineer for the Pennsylvania Railroad and later entered the service of the Metropolitan Elevated in New York. He was also at one time connected with the Kings County Elevated Railroad, of Brooklyn.

MR. LEWIS B. STILLWELL, of New York, was the recipient of two honorary degrees at commencement exercises this year. One was from Lehigh University and was the degree of Master of Science. It is said that this is only the third honorary degree ever given by Lehigh. The second degree was that of Doctor of Science, which was conferred on June 26 by Wesleyan University, at Middletown, at which Mr. Stillwell took part of his undergraduate course. The recognition by these two universities of ability in the engineering field will be generally appreciated by engineers.

MR. J. F. DAVIDSON, general superintendent of the United Railways Company, of St. Louis, has resigned, and Mr. Joseph Crafton, his chief clerk, has succeeded him. Mr. Davidson is one of the oldest street railway men in point of service in St. Louis. He ran car No. 1 of the old Olive Street line. Prior to the consolidation of St. Louis companies, Mr. Davidson was general superintendent of the Missouri Railroad, which included the Olive, Laclede and Market Street lines. Mr. Davidson will withdraw entirely from street railway work, and will devote his time to the improvement of property which he recently acquired in Oklahoma.

MR. THOMAS W. WILSON, who has just been elected president of the Street Railway Association of the State of New York, is general manager of the International Railway Company, of Buffalo, N. Y., to which position he was appointed in March, 1905, to succeed Mr. Thomas E. Mitten. Mr. Wilson was born in New York City in 1872, and was graduated from Lehigh University in 1894. From the first he has been connected with street railway work, and while at Lehigh served during his vacation periods in the drafting room of the Pennsylvania Steel Company. After finishing his course at Lehigh, Mr. Wilson entered the permanent employ of the Pennsylvania Steel Company as engineer of survey and special work. The following year he became assistant engineer of the Charleston Street Railway Company, of Charleston, S. C., of which he later became chief engineer. Under Mr. Wilson the lines at Charleston were equipped with electricity and much new construction carried out. Early in 1897, Mr. Wilson returned to the employ of the Pennsylvania Steel Company, but soon resigned to enlist in the Eighth Regiment of Pennsylvania Volunteers. After a few months service with the Pennsylvania Steel Company following his muster out. Mr. Wilson accepted the position of assistant engineer of the International Traction Company. In this capacity he served for four years. being then made chief engineer. It was from this position of chief engineer that he was promoted to be general manager of the company.



THOMAS W. WILSON

MR. ERNEST GONZENBACH, vice-president and general manager of the Sheboygan Light, Power & Railway Company, has also been appointed manager of the Milwaukee-Northern Railway, with which the Sheboygan company has a joint operating agreement, preparatory to a complete amalgamation of the two properties. The Milwaukee-Northern Railway is building a street railway system in the city of Milwaukee and a double-track interurban line between Milwaukee and Cedarburg, Wis., at which town it branches to Sheboygan, where it will connect with the local city system and existing interurban railway to Plymouth, Wis., which is being extended to Elkhard Lake, Wis. The other branch of the Milwaukee-Northern will go from Cedarburg to Fond du Lac, Wis., where it will connect with the Fox River Valley system, which is connected with electric railways under various ownerships all the way from Fond du Lac to Green Bay, Wis. The total mileage of the consolidated system which will come under Mr. Gonzenbach's management, in operation and actually under construction, amounts to 165 miles of single track, and includes a local system in the city of Wilwaukee and a local system in Sheboygan, Wis., and an extensive electric light and power system in Sheboygan. Mr. Gonzenbach was born at Schloss Hauptwyl, Switzerland, in 1870, and attended the "Technisches Gymnasium" at the city of St. Gallen, Switzerland. Immediately after leaving school he came to the United States and settled in the far West. After some little experience in ranching, Mr. Gonzenbach went to Chicago, where he entered electric railroading, as an assistant in one of the power houses in that city. Finally, he was admitted to what was then called the "Expert Course" of the Thomson-Houston Company, at Lynn, Mass., where he remained for three or four years erecting apparatus of every description. In 1895, Mr. Gonzenbach engaged for himself as an electrical engineer at St. Johnsbury, Vt., and during the three years that followed he constructed a number of electric light and transmission plants throughout Northern Vermont and New Hampshire. In 1898 he entered the employ of the Westinghouse Electrical & Manufacturing Company, from which company he resigned in 1900 to become electrical engineer of the Albany & Hudson Railroad. From the Albany & Hudson Company Mr. Gonzenbach went to the Aurora, Elgin & Chicago Railway as electrical engineer, after which he was engaged for two years as consulting engineer, principally in the construction of the Youngstown & Southern Railway. On Jan. 1, 1905, he was appointed general manager of the Sheboygan Light, Power & Railway Company, and last fall was made vice-president and general manager of the Sheboygan company, and appointed to the same position with the Greensboro Electric Company, of Greensboro, N. C. Mr. Gonzenbach is the author of "Engineering Preliminaries for an Interurban Electric Railway," and has contributed articles on interurban railways to the Street Railway Journal, the "Railroad Gazette" and other papers. In 1903 he was awarded the Chanute medal of the Western Society of Engineers. Mr. Gonzenbach, furthermore, has patented a number of railroad devices, including a cable terminal, third-rail insulator, air brake improvements, pneumatic train control apparatus, etc.

E. GONZENBACH

MR. GUSTAVE MULHAUSEN, general manager of the Evansville, Suburban & Newburg Traction Company, celebrated the eighteenth anniversary of his connection with the company as general manager a few days ago by a banquet to twenty of his immediate personal friends. These gentlemen, Mr. Mulhausen took over the Evansville, Suburban & Newburg property which, as recently noted in the Street Railway Journal, is now equipped with electricity. At Booneville the guests were invited to board a large express car for the return to Evansville, and were surprised to find that Mr. Mulhausen had prepared for them an elaborate dinner, which was spread on an improvised table stretching practically the entire length of the car.

NEWS OF THE WEEK

CONSTRUCTION NOTES

Items in this department are classified geographically by States, with an alphabetical arrangement of cities under each State heading.

For the convenience of readers seeking information on particular subjects, the character of the individual items is indicated as follows:

* Proposed roads not previously reported.

o Additional information regarding new roads.

† Extensions and new equipment for operating roads.

Numerals preceding these signs indicate items referring to:

1. Track and roadway.
2. Cars, trucks and rolling stock equipment.
3. Power stations and sub-stations.
4. Car houses and repair shops.
5. Parks and amusement attractions.

1†FLORENCE, ALA.—Vice-President J. W. Worthington, of the Sheffield Company, which operates the Florence, Sheffield & Tuscumbia electric line, was in Florence recently looking into a proposed extension of the line in East Florence to take in the manufacturing district. Several of the leading members of the Young Men's Commercial Club were in conference with Mr. Worthington, who spoke very favorably of the extension. The proposed route is east on the Huntsville road, thence south to the Florence wagon works.

oLITTLE ROCK, ARK.—The mass meeting of citizens which was held recently to assist in the building of the interurban line between Hot Springs and Little Rock was attended by several hundred citizens and several prominent business men of Hot Springs. Twenty thousand dollars was raised in a few minutes and committees were appointed to canvass the city to sell the stock. It is now believed that the line is an assured fact. H. L. Remmel, who presided at the meeting, explained that $500,000 in preferred stock at 6 per cent was needed to make the interurban a sure go. He explained the common stock feature of the proposition, whereby every subscriber for preferred was to receive $1 in common stock for every $1 paid for the preferred.

oNAPA, CAL.—From the rate at which work is now being rushed on the extension of the San Francisco, Vallejo & Napa Valley Electric Railroad from this city to St. Helena, 18 miles north of here, it is said that cars will be running to the up-valley town by the middle of August. Nine hundred tons of steel rails, months overdue, have just reached here from the East. The work of stringing the trolley wires was commenced recently. The grading and bridge building are practically finished. The track will be laid at the rate of a half-mile a day. J. W. Thurber, of Los Angeles, has been awarded the contract for this work.

†OAKLAND, CAL.—The City Council has passed ordinances granting franchises along Wood Street to the Western Pacific, the Santa Fe and the San Francisco, Oakland & San Jose Railway (Key Route) Companies. The line of the Key Route will parallel the Western Pacific track from the Key Route yards at Fortieth Street to Wood and Seventh Streets. From this point it is the intention of the Key Route Company to run a line to the west on land that will be filled in and used for wharves.

1†SAN DIEGO, CAL.—Announcement has been made that on or before July 1 the contract between the Columbian Realty Company and the city for the grading of University Avenue from University Boulevard to the city limits will have been completed, and that the San Diego Electric Railway Company will then commence the construction of the University extension car line.

oSAN DIEGO, CAL.—The City Council has granted the petition of E. Bartlett Webster for a street railway franchise from Fourth and B to Sixth, down Sixth to F Streets and in due time the franchise will be advertised for sale.

oSAN FRANCISCO, CAL.—It is announced that the Peninsular Railroad, now being constructed between this city and San Jose by Southern Pacific interests, will be in operation by electricity in about twelve months. The road, it is said, will make the run between San Francisco and Congress Springs in one hour and a half. The railroad people intend to make a magnificent mountain resort at this place.

*SONORA, CAL.—Articles of incorporation of the Sonora Lime Belt Railroad Company have been filed, the purpose of the corporation being to build a standard gage railroad, to be operated by steam, electricity or other motive power. The estimated length of the railroad is 2 miles. The principal place of business is Sonora. The three directors are: James E. Lennon, Albert and Thomas Knowles. The capital stock is $25,000.

oVALLEJO, CAL.—Recently Melville Dozier and Attorney T. T. C. Gregory, of the Vallejo & Northern Railroad, arranged for the purchase of $110,000 worth of rights of way in Solano County alone. The company is also preparing to press its suits for condemnation in Yolo County. Dozier has stated that in about two weeks the engineers of his line and those of the Northern Electric will hold a joint conference in Sacramento with the government engineer, the Board of Supervisors of Sacramento and Yolo Counties and the city trustees of the Capital City to determine the location of the bridge across the river whereby the electric road will enter Sacramento. Whether or not the Vallejo & Northern line will use the steamers of the Monticello Steamship Company between this city and San Francisco is still a question which Dozier refuses to confirm or deny.

oVALLEJO, CAL.—The Vallejo, Benicia & Napa Valley Railroad Company has received 900 tons of rails and other material for the extension of its line up the Napa Valley, and it is intended to commence work at once. With the material which has just been received it will be possible to complete the extension of the road as far as Oakville, and it is expected that by the time this section of some 14 miles is finished shipments will have been received here in sufficient numbers to permit of the work on the line to St. Helena being taken up.

*DENVER, COL.—Incorporation papers for the new electric railway to connect Denver and Greeley, which will be called the "Denver & Greeley Railroad," were taken out a few days ago. Among the Greeley men interested are Mayor Frank J. Green, John C. Mosher, who is president; E. J. Decker, first vice-president; George M. Huston, second vice-president; H. H. Hake. The Denver promoters are J. D. Houseman, general manager; J. F. Church, John S. Flower, Max Strauss, James Williams. R. S. Sumner, the locating engineer retained, will start work immediately on the surveys. The company was incorporated for $50,000, but over $1,000,000 will be expended on the line when it is completed. The towns in Northern Colorado in addition to Greeley through which the road will run are Longmont, Loveland, Johnstown, Hillsborough, Fort Collins, Windsor, Severance and Eaton. Eventually it will extend into Denver.

*GRAND JUNCTION, COL.—Interurban electric connection between Grand Junction, Palisades, Fruita and all other towns of importance in the Grand Valley is one of the possibilities in the formation of the Electric & Hydraulic Company, incorporation papers for which were recorded here recently. The capital stock is $100,000, and the incorporators are chiefly capitalists of Colorado Springs. They include John Hays Hammond, John S. Bartlett, Irving W. Bonbright, Henry Hine, Leonard E. Curtis and others. The incorporation papers state that the company intends first promoting power and electric railway schemes in Colorado, and in Mexico.

†BRIDGEPORT, CONN.—The Naugatuck Valley Electric Railway Company, which has been building an electric line south from Naugatuck through Beacon Falls to Seymour, is practically completed. Special cars have been run over the line and the road is to be opened for public traffic by July 1.

oHARTFORD, CONN.—The chairman of the railroad committee, Senator Thompson, reported favorably on a resolution incorporating the Norwich, Colchester & Hartford Traction Company. The resolution authorizes the company to lay tracks in the towns of Norwich, Bozrah, Lebanon, Colchester, Marlborough, Glastonbury and East Hartford. The tracks are to begin at the tracks of the Consolidated Railway Company on West Main Street in the city of Norwich and continue through the towns named to connect with the track of the Consolidated Railway Company at the village of Silver Lane, in the town of East Hartford. The company is authorized to take land or other real property that may be necessary for the construction or operation of the railway in the manner provided by law. The capital stock is $100,000, with the right to increase to $1,000,000.

oCOEUR D'ALENE, IDAHO.—Charles Sweeny, president of the Exchange National Bank, and the Federal Mining & Smelting Company, of which he is the head, are reported to be financing the projected electric railway between Wallace and Coeur d'Alene, Idaho. The line is to extend through Fourth of July canyon, in which a survey was made by the Federal Mining & Smelting Company some time ago, but it was not satisfactory, and H. F. Robertson, formerly locating engineer for the Inland Empire system, has been employed to secure a more satisfactory route. It is believed the purpose of the company in building the railroad is to establish a smelter near Spokane, in which event the line will be extended to that city.

oCOEUR D'ALENE, IDAHO.—The Spokan Wallace & Interstate Electric Railway Company, which proposes to connect Coeur d'Alene with Wallace, has filed a plat of definite location. A tunnel 4000 ft. long will have to be constructed. The road will be 51 miles long. Grading will begin Aug. 1.

*CHICAGO, ILL.—The Paris & Northern Traction Company, with the principal office at Paris, has been incorporated with a capital of $5,000 to construct a railway from Paris, Edgar County, Ill., through the counties of Edgar and Vermilion to Ridge Farm and Brocton, in Vermilion County, Illinois. The incorporators and first board of directors are: F. L. Kidder, L. L. Caninne, John J. Cummings and J. E. Parrish, of Paris, Ill., and George E. Fair, of Chrisman, Ill.